



Stage 2: Site Investigation

at

**KAO Business Park,
London Road,
Harlow,
CM17 9NA**

for

Harlow Properties Ltd

Job No. 14.8039
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Trading Terms

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The following notes should be read in conjunction with the report. Any variation to the general procedures outlined below are indicated in the text.

Foreword

The recommendations made and opinions expressed in the report are based on the conditions revealed by the site works as indicated on the site record sheets, together with an assessment of the data from the insitu and laboratory testing or in respect of the desktop reports. No responsibility can be accepted for conditions that have not been revealed by the research, for example, due to inaccuracies in the data. While the report may offer opinions, these comments are for guidance only and no liability can be accepted for their accuracy.

Routine Sampling

During the site investigation, soil, water and leachate samples have been taken in accordance with recommendations within BS.5930: 1990 *Code of Practice for Site Investigations* (Amendment 2: 2010), & BS.10175: 2011. All samples have been marked accordingly, and stored under suitable conditions to prevent any deterioration of the specimen (e.g. volatilisation of hydrocarbons). All samples have been placed in suitably labelled sealed plastic containers and sampling equipment cleaned between sample locations to prevent possible cross contamination.

During the compilation of desktop studies a number of sources have been contacted in order to provide any relevant information regarding the site in question. The sources contacted provide their own Terms & Conditions with regard to the data provided. As such, each source, e.g. Sitescope, Council Websites, etc. must be considered only in relation to these individual Terms & Conditions. All research has been carried out in accordance with recommendations within BS.10175: 2011.

The method of construction employed to form trial pits is entered on their records. In general, it is not possible to extend machine excavated trial pits to depths significantly below the local water table, especially in predominantly granular soils. Except for manually excavated pits, and unless otherwise stated, the trial pits have not been provided with temporary side support during their construction, hence personnel have not entered them and examined the strata or any construction details so exposed.

Laboratory Testing

Unless stated otherwise within the text, all laboratory tests have been performed in accordance with the requirements detailed in British Standards 1881:1990 or other standards or specifications that may be appropriate.

Regulatory Bodies

After the compilation of desktop study and walkover survey or site investigation works all parties must communicate with regulatory bodies including the Local Authority (both Planning & Environmental Health) and the Environment Agency. It must be accepted that further requirements may develop. It is possible that aspects of desktop study may need to be altered to conform to the requirements of the regulatory bodies.

Definitions

Reference to the word "contamination" in this report does not relate to the statutory definition of contaminated land under 1990 Environmental Protection Act unless otherwise stated. The definition used in this report is: "Land that contains substances that, when present in sufficient quantities or concentrations, are likely to cause harm, directly or indirectly, to man, to the environment, or on occasion to other targets" (NATO CCMS, 1985).

Walkover Survey

It should be noted that a walkover survey is designed as a brief inspection of the site in question, however every reasonable effort has been made to access all areas of the site, areas where this has not proved possible will be referenced in the text. The site reconnaissance is undertaken with permission of the client after the document search is completed with the aim of recording any further aspects of the site not revealed by the desktop study however this does not in itself guarantee that every possible risk has been seen.

Conceptual Model/Risk Assessment/ Sampling Regime

The conceptual model, Risk assessment and sampling regime has been formulated in accordance with BS10175:2011 and CLR 8 based upon the relevant information gained from the desktop and walkover survey. While the model and assessment offer opinions and interpretations of these guidelines, the comments made are for guidance only and no liability can be accepted for their accuracy.

Restrictions

In some instances a site investigation must be separated into two stages, depending on the access to the sub soils at the time of the initial site attendance. It must also be noted that in many instances the access afforded is restricted due to continuing activity on the site. In such instances all reasonable effort were to achieve maximum sampling coverage. This does not imply a guarantee that inaccessible areas are similar.

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1.0 INTRODUCTION

Constructive Evaluation (CE) Limited were instructed by Harlow Properties Ltd (the Client) (EQ9037 (rev.2), 27th February 2014) to carry out a Stage 2: Site Investigation at a site known as KAO Business Park, London Road, Harlow, CM17 9NA.

The site is currently occupied by light industrial/office units with associated car parking and areas of softscaping. It is understood that proposals for the site include the demolition of several existing buildings with new offices to be constructed, however proposed plans have not been made available to CE at the time of writing.

The client has instructed CE to undertake a Geo-Environmental Site Investigation (SI) based upon a previously completed Stage 1: Desk Study and Walkover Survey Report, completed by CE; which should be read in conjunction with this report.

The purpose of this investigation is to provide information on the underlying ground conditions with regards to foundation design, any retaining structures, and analysis on the presence, if any, of contamination on site from the exploratory borehole locations.

Works comprised of a series of cable percussive boreholes to a maximum of 20.00mbgl, this was supplemented by lightweight window sampling and CBR tests.

This report has been formulated in accordance with BS10175:2011:2013+A1 *Investigations into Potentially Contaminated Sites – Code of Practice*, CLR11 – *Model Procedures for the Management of Land Contamination*, and National Planning Policy Framework (2012). The Planning Policy Statement 23 – *Planning and Pollution Control* was withdrawn on 27th March 2012, and superseded by the National Planning Policy Framework.

2.0 PREVIOUS REPORTS

A Stage 1 Desktop Report was previously completed by CE (Ref: 14.8039, Dated: April 2014) in order to produce a Conceptual Site Model (CSM) of the potential contamination risks.

This report identified limited specific sources of potential contamination on and off site that are considered to present risks to the various receptors. However, given the lack of knowledge regarding details of the historic operations and processes on site it was considered that there is the potential for shallow soils to have been impacted. This was considered to be limited to the centre and north of the site where laboratory/works have been present and ancillary processes will have taken place.

The risk to future end users, services, groundwater and future developments is generally considered to be **Low** and the risk to site workers is considered to be **Moderate**. These risk categories are based on the presence of an above ground diesel tank (AST) in the west of the site and uncertainties concerning the impact that the historic laboratories/works will have had on the underlying soils.

A **Low** and **Moderate** has been assigned for asbestos and it was considered that if it is identified within the buildings during redeveloped then it should be suitably assessed and dealt with a qualified surveyor prior to demolition works.

As such it was considered that soil samples should be obtained across the site given the gaps in knowledge as well as targeting the AST to the west.

3.0 SITE CONDITION

The site is generally made up of three areas; an undeveloped bank of grass to the south, central car park facilities and, offices and laboratories in the north.

It is accessible by vehicular and pedestrian means along the south eastern boundary from London Road via security gates, leading into the car park which occupies the centre of the site. There are three sections within the main car park; an area of open-jointed brick paving, a similar sized area of tarmac spaces and a multi-storey car park to the west.

The multi-storey car park is unused and at the time of the walkover and was surrounded by cones and signs warning that it was used for police dog training.

The grassed area to the south of the car park appeared to have been landscaped and sloped down towards the south. The southern boundary was lined in trees with an electrical substation noted within brick housing amongst these trees in the southeast corner.

The northern portion of the site comprises of various aged office blocks and laboratories, which were largely vacant. There are areas of softscaping in between the blocks which are interconnected with covered walkways and bridges. Vehicular access is made via secure gates in the west with concrete security blocks preventing access to the east. Several single lane roads allow vehicular movement around the site.

To the immediate northwest of the site is Markhall Wood, with the A414 running north-south through it. The south, east and west is generally comprised of houses and grassed open spaces with a school and Tesco store located to the southeast.

4.0 PHYSICAL SETTING

4.1 Geology

The relevant 1:50,000 British Geological Survey Map 240 (Epping) indicates the majority of the site to be on superficial deposits of the Lowestoft Formation with an area in the south on Head Deposits, underlain by the London Clay Formation.

Lowestoft Formation: forms an extensive sheet of chalky till, together with outwash sands and gravels, silts and clays. The till is characterised by its chalk and flint content. The carbonate content of the till matrix is about 30%, and tills within the underlying Happisburgh Formation have less than 20%.

Head Deposits: are comprised of gravel, sand and clay depending on the upslope source and distance from that source. The deposits are poorly sorted and formed mostly by solifluction, hillwash and soil creep.

London Clay Formation: typically consists of dark bluish to brownish grey, stiff heavily fissured Clay, containing variable amounts of fine grained sand and silt (particularly at the top and base of the deposit), weathering to orange brown clay near surface.

4.2 Hydrogeology

Aquifer within Superficial Deposits

Lowestoft Formation (Unproductive) – rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow.

Head (Secondary Undifferentiated) – has been assigned in cases where it has not been possible to attribute either category A or B to a rock type. In most cases, this means that the layer in question has previously been designated as both minor and non-aquifer in different locations due to the variable characteristics of the rock type.

Aquifer within Bedrock Deposits

London Clay Formation – The site is underlain by unproductive strata which are rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow.

5.0 FIELDWORKS

The following intrusive works were carried out between the 2nd and 10th April 2014 supervised by an Engineering Geologist and Environmental Scientist from CE. The SI was undertaken in accordance with the scope of works agreed with our Client and in relation to statutory guidance including BS5930: 1999 Code of Practice for Site Investigations (Amendment 2: 2010) and BS10175: 2011+A1: 2013 Investigation of Potentially Contaminated Sites: Code of Practice.

5.1 Soils

- Prior to any excavations taking place a Cable Avoidance Tool (CAT) was used to check for the position of any underlying electrical services. In addition, starter pits were excavated to 1.2 meters below ground level (mbgl) to clear test locations prior to any further drilling commencing.
- Seven cable percussive boreholes (BH1-BH7) were sunk to a maximum depth of 20.00mbgl using a Shell and Auger drilling rig. This was supplemented by the completion of insitu Standard Penetration Tests (SPTs) and U100 samples throughout drilling, at standard centres.
- Nineteen lightweight window sample boreholes were completed (WS1-WS19).
- Twenty two Clegg Impact tests were completed within twelve trial pits (CBR1-CBR12) to enable the calculation of CBR values.
- All locations were logged, groundwater conditions and visual or olfactory evidence of contamination noted and representative soil samples removed in accordance with current protocol for contamination and geotechnical parameters.
- Two bespoke soakage tests were completed during the works, one within BH7 during drilling and the other within location SA1 located to the north of the site.
- Upon completion BH7 was installed with monitoring equipment comprising of 50mm diameter slotted and plain pipe surrounded by gravel filter packs and a bentonite seal. The positions were completed with a gas tap and finished at the surface with a cast iron lockable stopcock cover
- The remaining investigative positions not installed were subsequently backfilled with arisings compacted and reinstated at the surface in accordance with existing ground conditions.

The site layout plan indicating the position of the test location is provided in Appendix A, with photographs taken during the investigation in Appendix B.

6.0 GROUND CONDITIONS

6.1 Soils

The following strata conditions were encountered during the intrusive works:

Hardstanding – Tarmac surfacing was described in the northern half of the open car park and around the units in the northwest corner of the site area to a maximum thickness of 0.20mbgl.

The southern half of the open car park is laid to brick paving, this is in turn underlain by a fine gravel subbase and subsequently by a coarse gravel base to a maximum depth of 0.70mbgl.

Made Ground – Made Ground soils were encountered to a maximum depth of 2.50mbgl. However the thickest Made Ground deposits were consistently described in the bunded area which forms the southwest corner of the site. Here, Made Ground soils, described as reworked slightly gravelly clay, locally with masonry rubble to depths of 1.00m to 2.50mbgl.

Elsewhere onsite the Made Ground soils are described to a maximum depth of 1.70mbgl, but generally not deeper than 0.70mbgl and are described as either subbase to pavements or reworked silty sandy and gravelly Clay soils with masonry rubble. Full details of the Made Ground soils are shown in the logs in Appendix C.

Alluvium – At the locations of WS4 and WS5 the upper most natural soils are described as soft consistency dark grey slightly gravelly silty Clay. The gravels are fine, subrounded and of flint or chalk. This material is encountered to the base of both of these boreholes, a maximum depth of 3.00mbgl.

Slightly Sandy Slightly Gravelly Clay – With the exception of BH2, across the remainder of the site the upper most natural soils are described as stiff to very stiff consistency brown mottled grey and speckled white slightly sandy and slightly gravelly Clay. The gravels are subangular to rounded, fine to coarse sized chalk and occasional flint. This material is considered to be representative of the weathered Lowestoft Formation and is encountered to a maximum depth of 8.00mbgl.

The latter stratum is observed to become very stiff and dark grey with depth at BH1, 3, 4, 5 and 6; considered representative of unweathered Lowestoft formation material. This soil is encountered to a maximum depth of 13.35mbgl.

Gravel – Within BH1 and BH6, the above soils were found to be underlain by dense brown sandy flint Gravel, the thickness of this deposit was proven in BH1 only at 1.70m thick. The maximum proven depth of this material is 8.40mbgl in BH1 and 13.40mbgl in BH6.

Gravelly Silt – At locations BH1 and BH7 the gravel / chalky clay soils are underlain by material described as stiff consistency gravelly Silt. The gravel is described as fine to coarse sized chalk. This material is considered to be representative of depositional variation in the Lowestoft Formation. This soil is encountered to a maximum depth of 12.00mbgl.

Fissured Clay – Below the base of the latter deposit in BH1, the solid geology of the London Clay Formation is encountered; this material is described as very stiff consistency fissured dark grey silty Clay. Fissures are closely spaced, subvertical and subhorizontal. This material

is encountered to the final drilled depth of 20.00mbgl.

Please refer to the stratigraphic logs contained within Appendix C for a more detailed description.

6.2 Groundwater

Limited instances of groundwater were encountered during drilling works. The only borehole which recorded a groundwater strike is BH6 at the top of the gravel at a depth of 13.35mbgl, this was observed to rise to 12.20mbgl after 20minutes.

In the northwest of the site, groundwater is encountered at depths of 0.80mbgl in WS14 and 1.40mbgl in WS13.

At the southwest corner groundwater is encountered within WS1 and WS5 at depths of 1.70m and 1.30mbgl respectively.

6.3 Visual and Olfactory Observations

With the exception of the anthropogenic material encountered on site the only evidence of contamination was identified within WS13 at a depth of 0.80mbgl. This was in the form of a moderate chemical odour with no staining.

7.0 INSITU TESTING

7.1 Clegg Impact Testing

Twenty two tests were completed within twelve trial pits the location of which was dictated by the 'Engineer' using a Clegg Impact tester.

The Clegg Impact tester comprises of a 50mm diameter cylindrical 4.5kg weight (hammer), which is dropped through a confined tube. The weight is fitted with a decelerometer, which measures the peak deceleration of the hammers impact, which is empirically translated to an electronic display. Four (4no.) successive blows of the hammer complete one (1no.) test, which provides an Impact Value (IV).

The IV value is converted to a CBR value using the formula $(0.24(IV^4) + 1)^2$.

7.1.1 CBR Results

The table below identifies the equivalent CBR% values determined by Clegg Impact Testing.

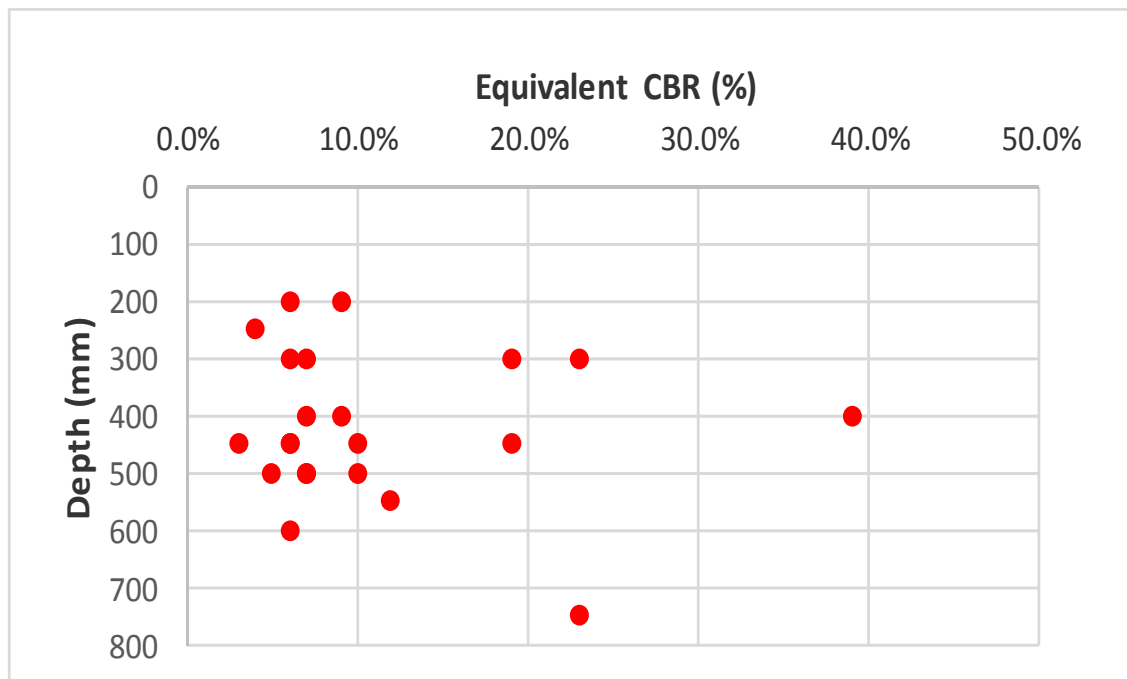
	CBR1	CBR1	CBR2	CBR2	CBR3	CBR3	CBR4
Depth (mm)	200	450	300	600	200	450	300
Equivalent CBR%	6	6	6	6	10	6	23

	CBR4	CBR5	CBR5	CBR6	CBR6	CBR7	CBR7
Depth (mm)	500	250	450	400	500	200	450
Equivalent CBR%	7	4	10	7	7	9	19

	CBR8	CBR8	CBR9	CBR10	CBR11	CBR11	CBR12
Depth (mm)	450	750	400	300	400	550	300
Equivalent CBR%	3	23	39	19	9	12	7

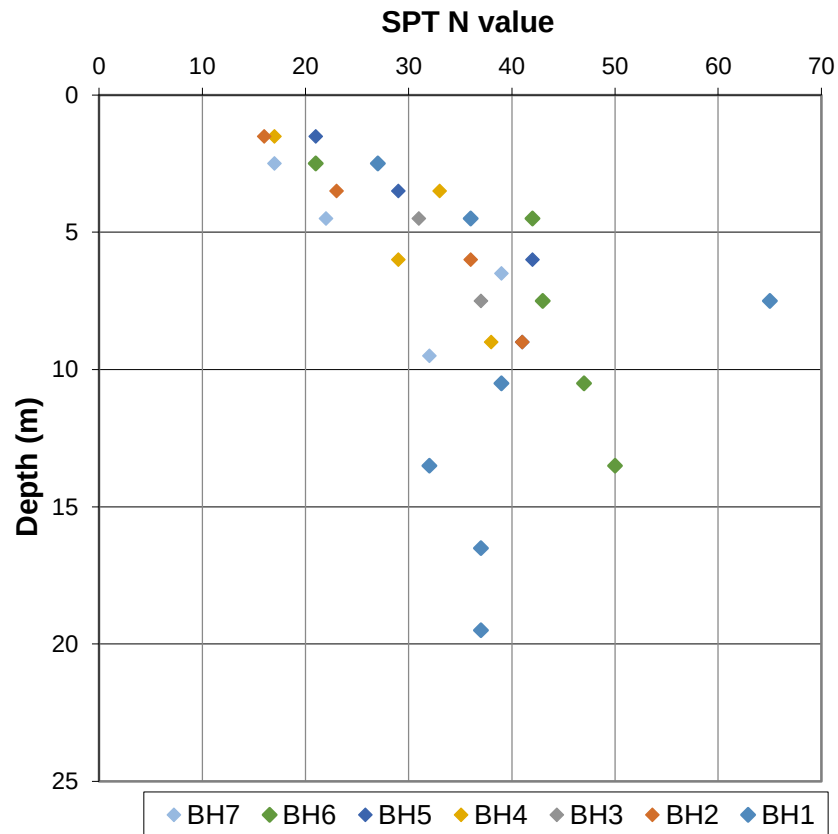
	CBR12
Depth (mm)	500
Equivalent CBR%	5

These results are shown on the graph below.



7.2 Standard Penetration Testing

Insitu Standard Penetration testing was completed at regular intervals throughout the drilling of each exploratory borehole. The results of this testing are summarised on the graph below.



The results of SPT testing show a gradual increase in N-Values from N=16-17 at 1.50mbgl to N= ~40 at 6.00-9.00mbgl within the Lowestoft Formation, corresponding to stiff consistency becoming very stiff consistency Clay soils.

The underlying London Clay Formation returns SPT N-Values in the range N=32 to N=37, representative of very stiff consistency clay soil, which compliments the engineers hand description.

7.3 Soil Infiltration Testing

Infiltration testing was completed within SA1 in general accordance with BRE Digest 365. At this location a hand excavated trial pit of 0.90m depth was filled to ground level and monitored over a period of 1180minutes; over this time the induced water level fell from ground level to 0.63mbgl, however a drop of only 60mm was recorded in the final 1020minutes. When taken as a whole the test would provide a coefficient of permeability for the soils in the order of $X.X \times 10^{-7}$ m/s however as the majority of the soakage was encountered within the Made Ground soils, this is considered something of an overestimate. A rate of $X.X \times 10^{-8}$ m/s would likely be considered more suitable for drainage calculations, however, this has not been proven.

Falling head permeability testing within BH7 at a depth of 4.00mbgl and a response zone of 1.50m thickness resulted in a 100mm fall in water level over a 60minute observation period. This testing indicates a coefficient of permeability in the order of 4.3×10^{-8} m/s.

The results of this testing indicate 'poor' drainage conditions.

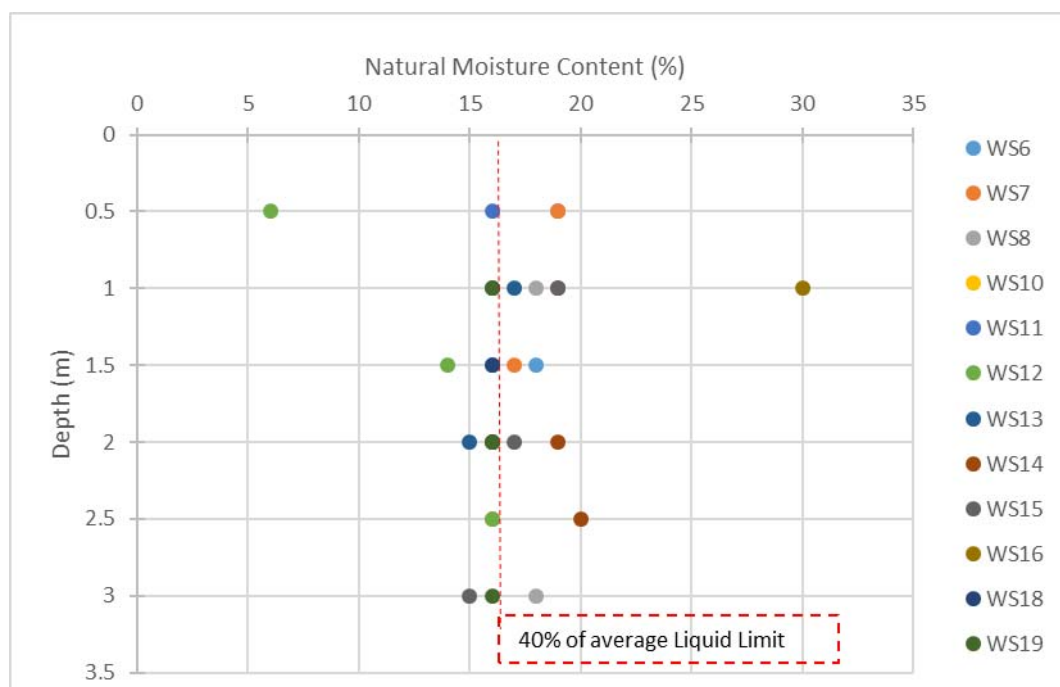
8.0 GEOTECHNICAL TESTING

8.1 Atterberg Limits and Natural Moisture Content

In total forty-six samples of the underlying natural soils were submitted for determination of their Natural Moisture Content; the returned values range from 6% to 43%. However forty-three of these result returned moisture content values in the range 13% to 20%. Statistical analysis of these results provide a median average of 16% and mean average of 16.5%

Atterberg limit testing was completed on ten samples recovered from the boreholes. Nine of these were taken from the Lowestoft Formation, these returned Liquid Limit values of 40% to 44% and Plasticity Index values of 23% to 26%. On this basis the Lowestoft Formation would be considered to be a clay of intermediate plasticity, and would be of medium shrinkage potential in accordance with NHBC guidelines, Chapter 4.2 'Building Near Trees'.

It is possible to compare Natural Moisture content with 40% of the liquid limit of a soil as an indicator for soil desiccation. 40% of the average of the liquid limit values within the Lowestoft Formation is 16%, the graph below compares the Natural Moisture Content values derived from the window sample boreholes with this value.



Although several results lie below the threshold, this is expected to be primarily a function of the heavily overconsolidated nature of the boulder clay (Lowerstoft Formation). However the significantly lowered value of 6% within WS12 at a depth of 0.50m, and the increasing trend in this location would be suggestive of desiccated soil, especially given the presence of a mature oak tree adjacent to this location.

8.2 Sulphate and pH Analysis

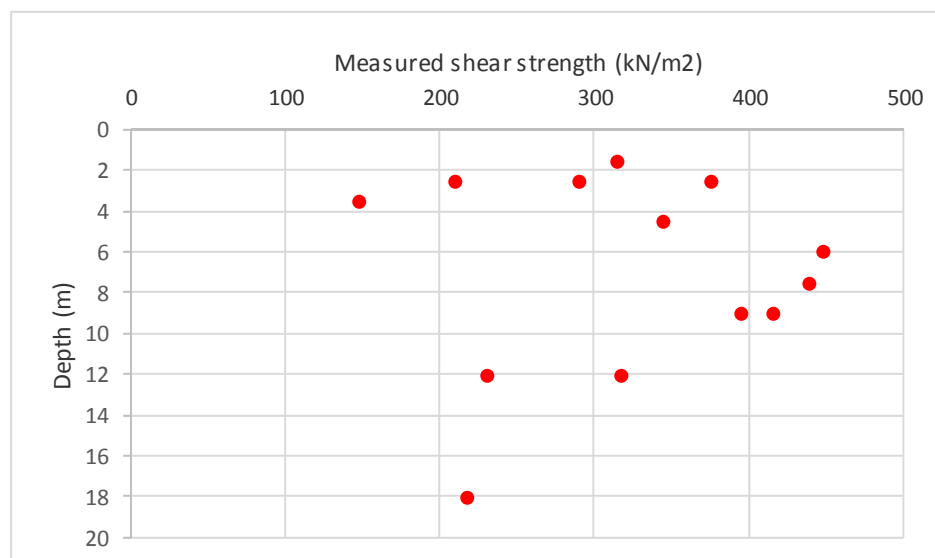
Twenty samples were submitted for determination of pH and Water Soluble Sulphate concentration.

Water soluble sulphate concentrations were found to range from 0.02g/l to 0.23g/l, with pH levels ranging from 7.8 to 8.7.

8.3 Triaxial Compressive Strength

Fifteen undisturbed samples of the boulder clay and London Clay Formation from depths ranging between 1.50m and 18.00mbgl were submitted for determination of undrained cohesion (c_u) in triaxial compression.

The results of this analysis are shown on the graph below.



8.4 One Dimensional Oedometer Consolidation

Three undisturbed samples of the recovered cohesive soils were submitted for determination of their coefficient of consolidation (m_v) in the oedometer. The two samples from the Lowestoft Formation return m_v values of 0.02-0.43m²/MN, however results are generally less than 0.10m²/MN with the higher results recorded during the first loading stage (loading back to overburden) and as a result these soils would be considered to be of Low to very low compressibility.

The London Clay Formation returned m_v values of 0.02 to 0.20m²/MN similarly the higher value was recorded during the initial loading stage and as a result this material is considered to be a Low compressibility clay.

9.0 DISCUSSION OF GROUND CONDITIONS

9.1 General

It is understood that the existing KAO Business Park is scheduled for partial redevelopment, including demolition of selected buildings onsite and erection of new commercial premises. At the time of writing this report the final loadings and building layouts are not known; however it is assumed that the new development will include large multi-storey buildings.

Generally the site is covered by a veneer of Made Ground comprising reworked sandy gravelly clay with masonry rubble. This material is generally less than 0.70m thick however deeper areas of Made Ground are described, most notably to the southwest corner to a maximum depth of 2.50mbgl.

Locally to the southwest corner, within WS4 and WS5, the made ground soils are underlain by soft consistency organic silty Clay, considered representative of Alluvium to a maximum proven depth of 3.00mbgl.

Generally however the uppermost natural soils are considered representative of the Lowestoft Formation, a diamicton (boulder clay) deposit. This material is described as stiff to very stiff consistency slightly sandy clay with variable content of chalk and flint gravels. This material is encountered to a maximum depth of 13.35mbgl, however the base of this deposit is described as shallow as 6.70mbgl locally within BH1.

Insitu SPT testing within this soil supports the Engineer's hand description of this material as stiff to very stiff consistency clay. The insitu hand shear vane testing completed within the window sample boreholes returned shear strength values of 38-227kN/m², however many tests were considered to exceed this upper figure. Generally shear strength values were in excess of 100kN/m² and these soils would be considered to be of high to very high strength clay.

Laboratory testing has shown that this material is a very high to extremely high strength clay soil, of Intermediate plasticity and would be considered to be of low to very low compressibility.

This material is underlain by gravel at locations BH1 and BH6, described as dense brown sandy flint gravel. SPT N-Values within this cohesionless soil are recorded in excess of N=50 and therefore this material is considered to be a very dense granular soil, slightly more competent than as described by the logging engineer.

The base of the gravel is proven at BH1 only, with a thickness of 1.70m for this material. This soil is underlain by a stiff consistency gravelly silt to a maximum depth of 12.00mbgl, this material is also described within BH7 between 8.00m and 10.20mbgl. SPT N-Values within this soil range from N=32 to N=47, considered representative of very stiff consistency cohesive soil.

The London Clay Formation is encountered between 12.00m and 20.00mbgl in BH1 and is described as very stiff consistency dark grey fissured Clay. SPT N-Values within this material range from N=32 to N=37, which compliments the logging engineer's hand description.

Laboratory testing indicates that the London Clay Formation material is of Very High Plasticity, very high strength and low to very low compressibility.

Perched groundwater was encountered at 0.80m to 1.70mbgl in WS4, 5 13 and 14. Groundwater was also encountered within granular soils at a depth of 13.35mbgl in BH6; this was noted to rise to 12.20mbgl suggesting that this water is held under confining pressure.

9.2 Shallow Foundations

Proposed foundation construction at the time of writing is currently unknown, however the proposed construction involves multi storey buildings therefore the anticipated loads are expected to be moderate to moderately high.

The Made Ground soils encountered across the site would not be considered suitable as a bearing stratum; soils of this origin are frequently present in a weak and variable condition such that unacceptable settlement would be anticipated even under light loading intensities.

Additionally the alluvial soils encountered in the southwest corner would not be considered suitable for the formation of structural foundations as this material is considered to be weak and would be expected to be highly compressible.

Foundations may be considered within the Lowestoft formation at depths ranging from 1.00m to 3.00mbgl. This soil has very high strength and a safe bearing pressure of 200kN/m² at a depth of 1.00-2.00mbgl would be considered achievable. This may be seen to increase to 300kN/m² at 2.00-3.00mbgl.

Consideration should be given to the influence of tree roots and shrink swell action on shallow foundations. The guidance of the NHBC in relation to appropriate final foundation depths should be adhered to in order to ensure seasonal volume change effects are minimised. In addition the use of soil heave precaution maybe required as part of the construction work, particularly within the areas of desiccated soils.

9.3 Deep Foundations

As stated in more detail in section 9.4, a suspended floor slab is expected to prove most suitable for this site. As a result it may be necessary to consider a piled option to cater for the new loads anticipated by the new development.

Bored or CFA piles may be considered, the table below provides indicative safe working loads for single 8m long piles sited in the Lowestoft Formation.

Pile Length (m)	Safe Working Load (kN)	
	300mm Diameter	450mm Diameter
8.0m	280	485

These pile calculations have been made on the following assumptions:

- No skin friction has been included for the top 1.00m.
- Piles are installed from the current ground level.
- Groundwater conditions are controlled during installation of piles; using casing or similar.
- A Factor of Safety of 3.0 against both skin friction and end bearing capacity.
- Piling sleaving is used through the Made Ground to prevent negative skin friction.

It is possible that pile groups may be required as part of the pile designs and therefore the total working loads of the piles in cohesive soils will be considerably less than the separate totals combined, as a result of interaction of the piles.

The figures provided are intended as guidelines only for the design of the piling layout. A specialist piling contractor should be consulted on the final most appropriate methodology and design of piled solution once the final loads of the new development are known. In addition, prior to any piling, the underlying soils (particularly Made Ground) should be assessed for a piling mat design.

9.4 Floor Slabs

The floor slab design will depend on the final foundation designs and is dependant on the underlying materials, including bearing capacity and the presence of any cohesive or Made Ground Soils.

Given the variable thickness of Made Ground and the high shrinkage potential soils encountered, it would be recommended that a fully suspended floor slab is used in order to account for these factors; the advice of the NHBC guidelines should be adhered to in the design of such a floor.

9.5 Excavations and Groundwater

It is possible that excavations of less than 1.2mbgl will require support to their faces due to the variable nature of Made Ground. Should excavations be taken below this then adequate support should be provided in order to satisfy statutory safety regulations.

Groundwater has been identified up to 0.80mbgl during site works; however this would not be expected to be a problem across the entire site.

Therefore locally excavations made below groundwater levels on site may be subject to the inflow of groundwater which is expected to result in the further instability of excavation faces, particularly where granular soils are encountered. It is strongly recommended that provision is made in the specification of ground works for dewatering. If groundwater is identified within any of the excavations during the construction phase then it should be dealt with appropriately and removed using good engineering practices.

The design of any temporary retaining structures to support excavation faces should be made assuming the following moderately conservative parameters:

Material	Effective angle of friction (ϕ')	Effective Cohesion; c' (kPa)	Bulk Density kN/m^3
Made Ground	24	0	16
Lowestoft Formation	28	0	18

9.6 Aggressive Chemical Environment to Concrete

Sulphate concentrations within the Made Ground and Natural soils were found to range from 0.02g/l to 0.23g/l and pH levels were noted to range from 7.8 to 8.7 suggesting that a design class of DS-1 and a sub class of AC-1 should be adopted for buried concrete structures within these soils, (Reference made to current BRE SD1 Guidelines) based on the soils tested.

Should piled foundations be adopted into the London Clay at depth it would be prudent to conduct further sulphate analysis to determine the appropriate design class within this material.

9.7 Pavements

CBR testing of shallow soils has identified a range of CBR values from 3% to 39%. It is suggested that a moderately conservative CBR value of 4-5% is adopted for the construction of new pavements.

9.8 Soakage

The testing for soil infiltration completed during this investigation did not yield clear results owing to the slow rates of soakage. As a result an alternative method for disposal of surface water may need to be explored. Furthermore it is recommended that a series of BRE 365 infiltration tests are completed at greater depth to assist in drainage design.

10.0 CONTAMINATION TESTING

Selected soil and groundwater samples have been submitted for analysis.

10.1 Soils

Twenty soil samples were submitted to QTS Environmental, a UKAS and MCERTS accredited laboratory testing facility, for a screen of contamination testing from both the Made Ground and underlying natural soils.

The testing completed comprised of a focused suite of heavy metals and hydrocarbons including speciated Total Petrol Hydrocarbons (TPH CWG aromatic/aliphatic split), BTEX, MTBE and speciated Polycyclic Aromatic Hydrocarbons (PAH), as well as a background suite of pH, SOM, total cyanide, and total phenols.

In addition, samples of Made Ground were submitted for an asbestos screen.

The results of this laboratory testing have been compared to the available Soil Guideline Values (SGVs) as well as the CIEH 'LQM' guideline values for inorganic and organic contaminants in soils.

Comparisons were made against generic assessment criteria for the 'commercial' land use setting based on the current and proposed end use of the site.

10.2 Soil Results

All the results for both inorganic and organic determinands returned concentrations below the relevant and available SGV/LQM guideline values.

It should be noted that concentrations of a number of PAH congeners are elevated above the detection limit of analysis, especially within WS14 at 0.30mbgl. As previously stated these results are still below the SGV/LQM guideline values, however, they are considered sufficiently elevated to potentially degrade water supply pipes.

Furthermore all asbestos screens returned a negative result for the presence of fibres.

The laboratory certificates can be reviewed within Appendix E.

11.0 UPDATED CONCEPTUAL SITE MODEL & RISK ASSESSMENT

The Conceptual Site Model (CSM) has been re-formulated in accordance with the SI results and BS10175:2011+A1:2013 to provide information regarding the possible sources of contamination on site, the pathway in which the contamination can migrate and a vulnerable receptor to the contamination, all of which need to be present for there to be a risk. Consequently, the previous Source – Pathway – Receptor relationships have been re-evaluated as follows:

<i>Source</i>	<i>Pathway</i>	<i>Receptor</i>	<i>Potential Risk</i>
On site hydrocarbons (PAH, TPH, BTEX and MTBE) and heavy metals from current fuel tank located in the west of the site.	Inhalation, ingestion and dermal contact from exposure to contaminated soils.	End users.	Negligible risk given the results of the laboratory testing.
		Site workers.	Low risk given the results of the laboratory testing, however, given the variable composition of Made Ground appropriate PPE should be utilised to mitigate any residual risk.
	Impacted Soils.	Services.	Moderate risk, given the elevated PAH concentrations and depending on the location of installations pipework could be at risk from degradation. In order to mitigate this risk the Water Regulations Advisory Scheme (WRAS) should be followed in conjunction with the local water board.
	Volatilisation of hydrocarbons from the underlying soils to indoor and/or outdoor air.	End user and buildings.	Negligible risk given the results of the laboratory testing.
		Site workers.	Negligible risk given findings of the laboratory analysis and the limited time that that workers will be on site and the appropriate use of PPE during works.
		Ancient Woodlands	Negligible risk given the results of the laboratory testing.
Asbestos Containing Materials located within onsite laboratory/works.	Inhalation, ingestion and dermal contact from exposure to contaminated soils.	End users.	Negligible risk given the results of the laboratory testing.
		Site workers.	Low risk given the results of the laboratory testing, however, given the variable composition of Made Ground appropriate PPE should be utilised to mitigate any residual risk.

<i>Source</i>	<i>Pathway</i>	<i>Receptor</i>	<i>Potential Risk</i>
On site hydrocarbons (PAH, TPH, BTEX and MTBE) and heavy metals from historic laboratory/works with associated processes.	Inhalation, ingestion and dermal contact from exposure to contaminated soils.	End users.	Negligible risk given the results of the laboratory testing.
		Site workers.	Low risk given the results of the laboratory testing, however, given the variable composition of Made Ground appropriate PPE should be utilised to mitigate any residual risk.
	Impacted Soils.	Services.	Moderate risk, given the elevated PAH concentrations and depending on the location of installations pipework could be at risk from degradation. In order to mitigate this risk the Water Regulations Advisory Scheme (WRAS) should be followed in conjunction with the local water board.
	Volatilisation of hydrocarbons from the underlying soils to indoor and/or outdoor air.	End user and buildings.	Negligible risk given the results of the laboratory testing.
		Site workers.	Negligible risk given findings of the laboratory analysis and the limited time that that workers will be on site and the appropriate use of PPE during works.
	Infiltration and migration of contaminants through the underlying soils.	Secondary Undifferentiated Aquifer	Negligible risk given the results of the laboratory testing.
		Ancient Woodlands	Negligible risk given the results of the laboratory testing.

Negligible Risk	Defined as the site should be considered suitable for the present or future use and environmental setting. Contaminants unlikely to be present, which might have unacceptable impact on key targets.
Low Risk	Defined as the site should be considered suitable for the present or future use and environmental setting. Contaminants may be present but unlikely to have unacceptable impact on key targets.
Moderate Risk	Defined as the site may not be suitable for the present or future use and environmental setting. Contaminants are probably present and might have unacceptable impact on key targets.
High Risk	Defined as the site is probably or certainly not suitable for the present or future use and environmental setting. Contaminants are probably or certainly present and likely to have unacceptable impact on key targets.

12.0 CONTAMINATION CONCLUSIONS

The results of the contamination testing have returned minor elevations of PAH although the concentrations were below the relevant and available guideline values.

Negligible risks have been assessed to the future site users from the presence of heavy metals, hydrocarbons and asbestos this assessment reflects the results of the laboratory analysis, the limited pathways and potential exposure time.

A low risk has been assigned to site workers during ground works, this is largely a precautionary risk based on the presence of Made Ground which has the potential for compositional variability. In addition the minor elevation of PAH detected within WS14 next to the tank in the west warrants the use of appropriate PPE to prevent unnecessary contact with potentially impacted soils.

Services have given a moderate risk on the basis that the elevated PAH concentration within WS14, which is in an area for potential redevelopment, may cause damage due to the high organic content. As such prior to the installation of any new services the Local Water Board should be contacted and pipework materials should adhere to the guidelines within the Water Regulations Advisory Scheme (WRAS).

The risk levels regarding asbestos are in relation to the soils and on the basis that a pre-demolition survey within the existing buildings will be completed on site and any asbestos identified will be removed prior to works commencing.

13.0 RECOMMENDATIONS

The following recommendations are based on the plans proposed at the time of writing and maybe subject to change after the completion of the further investigation works.

13.1 *Statutory Consultees*

We would recommend that this report be forwarded to the relevant Statutory Consultees including the Local Council's Environmental Health and Planning Department to seek their comments and subsequent approval prior to works commencing on site.

It is recommended that you confirm with the Statutory Authorities whether as part of any planning conditions if they require a validation and/or closure report providing documentation/audit trail for the importation/removal/reuse of material on site and any other remedial works completed on site.

The Validation Statement is produced by a qualified Environmental Consultant to provide a statement that the development and any remedial works have been completed to the required standard and that the site is now suitable for the intended use and poses minimal or no risk to the various receptors.

13.2 *Watching Brief*

We would recommend that a watching brief is maintained on site, particularly during the ongoing ground works stage. This must be undertaken as part of good working practices and in case there are any areas of unidentified contamination.

During any ground works, an appraisal of the exposed soils should be made by the on-site manager. If any material is noted to show visual and/or olfactory sign of contamination this material should be stockpiled separately and tested prior to its appropriate removal off site or re-use where necessary. A suitably qualified environmental specialist should be contacted to advise what further work is required.

The on-site manager should be appointed by the contractor and it would be recommended that this person be able to display the relevant level of qualification and/or experience in managing major construction works on contaminated land.

13.3 *Waste Disposal*

As surplus arisings will likely be generated as part of the build programme, it is recommended that a copy of the laboratory results are given to the waste contractors and/or landfill operators involved to discuss the requirements with regards to removal of surplus subsoils from the site and the acceptance of the waste at the landfill. All surplus arisings should be appropriately classified as 'hazardous' or 'non hazardous' prior to its movement off site.

All materials must be transported in compliance with the Duty of Care Regulations by authorising movements with Carrier's individually numbered Duty of Care conveyance notes, complete with the appropriate EWC Codes. All relevant dockets will need to be kept to provide evidence of the removal.

It may be necessary depending upon the initial classification and the specific requirements of the waste carrier and the accepting landfill facility to complete Waste Acceptance Criteria (WAC) testing; it is prudent to ascertain the testing requirements of each prior to the movement of any spoil.

Contaminated soil that is, or must be disposed of, is waste. Therefore, its handling, transport, treatment and disposal is subject to waste management legislation, which includes:

- Duty of Care Regulations 1991
- Hazardous Waste (England and Wales) Regulations 2005
- Environmental Permitting (England and Wales) Regulations 2010
- The Waste (England and Wales) Regulations 2011

The client should ensure that all contaminated materials are adequately characterised both chemically and physically in line with British Standard BS EN 14899:2005 'Characterization of Waste – Sampling of Waste Materials – Framework for the Preparation and Application of a Sampling Plan' and that the permitting status of any proposed treatment or disposal activity is clear. If in doubt, the Environment Agency should be contacted for advice at an early stage to avoid any delays.

If the total quantity of waste material to be produced or taken off site as hazardous waste is 500kg or greater in any 12 month period then the developer will need to register with the EA as a hazardous waste producer.

A copy of such documentation should be retained and forwarded to CE for inclusion into a verification/validation report.

13.4 Site Waste Management Plan (SWMP)

The client or principal contractor has a responsibility to ensure that a Site Waste Management Plan (SWMP) is in place before demolition, excavation and/or construction works commence for projects exceeding costs of £300,000. The plan must record predicted and actual waste streams involved in the site works as well as distinguishing between inert, non-inert and hazardous waste by way of WAC testing. The plan must also identify how such wastes will be managed with reuse, recycling and/or recovery options being explored before disposal options are considered. For projects exceeding £500,000, the SWMP must be updated at least every six months to record actual volumes of waste produced with precise information about disposal arrangements and where that will occur.

During construction works visual and olfactory appraisal of the underlying soils should be made. If during construction works any material is noted to show visual and/or olfactory sign of contamination a suitable geo-environmental consultant should be contacted to supervise/guide further works. This material should be stockpiled separately and tested prior to its appropriate removal of site or re-use as necessary.

13.5 Services

We would recommend that if new services are to be included into the design of this development, the local water board are contacted to determine the type of pipework that should be used on this site.

All services and in particular potable water supply pipes should be made out of suitable materials with respect to contamination, particularly organic contaminants, which are known to degrade polymeric materials from which services are often made.

It would be prudent to situate services within lined trenches. The trenches should be lined with a geotextile membrane and backfilled with clean fill, such as pea shingle, which will demarcate the services from the surrounding soils.

This approach is largely to ensure that the risks to future service maintenance workers are mitigated, with respect to potential dermal contact, inhalation and ingestion pathways. Upon determination of the design, agreement should be sought from the Local Authority by way of a Remediation Strategy prior to commencement of groundworks.

It is recommended that a suitably qualified Environmental Scientist attends site to validate the construction of the service trenches, to take photographic records which should be included within a final Validation Report.

13.6 Piling Solution

Should pile foundations be adopted for the site, the Environment Agency will have to be consulted for their approval as per their guidelines stated within the following document: *'Piling and Penetrative Ground Improvement Methods on Land Affected by Contamination'*.

A Piling Method Statement should be prepared by the piling contractor and should be submitted to the EA prior to site works commencing for agreement. For both geotechnical and contamination parameters it is recommended that the method of pile emplacement selected should prevent the downward migration of contaminants from the subsurface and indeed from the groundwater that has been identified within the Made Ground.

Arisings from the piling process will require classification to be disposed off site as waste – please refer to Chapter 12.9 for waste requirements.

13.7 Decommissioning of Boreholes

The boreholes on site will require eventual decommissioning. This process should be completed in accordance with the EA's guidance document *'Decommissioning Redundant Boreholes and Wells'*. This should only be completed once all of the Statutory Consultees needs have been met.

If the Statutory Consultees require the bored positions to be retained throughout the course of the development, adequate protection of the installations, particularly ground works, should be maintained. This can be done by means of erecting a physical barrier i.e. concrete ring or road pins with hazard tape.

A method statement for decommissioning should be completed and submitted to the EA prior to any works proceeding.

13.8 Landscaped Areas

Specifications for topsoil requirements are outlined within BS3882:2007 'Specification for Topsoil and Requirements for Use', which should be used as guidance for the composition and chemical analysis required for the imported material. All certification of the removal, importation and re-use of any materials will have to be kept. It is prudent to contact the Local Authority to determine their specification for imported topsoil analysis.

Furthermore, should material be taken from other areas on the site for soft landscaping areas it must be tested to ensure that it is fit for this purpose.

APPENDICES

Their contents are listed below:

Appendix A – Site Plans

Appendix B – Site Investigation Photographs

Appendix C – Borehole, Window Sample and Trial Pit Logs

Appendix D – Insitu Soakage Test and CBR Results

Appendix E – Laboratory Certificates

Appendix F – Limitations

APPENDIX A

Site Plan

A414

NOTES

1. Do not scale from this drawing except for planning purposes. Use figured dimensions only.
2. All dimensions must be checked on site prior to commencement of work.
3. Where applicable this drawing is to be read in conjunction with other consultants drawings.
4. This drawing is the copyright of Constructive Evaluation Ltd.



rev	date	amendment	check

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Client.
 BARRY SAUNDERS & PARTNERS

Project.
 KAO BUSINESS PARK, HARLOW

Drawing.
 SITE INVESTIGATION PLAN

scale
 NT5

date APR 14	drawn D.Y	checked
drawing number 14.8039	revision	

APPENDIX B

Site Investigation Photographs

Investigation Photographs

Project Ref:14.8039
Site Name: KAO Business Park

1.



2.



- 1) WS1
- 2) WS1
- 3) WS2
- 4) WS2

3.



4.



Investigation Photographs

Project Ref:14.8039
Site Name: KAO Business Park

5.



6.



- 5) WS3
- 6) WS3.
- 7) WS4
- 8) WS4

7.



8.



Investigation Photographs

Project Ref:14.8039
Site Name: KAO Business Park

9.



10.



11.



12.



- 9) WS5
- 10) WS5
- 11) WS6
- 12) WS6

Investigation Photographs

Project Ref:

Site Name:

13.



14.



15.



16.



13) WS7

14) WS8

15) WS8

16) WS9

Investigation Photographs

Project Ref:14.8039
Site Name: KAO Business Park

17.



18.



- 17) WS10
- 18) WS10
- 19) WS11
- 20) WS11

19.



20.



Investigation Photographs

Project Ref:14.8039
Site Name: KAO Business Park

21.



22.



- 21) WS12
- 22) WS12
- 23) WS13
- 24) WS13

23.



24.



Investigation Photographs

Project Ref:14.8039
Site Name: KAO Business Park

25.



26.



27.



28.



- 25) WS14
- 26) WS14
- 27) WS14
- 28) WS15

Investigation Photographs

Project Ref:14.8039
Site Name: KAO Business Park

29.



30.



31.



32.



- 29) WS16
- 30) WS16
- 31) WS16
- 32) WS17

Investigation Photographs

Project Ref:14.8039
Site Name: KAO Business Park

33.



34.



33) WS18

34) WS18

35) WS19

35.



APPENDIX C

Borehole, Window Sample & Trial Pit Logs

Borehole Logs

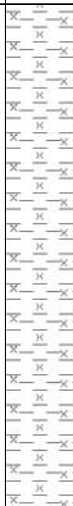
Project Name KAO Business Park	Project No. 14.8039	Co-ords: -	Hole Type Cable
Location: Harlow Plant: Pilcon 150 CP Rig		Level: -	Scale 1:75
Client: Harlow Properties Ltd Drilled By: MT		Dates: 02/04/2014	Logged By GC

Well	Water Strikes	Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.25			0.25			Block Paving (MADE GROUND)	
		0.50-0.70	D		0.70			Dark brown black very sandy Gravel. Sand is medium to coarse. Gravel is subangular to subrounded fine to coarse sized clinker flint. (MADE GROUND)	1
		1.00-1.20	D						
		1.50-2.00	U	39				Very stiff consistency dark grey speckled white silty CLAY. Scattered medium to coarse sand. Occasional to frequent scattered subangular to rounded, fine to coarse sized chalk gravel. (WEATHERED LOWESTOFT FORMATION)	2
		2.00-2.20	D						
		2.50	SPT	N=27					
		2.50-3.00	SPTLS	(3,3,6,6,7,8)					
		3.00-3.20	D						3
		3.50-4.00	U	44	3.50			Very stiff consistency dark grey speckled white silty CLAY. Scattered medium to coarse sand. Occasional to frequent scattered subangular to rounded, fine to coarse sized chalk gravel. (UNWEATHERED LOWESTOFT FORMATION)	4
		4.00-4.20	D						
		4.50	SPT	N=36					
		4.50-5.00	SPTLS	(4,4,10,9,9,8)					5
		5.50-5.70	D						6
		6.00-6.50	U	45					
		6.50-6.70	D		6.70				
		7.50	SPT	N=65				Very stiff consistency light brown speckled Dense brown very sandy GRAVEL. Sand is medium to coarse. Gravel is subangular to rounded, medium to coarse sized flint. (UNWEATHERED LOWESTOFT FORMATION)	7
		7.50-8.00	SPTLS	(6,8,15,15,15,20)					8
		8.50-8.70	D		8.40			Stiff light brown clayey gravelly SILT. Gravel is subangular to rounded, fine to coarse sized chalk.	9
		9.00-9.50	U	47					
		9.50-9.70	D						10
		10.50	SPT	N=39					
		10.50-11.00	SPTLS	(5,6,6,7,12,14)					11
		11.50-11.70	D						
		12.00	U	51	12.00				12
		12.50-12.70	D					Very stiff consistency fissured dark grey silty CLAY. Fissures are very closely to closely spaced subvertical and subhorizontal. (LONDON CLAY FORMATION)	13
		13.50	SPT	N=32					
		13.50-14.00	SPTLS	(4,6,6,7,9,10)					14
		14.50-14.70	D						
			Type	Results					

Continued next sheet

Remarks: Buried service clearance pit dug to 1.0mbgl in 1 hour.

Project Name KAO Business Park	Project No. 14.8039	Co-ords: -	Hole Type Cable
Location: Harlow Plant: Pilcon 150 CP Rig		Level: -	Scale 1:75
Client: Harlow Properties Ltd Drilled By: MT		Dates: 02/04/2014	Logged By GC

Well	Water Strikes	Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		15.00-15.50	U	52	20.00			Very stiff consistency fissured dark grey silty CLAY. Fissures are very closely to closely spaced subvertical and subhorizontal. (LONDON CLAY FORMATION)	16
		15.50-15.70	D						17
		16.50	SPT	N=37					
		16.50-17.00	SPTLS	(5,6,8,8,10,11)					18
		17.50-17.70	D						19
		18.00-18.50	U	55					
		18.50-18.70	D						20
		19.50	SPT	N=37					
		19.50-20.00	SPTLS	(5,5,7,8,10,12)					
		19.80-20.00	D						21
End of Borehole at 20.00 m								22	
								23	
								24	
								25	
								26	
								27	
								28	
								29	

Remarks: Buried service clearance pit dug to 1.0mbgl in 1 hour.

Project Name KAO Business Park	Project No. 14.8039	Co-ords: -	Hole Type Cable
Location: Harlow Plant: Pilcon 150 CP Rig		Level: -	Scale 1:75
Client: Harlow Properties Ltd Drilled By: MT		Dates: 02/04/2014	Logged By GC

Well	Water Strikes	Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.50-0.70	D		0.25			Block Paving (CONCRETE)	
		1.00-1.20	D		0.60			Greyish brown slightly gravelly sand. Sand is fine to coarse. Gravel is subangular to subrounded, fine to medium sized brick and concrete. (MADE GROUND)	1
		1.50	SPT	N=16	1.20			Grass over dark brown black very sandy Gravel. Sand is medium to coarse. Gravel is subangular to subrounded fine to coarse sized clinker flint. (MADE GROUND)	
		1.50-2.00	SPTLS	(2,3,3,3,4,6)					
		2.20-2.40	D					Very stiff consistency dark grey speckled white silty CLAY. Scattered medium to coarse sand. Occasional to frequent scattered subangular to rounded, fine to coarse sized chalk gravel. (WEATHERED LOWESTOFT FORMATION)	2
		2.50-3.00	U	20					
		3.00-3.20	D						3
		3.50	SPT	N=23					
		3.50-4.00	SPTLS	(3,4,5,5,6,7)					4
		4.20-4.40	D						
		4.50-5.00	U	33					5
		5.00-5.20	D						
		6.00	SPT	N=36					6
		6.00-6.50	SPTLS	(6,7,8,8,9,11)					
		6.70-6.90	D						7
		7.50-8.00	U	46					8
		8.00-8.20	D						
		8.70-8.90	D						9
		9.00	SPT	N=41					
		9.00-9.50	SPTLS	(8,10,9,10,10,12)					
		10.00	D		10.00			End of Borehole at 10.00 m	10
									11
									12
									13
									14

Remarks: Buried service clearance pit dug to 1.0mbgl in 1 hour. One hour removing spoil to skip. End of borehole at 10m.

Project Name KAO Business Park	Project No. 14.8039	Co-ords: -	Hole Type Cable
Location: Harlow Plant: Pilcon 150 CP Rig		Level: -	Scale 1:75
Client: Harlow Properties Ltd Drilled By: MT		Dates: 02/04/2014	Logged By GC

Well	Water Strikes	Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.10			Tarmac. (MADE GROUND)	
		0.50-0.70	D		0.45			Greyish brown slightly gravelly sand. Sand is fine to coarse. Gravel is subangular to subrounded, fine to medium sized brick and concrete. (MADE GROUND)	1
		1.00-1.20	D						
		1.50-2.00	U						
		2.00-2.20	D						2
		2.50	SPT	N=27					
		2.50-3.00	SPTLS	(4,5,3,8,7,9)					
		3.00-3.20	D						3
		3.50-4.00	U						
		4.00-4.20	D		4.20				4
		4.50	SPT	N=31				Very stiff consistency blue grey speckled white silty CLAY. Scattered medium to coarse sand. Occasional to frequent scattered subangular to rounded, fine to coarse sized chalk gravel. (UNWEATHERED LOWESTOFT FORMATION)	5
		4.50-5.00	SPTLS	(4,6,6,7,9,9)					
		5.50-5.70	D						6
		6.00-6.50	U						
		6.50-6.70	D						7
		7.50	SPT	N=37					
		7.50-8.00	SPTLS	(5,6,10,8,9,10)					8
		8.50-8.70	D						9
		9.00-9.50	U						
		9.50-9.70	D						
		9.80-10.00	D		10.00				10
								End of Borehole at 10.00 m	
									11
									12
									13
									14

Remarks: Buried service clearance pit/starter pit dug to 1.0mbgl. No groundwater encountered.

Project Name KAO Business Park	Project No. 14.8039	Co-ords: -	Hole Type Cable
Location: Harlow Plant: Pilcon 150 CP Rig		Level: -	Scale 1:75
Client: Harlow Properties Ltd Drilled By: MT		Dates: 04/04/2014	Logged By GC

Well	Water Strikes	Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.15-0.40			0.15 0.40			Tarmac. (MADE GROUND)	
		0.50-0.70	D					Greyish brown slightly gravelly sand. Sand is fine to coarse. Gravel is subangular to subrounded, fine to medium sized brick and concrete. (MADE GROUND)	1
		1.00-1.20	D						
		1.50	SPT	N=17				Very stiff consistency brown speckled white silty CLAY. Scattered medium to coarse sand. Occasional to frequent scattered subangular to rounded, fine to coarse sized chalk gravel. (WEATHERED LOWESTOFT FORMATION)	2
		1.50-2.00	SPTLS	(2,3,3,4,5,5)					
		2.00-2.20	D						
		2.50-3.00	U						
		3.00-3.20	D						3
		3.50	SPT	N=33					
		3.50-4.00	U	(4,5,10,8,7,8)					
		4.00-4.20	D		3.95				4
		4.50-5.00	U					Very stiff consistency stiff dark grey speckled white silty CLAY. Scattered medium to coarse sand. Occasional to frequent scattered subangular to rounded, fine to coarse sized chalk gravel. (UNWEATHERED LOWESTOFT FORMATION)	5
		5.00-5.20	D						
		6.00	SPT	N=29					6
		6.00-6.50	SPTLS	(3,5,4,9,8,8)					
		7.00-7.20	D						7
		7.50-8.00	U						
		8.00-8.20	D						8
		9.00	SPT	N=38					9
		9.00-10.00	SPTLS	(5,5,6,11,11,10)					
					10.00			End of Borehole at 10.00 m	10
									11
									12
									13
									14

Remarks: Test pit/starter pit dug to 1.2m. No groundwater encountered.

Project Name KAO Business Park	Project No. 14.8039	Co-ords: -	Hole Type Cable
Location: Harlow Plant: Pilcon 150 CP Rig		Level: -	Scale 1:75
Client: Harlow Properties Ltd Drilled By: MT		Dates: 05/04/2014	Logged By GC

Well	Water Strikes	Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.30			Grass over topsoil. (TOPSOIL)	
		0.50-0.70	D					Stiff consistency brown grey speckled white silty CLAY. Scattered medium to coarse sand. Occasional to frequent scattered subangular to rounded, fine to coarse sized chalk gravel. (WEATHERED LOWESTOFT FORMATION)	1
		1.00-1.20	D						
		1.50	SPT	N=21					
		1.50-2.00	SPTLS	(3,3,5,5,5,6)					
		2.00-2.20	D						2
		2.50-3.00	U						
		3.00-3.20	D						3
		3.50	SPT	N=29					
		3.50-4.00	SPTLS	(4,6,7,6,7,9)					
		4.00-4.20	D						4
		4.50-5.00	D						
		5.00-5.20	D		5.10			Very stiff consistency dark grey speckled white silty CLAY. Scattered medium to coarse sand. Occasional to frequent scattered subangular to rounded, fine to coarse sized chalk gravel. (UNWEATHERED LOWESTOFT FORMATION)	5
		6.00	SPT	N=42					
		6.00-6.50	SPTLS	(5,10,10,9,10,13)					6
		7.00-7.20	D						7
		7.50-8.00	U						
		8.00-8.20	D						8
		9.00	SPT	N=41					
		9.00-9.50	SPTLS	(6,6,8,11,10,12)					9
		9.80-10.00	D		10.00				10
								End of Borehole at 10.00 m	
									11
									12
									13
									14

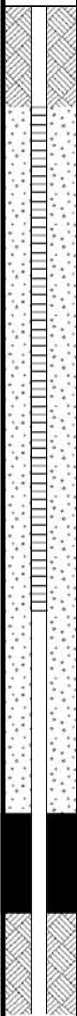
Remarks: Test pit/starter pit dug to 1.2mbgl. No groundwater encountered.

Project Name KAO Business Park	Project No. 14.8039	Co-ords: -	Hole Type Cable
Location: Harlow Plant: Pilcon 150 CP Rig		Level: -	Scale 1:75
Client: Harlow Properties Ltd Drilled By: MT		Dates: 07/04/2014	Logged By GC

Well	Water Strikes	Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.15-0.45			0.15 0.45			Grass over brown slightly gravelly sand. Sand is medium to coarse. Gravel is subangular to subrounded, fine to coarse sized flint. (MADE GROUND)	
		0.50-0.70	D						
		1.00-1.20	D					Light brown sandy gravel. Sand is medium to coarse. Gravel is subangular to subrounded fine to coarse sized brick, concrete and flint. (MADE GROUND)	1
		1.50-2.00	U						
		2.00-2.20	D						
		2.50	SPT	N=21					
		2.50-3.00	SPTLS	(3,4,3,5,6,7)					
		3.00-3.20	D						2
		3.50-4.00	U						
		4.00-4.20	D						
		4.50	SPT	N=42					
		4.50-5.00	SPTLS	(5,8,8,10,11,13)					3
		5.50-5.70	D						
		6.00-6.50	U						
		6.50-6.70	D						4
		7.50	SPT	N=43					
		7.50-8.00	SPTLS	(4,6,9,9,11,14)					5
		8.50-8.70	D						
		9.00-9.50	U						
		9.50-9.70	D						6
		10.50	SPT	N=47					
		10.50-11.00	SPTLS	(5,8,8,11,12,16)					7
		11.50-11.70	D						
		12.00-12.50	U						8
		12.50-12.70	D						
		13.50	SPT	50/180mm					
		13.50-14.00	SPTLS	80mm (6,6,10,20,20)					9
					13.35 13.40				
									10
									11
									12
									13
									14

Remarks: Test pit/starter pit dug to 1.2mbgl. No groundwater encountered.

Project Name KAO Business Park	Project No. 14.8039	Co-ords: -	Hole Type Cable
Location: Harlow Plant: Pilcon 150 CP Rig		Level: -	Scale 1:75
Client: Harlow Properties Ltd Drilled By: MT		Dates: 06/04/2014	Logged By GC

Well	Water Strikes	Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.20-0.40			0.20 0.40			Concrete paving with sand. (MADE GROUND)	
		0.50-0.70	D					Concrete. (MADE GROUND)	
		1.00-1.20	D					Greyish brown slightly gravelly sand. Sand is fine to coarse. Gravel is subangular to subrounded, fine to medium sized brick and concrete. (MADE GROUND)	1
		1.50-2.00	D		1.80			Very stiff consistency brown/grey speckled white silty CLAY. Scattered medium to coarse sand. Occasional to frequent scattered subangular to rounded, fine to coarse sized chalk gravel. (WEATHERED LOWESTOFT FORMATION)	2
		2.00-2.20	D						
		2.50	SPT	N=17 (2,2,3,4,5,5)					
		2.50-3.00	SPTLS						
		3.00-3.20	D					Stiff light brown clayey gravelly SILT. Gravel is subangular to rounded, fine to coarse sized chalk.	3
		3.50-4.00	U						4
		4.50	SPT	N=22 (3,4,5,5,5,7)					5
		4.50-5.00	SPTLS						6
		5.00-5.50	U					Stiff light brown clayey gravelly SILT. Gravel is subangular to rounded, fine to coarse sized chalk.	7
		5.50-5.70	D						8
		6.50	SPT	N=39 (4,7,7,9,10,13)					9
		6.50-7.00	SPTLS						10
		7.50-7.70	D		8.00			Stiff light brown clayey gravelly SILT. Gravel is subangular to rounded, fine to coarse sized chalk.	11
		8.00-8.50	U						12
		8.50-8.70	D						13
		9.50	SPT	N=32 (4,5,5,6,10,11)					14
		9.50-10.00	SPTLS					Stiff light brown clayey gravelly SILT. Gravel is subangular to rounded, fine to coarse sized chalk.	15
		10.00-10.20	D		10.20				16
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									100

Remarks: Starter pit dug to 1.2mbgl. No groundwater encountered. One hour soakage test completed.

Window Sample Logs

Hole Type	WS
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Scale
1:25

Logged By
SG

Remarks: Buried service clearance pit dug to 1.0mbgl. Groundwater encountered at 1.7m.

Project Name KAO Business Park	Project No. 14.8039	Co-ords: -	Hole Type WS
Location: Harlow Plant: Lightweight window sampler		Level: -	Scale 1:25
Client: Harlow Properties Ltd Drilled By: GB		Dates: 02/03/2014	Logged By SG

Well	Water Strikes	Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.50	ES		0.60			Grass over brown slightly gravelly slightly sandy silty Clay. Gravels are fine to coarse, angular to subrounded brick, flint and chalk. Sand is fine. (MADE GROUND)	
		1.00	D		1.00			Firm consistency brown slightly gravelly slightly sandy silty CLAY. Gravel is fine to coarse, angular to subrounded flint, brick and chalk. Sand is fine. (RE-WORKED TILL)	1
		1.50-2.00	D					Firm/stiff consistency orange brown/brown slightly gravelly slightly sandy CLAY. Gravels are fine to coarse, subangular to subrounded flint/chalk. (TILL)	2
		2.00-2.50	D		2.50			Stiff consistency brown and light grey mottled slightly gravelly slightly sandy silty CLAY. Gravel is fine to coarse, subangular to subrounded flint/chalk. (TILL)	3
		2.50-3.00	D		3.00			End of Borehole at 3.00 m	4
			Type	Results					

Remarks: Buried service clearance pit dug to 1.0mbgl. No groundwater encountered.

Project Name
KAO Business Park

Project No.
14.8039

Co-ords: -

Hole Type	WS
1	1
2	2
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100	100

Location: Harlow

Plant: Lightweight window sampler

Level: -

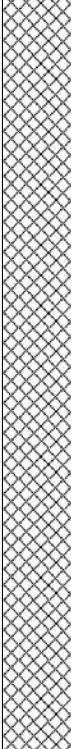
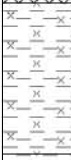
Scale
1:25

Client: Harlow Properties Ltd

Drilled By: GB

Dates: 02/03/2014

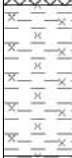
Logged By
SG

Well	Water Strikes	Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.50	D		2.50			Grass over brown gravelly silty clay. Gravels are fine to coarse, occasional cobble sized flint, brick and concrete. (MADE GROUND)	1
		1.00	D						
		1.50-2.00	D						
		2.00-2.50	D						
		2.50-3.00	D						
					3.00		Soft consistency dark grey slightly gravelly silty CLAY. Gravels are fine, subangular to subrounded flint and chalk. Slight organic odour. (POSSIBLE ALLUVIUM)	3	
							End of Borehole at 3.00 m	4	

Remarks:	Buried service clearance pit dug to 1.0mbgl.
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Project Name KAO Business Park	Project No. 14.8039	Co-ords: -	Hole Type Cable
Location: Harlow Plant: Lightweight window sampler		Level: -	Scale 1:25
Client: Harlow Properties Ltd Drilled By: GB		Dates: 02/03/2014	Logged By SG

Well	Water Strikes	Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.50 0.50	D ES					Grass over brown slightly gravelly slightly sandy Clay. Gravel is fine to coarse, angular to subrounded flint, chalk and brick. (RE-WORKED TILL)	
								0.5m - Becoming firm/stiff below 0.5m.	
		1.00	D					1.2m - Becoming soft below 1.2m.	1
		1.50-2.00	D						2
		2.00-3.00	D		2.50			Soft consistency dark grey slightly gravelly silty CLAY. Gravels are fine, subangular to subrounded flint/chalk. Slight organic odour. (POSSIBLE ALLUVIUM)	
		2.50-3.00	D		3.00				3
								End of Borehole at 3.00 m	
									4

Remarks: Buried service clearance pit dug to 1.0mbgl. Groundwater encountered at 1.3m.

Project Name KAO Business Park	Project No. 14.8039	Co-ords: -	Hole Type WS
Location: Harlow Plant: Lightweight window sampler		Level: -	Scale 1:25
Client: Harlow Properties Ltd Drilled By: AT		Dates: 02/03/2014	Logged By GC

Well	Water Strikes	Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.20	ES		0.20			Dark brown very silty Sand. Sand is fine to medium. Abundant rootlets. (TOPSOIL)	
					0.30			Light brown slightly gravelly Clay. Gravel is subangular to subrounded, fine to coarse sized chalk and flint. Double geotextile membrane at base. (MADE GROUND)	
		0.50	D		0.45			Loose slightly sandy medium to coarse, subangular to subrounded, fine to coarse sized granite gravel. Sand is fine to coarse. Frequent cobble sized granite clast. (MADE GROUND)	
								Stiff light brown mottled light grey speckled white locally sandy slightly Gravelly CLAY. Sand is medium to coarse, gravel is subangular to rounded, fine to coarse sized chalk and occasional flint.	1
		1.00	IVN 1	181					
		1.00	ES						
		1.00	D						
		1.50	IVN 2	214					
		1.50	D						
		2.00	IVN 3	227	2.10				2
		2.00	D						
		2.50	IVN 4	227	2.50			Very stiff brown mottled grey slightly sandy slightly Gravelly CLAY. Sand is medium to coarse. Gravel is subangular to rounded, fine to coarse sized chalk.	
		2.50	D					End of Borehole at 2.50 m	3
									4

Remarks: Buried service clearance pit dug to 1.0mbgl. End due to refusal at 2.5m. No groundwater.

Project Name KAO Business Park	Project No. 14.8039	Co-ords: -	Hole Type WS
Location: Harlow Plant: Lightweight window sampler		Level: -	Scale 1:25
Client: Harlow Properties Ltd Drilled By: AT		Dates: 02/03/2014	Logged By GC

Well	Water Strikes	Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.20			Grass over brown sandy clayey silt. Abundant rootlets. (TOPSOIL)	
		0.50 0.50	ES D					Stiff light brown mottled light grey speckled white locally sandy slightly Gravelly CLAY. Sand is medium to coarse, gravel is subangular to rounded, fine to coarse sized chalk and occasional flint.	1
		1.00 1.00 1.00	IVN 1 ES D	38					
		1.50 1.50	IVN 2 D	159					
		2.00	D						2
		2.50 2.50	IVN 3 D	125	2.60				
		3.00 3.00	IVN 4 D	227	3.00			Very stiff consistency dark brown mottled dark grey Silty CLAY. Scattered subangular to rounded, fine to medium sized chalk gravel.	3
								End of Borehole at 3.00 m	
									4

Remarks: Buried service clearance pit dug to 1.0mbgl. Groundwater seepage at 0.95m.

Project Name KAO Business Park	Project No. 14.8039	Co-ords: -	Hole Type WS
Location: Harlow Plant: Lightweight window sampler		Level: -	Scale 1:25
Client: Harlow Properties Ltd Drilled By: AT		Dates: 07/03/2014	Logged By GC

Well	Water Strikes	Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.10			Tarmac. (MADE GROUND)	
					0.20			Dark grey speckled black slightly gravelly fine to medium grained Sand. Gravel is subangular to subrounded fine to medium sized granite and tarmac. (MADE GROUND)	
					0.35			Compact brown very sandy Gravel. Sand is fine to coarse. Gravel is subangular to subrounded, fine to coarse sized concrete/flint. (MADE GROUND)	
		0.50	ES						
		0.50	D						
		0.70	IVN 1	227					
		1.00	IVN 2	129					
		1.00	ES						
		1.20	D						
		1.50	IVN 3	176	1.50				
								End of Borehole at 1.50 m	
									1
									2
									3
									4

Remarks: Buried service clearance pit dug to 1.0mbgl. End at 1.5m due to refusal. No groundwater encountered.

Project Name KAO Business Park	Project No. 14.8039	Co-ords: -	Hole Type WS
Location: Harlow Plant: Lightweight window sampler		Level: -	Scale 1:25
Client: Harlow Properties Ltd Drilled By: AT		Dates: 07/03/2014	Logged By GC

Well	Water Strikes	Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.25			Grass over soft consistency brown very silty sandy clay, Sand is fine to medium (MADE GROUND)	
					0.35			Light brown very sandy Gravel. Sand is medium to coarse, gravel is subangular to subrounded, fine to coarse sized flint. (MADE GROUND)	
		0.50	D					Stiff to very stiff consistency brown mottled light grey and speckled white slightly Sandy CLAY. Sand is medium to coarse, scattered subangular to subrounded fine sized flint gravel. Frequent scattered fine gravel to bobbie sized chalk.	
		0.70	ES						
		1.00	IVN 1	227					1
		1.00	D						
		1.50	IVN 2	227					
		1.50	ES						
		1.50	D						
		2.00	IVN 3	220				1.70m - Becoming dark brown	2
		2.00	D						
		2.50	IVN 4	227					
		2.50	ES						
		2.50	D						
		3.00	IVN 5	227	3.00			End of Borehole at 3.00 m	3
		3.00	D						
									4

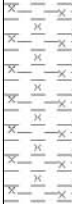
Remarks: Buried service clearance pit dug to 1.0mbgl. No groundwater encountered.

Project Name KAO Business Park	Project No. 14.8039	Co-ords: -	Hole Type WS
Location: Harlow Plant: Lightweight window sampler		Level: -	Scale 1:25
Client: Harlow Properties Ltd Drilled By: AT		Dates: 02/03/2014	Logged By GC

Well	Water Strikes	Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.20			Grass over soft consistency brown very silty sandy clay. Sand is fine to medium. (MADE GROUND)	
		0.30	ES		0.40			Firm consistency brown mottled dark brown and dark grey silty clay. Scattered medium to coarse grained chalk Sand. Scattered subangular to rounded, fine to coarse sized chalk and flint gravel. Abundant roots up to 10mm and rootlets.	
		0.50 0.50	ES D					Very stiff consistency brown mottled light grey and speckled white slightly Sandy CLAY. Sand is medium to coarse, scattered subangular to subrounded fine sized flint gravel. Frequent scattered fine gravel to bobbie sized chalk.	
		1.00 1.00	IVN 1 D	227					1
		1.50 1.50	IVN 2 D	194					
		2.00 2.00	IVN 3 D	227					2
		2.50 2.50	IVN 4 D	227					
		3.00 3.00	IVN 5 D	227	3.00				3
								End of Borehole at 3.00 m	
									4

Remarks: Buried service clearance pit dug to 1.0mbgl. No groundwater encountered.

Project Name KAO Business Park	Project No. 14.8039	Co-ords: -	Hole Type WS
Location: Harlow Plant: Lightweight window sampler		Level: -	Scale 1:25
Client: Harlow Properties Ltd Drilled By: AT		Dates: 02/03/2014	Logged By GC

Well	Water Strikes	Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.20	ES		0.15			Light brown very silty sandy Gravel. Sand is fine to medium. Gravel is subrounded to rounded, fine to medium sized flint. (MADE GROUND)	
		0.50 0.50	ES D		0.40			Light brown sandy Gravel. Sand is medium to coarse. Gravel is subangular to subrounded sized brick, concrete and flint. (MADE GROUND)	
		1.00 1.00 1.00	IVN 1 ES D	100	1.20			Firm consistency light brown mottled dark brown, speckled white silty clay with scattered subangular to rounded, fine to medium sized chalk gravel.	1
		1.50 1.50	IVN 2 D	194				Stiff light brown mottled light grey speckled white locally sandy slightly Gravelly CLAY. Sand is medium to coarse, gravel is subangular to rounded, fine to coarse sized chalk and occasional flint.	
		2.00 2.00	IVN 3 D	227	2.20			Very stiff brown mottled grey slightly sandy slightly Gravelly CLAY. Sand is medium to coarse. Gravel is subangular to rounded, fine to coarse sized chalk.	2
		2.50	D		2.50			End of Borehole at 2.50 m	
									3
									4
		Type	Results						

Remarks: Buried service clearance pit dug to 1.0mbgl. End at 2.5m due to refusal.

Project Name
KAO Business Park

Project No.
14.8039

Co-ords: -

Hole Type	WS
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Location: Harlow
Plant: Lightweight window sampler

Level: -

Scale
1:25

Client: Harlow Properties Ltd
Drilled By: AT

Dates: 02/03/2014

Logged By
GC

Well	Water Strikes	Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description	
		Depth (m)	Type	Results					
								Tarmac (MADE GROUND)	
		0.50	D		0.20			Reddish brown very sandy Gravel. Sand is fine to coarse. Gravel is subangular to subrounded, medium to coarse sized limestone to mudstone. (MADE GROUND)	
		0.80	ES		0.70			Firm to stiff consistency light brown mottled grey speckled white gravelly silty CLAY. Gravel is subangular to subrounded, fine to coarse sized chalk. Moderate chemical odour at 0.8m.	1
		1.00 1.00	IVN 1 D	78					
		1.20	ES		1.20			Stiff light brown mottled light grey speckled white locally sandy slightly Gravelly CLAY. Sand is medium to coarse, gravel is subangular to rounded, fine to coarse sized chalk and occasional flint.	
		1.50 1.50	IVN 2 D	194					
		2.00 2.00	IVN 3 D	227	2.10			Very stiff brown mottled grey slightly sandy slightly Gravelly CLAY. Sand is medium to coarse. Gravel is subangular to rounded, fine to coarse sized chalk.	2
		2.50	D						
		3.00	D		3.00				
									End of Borehole at 3.00 m
								4	
		Type	Results						

Remarks: Buried service clearance pit dug to 1.0mbgl. Groundwater encountered at 1.4mbgl.



Project Name KAO Business Park	Project No. 14.8039	Co-ords: -	Hole Type WS
Location: Harlow Plant: Lightweight window sampler		Level: -	Scale 1:25
Client: Harlow Properties Ltd Drilled By: GC		Dates: 02/03/2014	Logged By AT

Well	Water Strikes	Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.15			Tarmac. (MADE GROUND)	
		0.30	ES					Light brown speckled red gravelly Sand. Gravel is subangular to subrounded, fine to coarse sized brick, concrete and rare and half bricks. (MADE GROUND)	
		0.60 0.60	ES D		0.50			Firm to stiff consistency light brown mottled grey speckled white slightly gravelly silty CLAY. Gravel is subangular to rounded, fine to coarse sized chalk.	1
		1.00 1.00 1.00	IVN 1 ES D	49					
		1.50 1.50	IVN 2 D	178	1.40			Stiff light brown mottled light grey speckled white locally sandy slightly Gravelly CLAY. Sand is medium to coarse, gravel is subangular to rounded, fine to coarse sized chalk and occasional flint.	
		2.00 2.00	IVN 3 D	227	2.10			Very stiff brown mottled grey slightly sandy slightly Gravelly CLAY. Sand is medium to coarse. Gravel is subangular to rounded, fine to coarse sized chalk.	2
		2.50 2.50	IVN 4 D	227	2.50			End of Borehole at 2.50 m	
									3
									4

Remarks: Buried service clearance pit dug to 1.0mbgl. End at 2.5m due to refusal. Groundwater seepage encountered at 0.8mbgl.

Project Name KAO Business Park	Project No. 14.8039	Co-ords: -	Hole Type WS
Location: Harlow Plant: Lightweight window sampler		Level: -	Scale 1:25
Client: Harlow Properties Ltd Drilled By: AT		Dates: 02/03/2014	Logged By GC

Well	Water Strikes	Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.15			Grass over brown very silty Sand. Sand is fine to medium. (MADE GROUND)	
		0.50 0.50	ES D					Brown very silty sandy slightly gravelly Clay. Sand is fine to coarse. Gravel is subangular to subrounded sized chalk, flint and brick. (MADE GROUND)	
					0.80			Loose slightly sandy medium to coarse, subangular to subrounded, fine to coarse sized granite gravel. Sand is fine to coarse. Frequent cobble sized granite clast. (MADE GROUND)	1
		1.00 1.00 1.00	IVN 1 ES D	108					
		1.50 1.50	IVN 2 D	201					
					1.70			Very stiff brown mottled grey slightly sandy slightly Gravelly CLAY. Sand is medium to coarse. Gravel is subangular to rounded, fine to coarse sized chalk.	2
		2.00 2.00	IVN 3 D	227					
		2.50	IVN 4	175					
		2.50-3.00	D						
					3.00				
								End of Borehole at 3.00 m	3
									4

Remarks: Buried service clearance pit dug to 1.0mbgl. Very poor recovery at 2.4m-3.0m. No groundwater encountered.

Project Name
 KAO Business Park

 Project No.
 14.8039

Co-ords: -

 Hole Type
 WS

 Location: Harlow
 Plant: Lightweight window sampler

Level: -

 Scale
 1:25

 Client: Harlow Properties Ltd
 Drilled By: AT

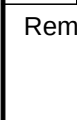
Dates: 02/03/2014

 Logged By
 GC

Well	Water Strikes	Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.20			Grass over brown very silty Sand. Sand is fine to medium. (MADE GROUND)	
								Brown very silty sandy slightly gravelly Clay. Sand is fine to coarse. Gravel is subangular to subrounded sized chalk, flint and brick. (MADE GROUND)	
		0.50	ES						
		0.60	ES						
					0.70				
		1.00	IVN 1 D	74				Stiff light brown mottled light grey speckled white locally sandy slightly Gravelly CLAY. Sand is medium to coarse, gravel is subangular to rounded, fine to coarse sized chalk and occasional flint.	1
		1.00							
		1.50	IVN 2 D	127					
		1.50							
		2.00	IVN 3 D	227					2
		2.00							
		2.30			2.30			Very stiff consistency dark brown mottled dark grey silty clay. Scattered subangular to rounded, fine to medium sized chalk gravel.	
		2.50	IVN 4 D	227	2.50				
		2.50						End of Borehole at 2.50 m	
									3
									4

Remarks: Buried service clearance pit dug to 1.0mbgl. End at 2.5 due to refusal. No groundwater encountered.

Project Name KAO Business Park	Project No. 14.8039	Co-ords: -	Hole Type WS
Location: Harlow Plant: Lightweight window sampler		Level: -	Scale 1:25
Client: Harlow Properties Ltd Drilled By: AT		Dates: 02/03/2014	Logged By GC

Well	Water Strikes	Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.25	ES		0.20			Grass over made ground. Dark brown clayey sandy Silt. Sand is fine to medium.	
					0.30			Brown speckled red slighty gravelly clay. Gravel is subangular to subrounded, fine to coarse sized brick. (MADE GROUND)	
		0.50	D					Stiff light brown mottled light grey speckled white locally sandy slightly Gravelly CLAY. Sand is medium to coarse, gravel is subangular to rounded, fine to coarse sized chalk and occasional flint.	
		1.00	IVN 1	227					1
		1.00	ES						
		1.00	D						
		1.50	IVN 2	227					
		1.50	D						
		2.00	IVN 3	227					2
		2.00	D		2.10				
		2.50	IVN 4	227	2.50			Very stiff brown mottled grey slightly sandy slightly Gravelly CLAY. Sand is medium to coarse. Gravel is subangular to rounded, fine to coarse sized chalk.	
		2.50	D					End of Borehole at 2.50 m	3
									4

Remarks: Buried service clearance pit dug to 1.0mbgl. No groundwater encountered.

Project Name KAO Business Park	Project No. 14.8039	Co-ords: -	Hole Type WS
Location: Harlow Plant: Lightweight window sampler		Level: -	Scale 1:25
Client: Harlow Properties Ltd Drilled By: AT		Dates: 02/03/2014	Logged By GC

Well	Water Strikes	Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.20			Grass over made ground. Dark brown clayey sandy Silt. Sand is fine to medium.	
		0.30	ES		0.40			Brown speckled red slightly gravelly clay. Gravel is subangular to subrounded, fine to coarse sized brick. (MADE GROUND)	
		0.50	D					Stiff light brown mottled light grey speckled white locally sandy slightly Gravelly CLAY. Sand is medium to coarse, gravel is subangular to rounded, fine to coarse sized chalk and occasional flint.	
		0.70	ES						
		1.00	IVN 1 D	227					1
		1.00							
		1.50	IVN 2 D	227					
		1.50							
		2.00	IVN 3 D	227	2.10			Very stiff brown mottled grey slightly sandy slightly Gravelly CLAY. Sand is medium to coarse. Gravel is subangular to rounded, fine to coarse sized chalk.	2
		2.00			2.40				
								End of Borehole at 2.40 m	3
									4

Remarks: Buried service clearance pit dug to 1.0mbgl. No groundwater encountered.

Project Name KAO Business Park	Project No. 14.8039	Co-ords: -	Hole Type WS
Location: Harlow Plant: Lightweight window sampler		Level: -	Scale 1:25
Client: Harlow Properties Ltd Drilled By: AT		Dates: 02/03/2014	Logged By GC

Well	Water Strikes	Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.20	ES		0.30			Grass over dark brown black very sandy Gravel. Sand is medium to coarse. Gravel is subangular to subrounded, fine to medium sized clinker flint. (TOPSOIL)	
		0.50	D					Stiff light brown gravelly slightly Sandy CLAY. Sand is medium to coarse. Gravel is subangular to rounded, fine to medium sized chalk and flint.	
		0.90	ES						
		1.00	IVN 1		108				
		1.00	D						
		1.50	IVN 2	167					
		2.00	D						
		2.30							
		2.50	IVN 3	178		Very stiff consistency dark brown mottled dark grey silty clay. Scattered subangular to rounded, fine to medium sized chalk gravel.			
		2.50	D						
		3.00	IVN 4	227	3.00		-----	End of Borehole at 3.00 m	
								4	

Remarks: Buried service clearance pit dug to 1.0mbgl. No groundwater encountered. No recovery at 1.4m to 2.0m.

Trial Pit Logs

Project Name KAO Business Park	Project No. 14.8039	Co-ords: - Level: -	Date 07/04/2014
Location: Harlow		Dimensions: -	Scale 1:15
Client: Harlow Properties Ltd		Depth 0.45m	Logged By

Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
Depth (m)	Type	Results				
			0.15			Grass over made ground brown slightly gravelly Sand. Sand is medium to coarse. Gravel is subangular to subrounded, fine to subrounded sized flint.
						Light brown gravelly Clay. Gravel is subangular to subrounded, fine to coarse sized flint and brick.)MADE GROUND)
			0.45		Trialpit Complete at 0.45 m	

Remarks:

Groundwater: No Groundwater



TableBASE 3.1 (Bld 426.72) Standard Trialpit Log v2 dated 27th Nov 03

Project Name
 KAO Business Park

 Project No.
 14.8039

 Co-ords: -
 Level: -

 Date
 07/04/2014

Location: Harlow

Dimensions: -

Client: Harlow Properties Ltd

 Depth
 0.45m

 Scale
 1:15

Logged By

Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
Depth (m)	Type	Results				
			0.20			Grass over dark brown clayey Sandy SILT. Sand is fine to medium.
			0.45			Firm to stiff slightly Gravelly CLAY. Gravel is subangular to rounded, fine to coarse sized chalk.
						Trialpit Complete at 0.45 m 1 2

Remarks:

Groundwater: No Groundwater



Project Name KAO Business Park	Project No. 14.8039	Co-ords: - Level: -	Date 07/04/2014
Location: Harlow		Dimensions: -	Scale 1:15
Client: Harlow Properties Ltd		Depth 0.50m	Logged By

[illegible]

Remarks:

Groundwater: No Groundwater



Project Name KAO Business Park	Project No. 14.8039	Co-ords: - Level: -	Date 07/04/2014
Location: Harlow		Dimensions: - Depth 0.70m	Scale 1:15
Client: Harlow Properties Ltd			Logged By

Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
Depth (m)	Type	Results				
			0.20			Grass over made ground. Dark brown sandy Silt. (MADE GROUND)
			0.40			Light brown slightly Gravelly CLAY. Gravel is subangular to subrounded, fine to coarse sized brick and flint.
			0.70			Firm to stiff slightly Gravelly CLAY. Gravel is subangular to rounded, fine to coarse sized chalk.
						Trialpit Complete at 0.70 m

Remarks:		
Groundwater:	No Groundwater	

Project Name KAO Business Park	Project No. 14.8039	Co-ords: - Level: -	Date 07/04/2014
Location: Harlow		Dimensions: -	Scale 1:15
Client: Harlow Properties Ltd		Depth 0.75m	Logged By

Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
Depth (m)	Type	Results				
			0.25			Grass over made ground. Dark brown clayey sandy Silt. Sand is fine to medium. (MADE GROUND)
						Brown slightly gravelly Clay. Gravel is subangular to rounded, fine to coarse sized chalk. Occasional whole and half bricks. (MADE GROUND)
						Loose coarse gravel to cobble sized mudstone/limestone. (MADE GROUND)
			0.70 0.75			----- Trialpit Complete at 0.75 m

Remarks:

Groundwater: No Groundwater



Project Name KAO Business Park	Project No. 14.8039	Co-ords: - Level: -	Date 07/04/2014
Location: Harlow		Dimensions: -	Scale 1:15
Client: Harlow Properties Ltd		Depth 0.40m	Logged By

Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
Depth (m)	Type	Results				
			0.35 0.40			Grass over dark brown sandy Silt. Sand is fine to medium. (MADE GROUND)
						Ligth grey silty fine to medium grained Sand. (MADE GROUND)
						Trialpit Complete at 0.40 m

Remarks:

Groundwater: No Groundwater



TableBASE 3.1 (Bld 426.72) Standard Trialpit Log v2 dated 27th Nov 03

Project Name
 KAO Business Park

 Project No.
 14.8039

 Co-ords: -
 Level: -

 Date
 07/04/2014

Location: Harlow

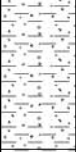
Dimensions: -

Client: Harlow Properties Ltd

 Depth
 0.55m

 Scale
 1:15

Logged By

Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
Depth (m)	Type	Results				
			0.25		 Dark brown sandy clayey SILT. Sand is fine to medium.	
			0.55		 Stiff consistency light brown speckled white silty slightly Gravelly CLAY. Gravel is subangular to subrounded, medium to coarse sized chalk.	
Trialpit Complete at 0.55 m						

Remarks:

Groundwater: No Groundwater

Project Name KAO Business Park	Project No. 14.8039	Co-ords: - Level: -	Date 07/04/2014
Location: Harlow		Dimensions: -	Scale 1:15
Client: Harlow Properties Ltd		Depth 0.50m	Logged By

Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
Depth (m)	Type	Results				
			0.15			Grass over made ground. Dark brown clayey sandy Silt. Sand is fine to medium. (MADE GROUND)
						Brown clayey sandy Gravel. Sand is fine to medium. (MADE GROUND)
						Stiff consistency light brown slightly gravelly clay. Gravel is subangular to subrounded, fine to coarse sized chalk (MADE GROUND)
			0.50			

Remarks:

Groundwater: No Groundwater



Project Name
 KAO Business Park

 Project No.
 14.8039

 Co-ords: -
 Level: -

 Date
 07/04/2014

Location: Harlow

Dimensions: -

 Scale
 1:15

Client: Harlow Properties Ltd

 Depth
 0.90m


Logged By

Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description	
Depth (m)	Type	Results					
			0.15			Grass over brown very silty Sand. Sand is fine to medium. (MADE GROUND)	
						Brown very silty sandy slightly gravelly Clay. Sand is fine to coarse. Gravel is subangular to subrounded, fine to coarse sized chalk, flint and brick. (MADE GROUND)	
			0.80				
			0.90			Very stiff brown mottled grey slightly sandy slightly Gravelly CLAY. Sand is medium to coarse. Gravel is subangular to subrounded, fine to coarse sized chalk.	
						Trialpit Complete at 0.90 m	

Remarks:

Groundwater: No Groundwater



APPENDIX D

Soakage Test and CBR Test Results

constructiveevaluation
Building & Material Test Consultants

Trial Hole: SA1

Trial Hole: SA1

[illegible]

Pit Size		Time in mins	
Length	0.30	12	75%
Width	0.25	2500	25% (estimated)
Depth	0.90		

N/A

The graph illustrates the depth of a diver over time. The y-axis represents 'Depth in metres' from 0.0% to 100.0% in 10.0% increments. The x-axis represents 'Time in minutes' from 0.00 to 1400.00 in 200.00 increments. A blue line shows the depth starting at 100.0% at 0.00 minutes, dropping sharply to about 40.0% by 100.00 minutes, and then gradually decreasing to approximately 30.0% by 1200.00 minutes. A horizontal black line is drawn at the 5.0% depth level, starting from 100.00 minutes.

Time in minutes	Depth in metres
0.00	100.0%
100.00	40.0%
200.00	36.0%
400.00	34.0%
600.00	33.0%
800.00	32.0%
1000.00	31.0%
1200.00	30.0%

BH7 Test 1



Depth of Hole (m)	4
Top of response Zone (m)	2.5
Depth of Response Zone (m)	4
Mid-point depth of reponse zone (m)	3.25
Dimeter of Response Zone (m)	0.15
Diameter of Standpipe (m)	0.15
Casing Height above GL (m)	0

Water Added (litres)

In time (Sec)

Inflow (l/sec)

Time (min)	Water Level Reading (mbgl)	Water level (mbgl)	Head (m)
0	0	0	3.25
15	0.04	0.04	3.21
30	0.07	0.07	3.18
45	0.09	0.09	3.16
60	0.1	0.1	3.15

CLEGG EQUIVALENT CBR TEST RESULT SHEET

Contract : KAO Business Park, Harlow

Job No. : 14.8039

Client : Harlow Properties Ltd

KAO Business Park	Impact Value		
	CBR 1	CBR 1	
Drop No	Depth : 200 mm	Depth : 450 mm	
1	4	3	
2	5	3	
3	6	4	
4	6	6	
5	6	7	
Equivalent CBR%	6	6	

KAO Business Park	Impact Value		
	CBR 2	CBR 2	
Drop No	Depth : 300mm	Depth : 600mm	
1	5	5	
2	5	5	
3	6	5	
4	6	6	
5	6	6	
Equivalent CBR%	6	6	

CLEGG EQUIVALENT CBR TEST RESULT SHEET

Contract : KAO Business Park, Harlow

Job No. : 14:8039

Client : Harlow Properties Ltd

KAO Business Park	Impact Value		
	CBR 3	CBR 3	
Drop No	Depth : 200mm	Depth : 450mm	
1	6	3	
2	7	5	
3	7	6	
4	9	6	
5	8	8	
Equivalent CBR%	10	6	

KAO Business Park	Impact Value		
	CBR 4	CBR 4	CBR
Drop No	Depth : 300mm	Depth: 500mm	
1	4	6	
2	6	7	
3	9	7	
4	16	7	
5	20	7	
Equivalent CBR%	23	7	

CLEGG EQUIVALENT CBR TEST RESULT SHEET

Contract : KAO Business Park, Harlow

Job No. : 14.8039

Client : Harlow Properties Ltd

KAO Business Park	Impact Value		
	CBR 5	CBR 5	
Drop No	Depth : 250 mm	Depth : 450 mm	
1	4	10	
2	5	7	
3	5	10	
4	4	9	
5	5	10	
Equivalent CBR%	4	10	

KAO Business Park	Impact Value		
	CBR 6	CBR 6	
Drop No	Depth: 400mm	Depth: 500mm	
1	5	6	
2	7	7	
3	7	7	
4	7	7	
5	7	7	
Equivalent CBR%	7	7	

CLEGG EQUIVALENT CBR TEST RESULT SHEET

Contract : KAO Business Park, Harlow

Job No. : 14.8039

Client : Harlow Properties Ltd

KAO Business Park	Impact Value		
	CBR 7	CBR 7	
Drop No	Depth : 200 mm	Depth : 450 mm	
1	6	9	
2	8	12	
3	8	14	
4	8	14	
5	8	15	
Equivalent CBR%	9	19	

KAO Business Park	Impact Value		
	CBR 8	CBR 8	
Drop No	Depth: 450mm	Depth: 750mm	
1	2	9	
2	3	13	
3	3	14	
4	3	16	
5	3	16	
Equivalent CBR%	3	23	

CLEGG EQUIVALENT CBR TEST RESULT SHEET

Contract : KAO Business Park, Harlow

Job No. : 14.8039

Client : Harlow Properties Ltd

KAO Business Park	Impact Value		
	CBR 9		
Drop No	Depth : 400 mm		
1	8		
2	11		
3	14		
4	22		
5	22		
Equivalent CBR%	39		

KAO Business Park	Impact Value		
	CBR 10		
Drop No	Depth: 300mm		
1	11		
2	10		
3	14		
4	14		
5	17		
Equivalent CBR%	19		

CLEGG EQUIVALENT CBR TEST RESULT SHEET

Contract : KAO Business Park, Harlow

Job No. : 14.8039

Client : Harlow Properties Ltd

KAO Business Park	Impact Value		
	CBR 11	CBR 11	
Drop No	Depth : 400 mm	Depth : 550 mm	
1	6	8	
2	7	9	
3	7	10	
4	8	10	
5	8	11	
Equivalent CBR%	9	12	

KAO Business Park	Impact Value		
	CBR 12	CBR 12	
Drop No	Depth: 300mm	Depth: 500mm	
1	6	4	
2	7	5	
3	7	5	
4	7	5	
5	7	5	
Equivalent CBR%	7	5	

APPENDIX E

Laboratory Certificates

SUMMARY OF GEOTECHNICAL TESTING

Sample details				Classification Tests				Density Tests		Undrained Triaxial Compression			Chemical Tests			Other tests and comments
Borehole No	Sample No	Depth (m)	Type	Description	MC (%)	LL (%)	PL (%)	PI	<425 µm (%)	Bulk (Mg/m³)	Dry (Mg/m³)	Cell Pressure (kPa)	Deviator Stress (kPa)	Shear Stress (kPa)	Failure Sketch	
BH1	-	1.50	U	Very stiff brownish grey gravelly CLAY. Gravel is flint and chalk nodules.	15	42	17	25	91	2.18	1.89	30	631	315		
BH1	-	6.00	U	Very stiff grey gravelly silty CLAY. Gravel is fine chalk nodules.	14					2.27	2.00	120	897	448		
BH1	-	12.00	U	Very stiff brownish grey gravelly silty CLAY. Gravel is flint and chalk nodules.	14	40	15	25	78	2.18	1.92	240	460	230		
BH1	-	18.00	U	Firm to stiff fissured brownish grey silty CLAY	26	81	29	52	100	2.02	1.60	360	433	217		
BH2	-	2.50	U	Very stiff grey gravelly silty CLAY. Gravel is flint and chalk nodules.	15					2.19	1.91	50	751	375		
BH2	-	7.50	U	Very stiff grey gravelly CLAY. Gravel is chalk nodules.	14	47	16	31	92	2.22	1.95	150	879	439		
BH3	-	3.50	U	Very stiff grey gravelly silty CLAY with 1 horizontal fissure. Gravel is fine chalk nodules.	17					2.05	1.76	70	295	147		
BH3	-	9.00	U	Very stiff grey gravelly silty CLAY. Gravel is flint and chalk nodules.	14	41	16	25	86	2.22	1.95	180	790	395		
BH4	-	2.50	U	Very stiff brown grey gravelly silty CLAY/ Gravel is fine chalk nodules.	16	40	17	23	90	2.19	1.89	50	580	290		
BH4	-	7.50	U	Very stiff fissured grey gravelly silty CLAY. Gravel is fine chalk nodules.	15					2.17	1.89	150	782	391		
BH5	-	2.50	U	Very stiff brown gravelly silty CLAY. Gravel is fine chalk nodules	15					2.12	1.85	50	418	209		
BH5	-	4.50	U	Very stiff grey gravelly silty CLAY. Gravel is fine chalk nodules.	15	44	18	26	84	2.15	1.87	90	688	344		

Sample type: B (Bulk disturb.) BLK (Block) C (Core) D (Disturbed) LB (Large Bulk dist.) U (Undisturbed)

Checked and Approved by

JS

J Sturges (Ops Mgr)

Date: 06/05/2014

Project Number:

Project Name:

GEO / 21158

KAO BUSINESS PARK, HARLOW
Project Number 14.8039



SUMMARY OF GEOTECHNICAL TESTING

[illegible]

Sample type: B (Bulk disturb.) BLK (Block) C (Core) D (Disturbed) LB (Large Bulk dist.) U (Undisturbed)

Checked and Approved by

57

J Sturges (Ops Mgr)

Date: 06/05/2014

Project Number:

Project Name:

GEO / 21158

KAO BUSINESS PARK, HARLOW
Project Number 14.8039



Quick Undrained Triaxial Compression Test

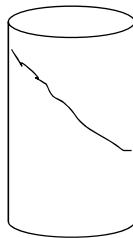
Borehole No: BH1
 Sample No: -
 Depth (m): 1.50

Description:
 Very stiff brownish grey gravelly CLAY. Gravel is flint and chalk nodules.

Single Stage Specimen

Specimen Details		Single specimen
Specimen conditions		Undisturbed
Length	(mm)	202.5
Diameter	(mm)	101.9
Moisture Content	(%)	15
Bulk Density	(Mg/m ³)	2.18
Dry Density	(Mg/m ³)	1.89
Test Details		Single specimen
Latex membrane thickness	(mm)	0.3
Membrane correction	(kPa)	1.0
Axial displacement rate	(%/min)	2.0
Cell pressure	(kPa)	30
Strain at failure	(%)	17.8
Maximum Deviator Stress	(kPa)	631
Shear Stress Cu	(kPa)	315

Mode of failure



Orientation of the sample	Vertical
---------------------------	----------

Distance from top of the tube	100 mm
-------------------------------	--------

Sample type	U
-------------	---

Checked and Approved by

JS

J Sturges (Ops Mgr)

Date: 02/05/2014

Project Number:

GEO / 21158

Project Name:

KAO BUSINESS PARK, HARLOW
Project Number 14.8039

GEOLABS®



Quick Undrained Triaxial Compression Test

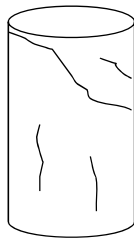
Borehole No: BH1
 Sample No: -
 Depth (m): 6.00

Description:
 Very stiff grey gravelly silty CLAY. Gravel is fine chalk nodules.

Single Stage Specimen

Specimen Details		Single specimen
Specimen conditions		Undisturbed
Length	(mm)	203.7
Diameter	(mm)	100.1
Moisture Content	(%)	14
Bulk Density	(Mg/m ³)	2.27
Dry Density	(Mg/m ³)	2.00
Test Details		Single specimen
Latex membrane thickness	(mm)	0.3
Membrane correction	(kPa)	0.7
Axial displacement rate	(%/min)	2.0
Cell pressure	(kPa)	120
Strain at failure	(%)	11.3
Maximum Deviator Stress	(kPa)	897
Shear Stress Cu	(kPa)	448

Mode of failure



Orientation of the sample Vertical

Distance from top of the tube 40 mm

Sample type U

Checked and Approved by

JS

J Sturges (Ops Mgr)

Date: 02/05/2014

Project Number:

GEO / 21158

Project Name:

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Quick Undrained Triaxial Compression Test

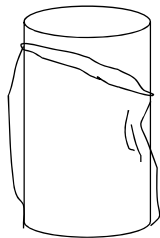
Borehole No: BH1
 Sample No: -
 Depth (m): 12.00

Description:
 Very stiff brownish grey gravelly silty CLAY. Gravel is flint and chalk nodules.

Single Stage Specimen

Specimen Details		Single specimen
Specimen conditions		Undisturbed
Length	(mm)	202.4
Diameter	(mm)	102.4
Moisture Content	(%)	14
Bulk Density	(Mg/m ³)	2.18
Dry Density	(Mg/m ³)	1.92
Test Details		Single specimen
Latex membrane thickness	(mm)	0.3
Membrane correction	(kPa)	1.0
Axial displacement rate	(%/min)	2.0
Cell pressure	(kPa)	240
Strain at failure	(%)	16.8
Maximum Deviator Stress	(kPa)	460
Shear Stress Cu	(kPa)	230

Mode of failure



Orientation of the sample	Vertical
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Distance from top of the tube	120 mm
-------------------------------	--------

Sample type	U
-------------	---

Checked and Approved by

JS

J Sturges (Ops Mgr)

Date: 02/05/2014

Project Number:

GEO / 21158

Project Name:

KAO BUSINESS PARK, HARLOW
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Quick Undrained Triaxial Compression Test

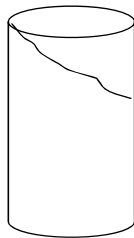
Borehole No: BH1
 Sample No: -
 Depth (m): 18.00

Description:
 Firm to stiff fissured brownish grey silty CLAY

Single Stage Specimen

Specimen Details		Single specimen
Specimen conditions		Undisturbed
Length	(mm)	202.0
Diameter	(mm)	101.8
Moisture Content	(%)	26
Bulk Density	(Mg/m ³)	2.02
Dry Density	(Mg/m ³)	1.60
Test Details		Single specimen
Latex membrane thickness	(mm)	0.3
Membrane correction	(kPa)	0.7
Axial displacement rate	(%/min)	2.0
Cell pressure	(kPa)	360
Strain at failure	(%)	10.4
Maximum Deviator Stress	(kPa)	433
Shear Stress Cu	(kPa)	217

Mode of failure



Orientation of the sample Vertical

Distance from top of the tube 120 mm

Sample type U

Checked and Approved by

JS

J Sturges (Ops Mgr)

Date: 02/05/2014

Project Number:

GEO / 21158

Project Name:

KAO BUSINESS PARK, HARLOW
 Project Number 14.8039

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Quick Undrained Triaxial Compression Test

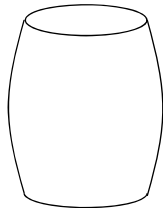
Borehole No: BH2
 Sample No: -
 Depth (m): 2.50

Description:
 Very stiff grey gravelly silty CLAY. Gravel is flint and chalk nodules.

Single Stage Specimen

Specimen Details		Single specimen
Specimen conditions		Undisturbed
Length	(mm)	203.0
Diameter	(mm)	101.0
Moisture Content	(%)	15
Bulk Density	(Mg/m ³)	2.19
Dry Density	(Mg/m ³)	1.91
Test Details		Single specimen
Latex membrane thickness	(mm)	0.3
Membrane correction	(kPa)	0.6
Axial displacement rate	(%/min)	2.0
Cell pressure	(kPa)	50
Strain at failure	(%)	8.4
Maximum Deviator Stress	(kPa)	751
Shear Stress Cu	(kPa)	375

Mode of failure



Orientation of the sample Vertical

Distance from top of the tube 40 mm

Sample type U

Checked and Approved by

JS

J Sturges (Ops Mgr)

Date: 02/05/2014

Project Number:

GEO / 21158

Project Name:

KAO BUSINESS PARK, HARLOW
 Project Number 14.8039

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Quick Undrained Triaxial Compression Test

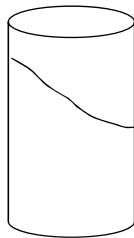
Borehole No: BH2
 Sample No: -
 Depth (m): 7.50

Description:
 Very stiff grey gravelly CLAY. Gravel is chalk nodules.

Single Stage Specimen

Specimen Details		Single specimen
Specimen conditions		Undisturbed
Length	(mm)	202.1
Diameter	(mm)	101.9
Moisture Content	(%)	14
Bulk Density	(Mg/m ³)	2.22
Dry Density	(Mg/m ³)	1.95
Test Details		Single specimen
Latex membrane thickness	(mm)	0.3
Membrane correction	(kPa)	1.0
Axial displacement rate	(%/min)	2.0
Cell pressure	(kPa)	150
Strain at failure	(%)	16.3
Maximum Deviator Stress	(kPa)	879
Shear Stress Cu	(kPa)	439

Mode of failure



Orientation of the sample	Vertical
---------------------------	----------

Distance from top of the tube	80 mm
-------------------------------	-------

Sample type	U
-------------	---

Checked and Approved by

JS

J Sturges (Ops Mgr)

Date: 02/05/2014

Project Number:

GEO / 21158

Project Name:

KAO BUSINESS PARK, HARLOW
Project Number 14.8039

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Quick Undrained Triaxial Compression Test

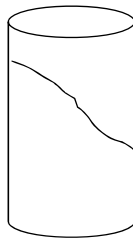
Borehole No: BH3
 Sample No: -
 Depth (m): 3.50

Description:
 Very stiff grey gravelly silty CLAY with 1 horizontal fissure.
 Gravel is fine chalk nodules.

Single Stage Specimen

Specimen Details		Single specimen
Specimen conditions		Undisturbed
Length	(mm)	202.4
Diameter	(mm)	102.2
Moisture Content	(%)	17
Bulk Density	(Mg/m ³)	2.05
Dry Density	(Mg/m ³)	1.76
Test Details		Single specimen
Latex membrane thickness	(mm)	0.3
Membrane correction	(kPa)	0.6
Axial displacement rate	(%/min)	2.0
Cell pressure	(kPa)	70
Strain at failure	(%)	9.4
Maximum Deviator Stress	(kPa)	295
Shear Stress Cu	(kPa)	147

Mode of failure



Orientation of the sample Vertical

Distance from top of the tube 50 mm

Sample type U

Checked and Approved by

JS

J Sturges (Ops Mgr)

Date: 02/05/2014

Project Number:

GEO / 21158

Project Name:

KAO BUSINESS PARK, HARLOW
 Project Number 14.8039

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Quick Undrained Triaxial Compression Test

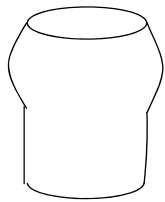
Borehole No: BH3
 Sample No: -
 Depth (m): 9.00

Description:
 Very stiff grey gravelly silty CLAY. Gravel is flint and chalk nodules.

Single Stage Specimen

Specimen Details		Single specimen
Specimen conditions		Undisturbed
Length	(mm)	202.4
Diameter	(mm)	101.4
Moisture Content	(%)	14
Bulk Density	(Mg/m ³)	2.22
Dry Density	(Mg/m ³)	1.95
Test Details		Single specimen
Latex membrane thickness	(mm)	0.3
Membrane correction	(kPa)	1.0
Axial displacement rate	(%/min)	2.0
Cell pressure	(kPa)	180
Strain at failure	(%)	16.8
Maximum Deviator Stress	(kPa)	790
Shear Stress Cu	(kPa)	395

Mode of failure



Orientation of the sample

Vertical

Distance from top of the tube

80 mm

Sample type

U

Checked and Approved by

JS

J Sturges (Ops Mgr)

Date: 02/05/2014

Project Number:

GEO / 21158

Project Name:

KAO BUSINESS PARK, HARLOW
 Project Number 14.8039

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Quick Undrained Triaxial Compression Test

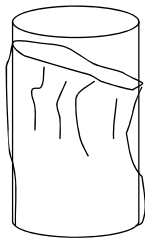
Borehole No: BH4
 Sample No: -
 Depth (m): 2.50

Description:
 Very stiff brown grey gravelly silty CLAY/ Gravel is fine chalk nodules.

Single Stage Specimen

Specimen Details		Single specimen
Specimen conditions		Undisturbed
Length	(mm)	202.5
Diameter	(mm)	101.3
Moisture Content	(%)	16
Bulk Density	(Mg/m ³)	2.19
Dry Density	(Mg/m ³)	1.89
Test Details		Single specimen
Latex membrane thickness	(mm)	0.3
Membrane correction	(kPa)	0.8
Axial displacement rate	(%/min)	2.0
Cell pressure	(kPa)	50
Strain at failure	(%)	12.3
Maximum Deviator Stress	(kPa)	580
Shear Stress Cu	(kPa)	290

Mode of failure



Orientation of the sample

Vertical

Distance from top of the tube

70 mm

Sample type

U

Checked and Approved by

JS

J Sturges (Ops Mgr)

Date: 02/05/2014

Project Number:

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Quick Undrained Triaxial Compression Test

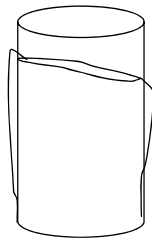
Borehole No: BH4
 Sample No: -
 Depth (m): 7.50

Description:
 Very stiff fissured grey gravelly silty CLAY. Gravel is fine chalk nodules.

Single Stage Specimen

Specimen Details		Single specimen
Specimen conditions		Undisturbed
Length	(mm)	204.7
Diameter	(mm)	101.8
Moisture Content	(%)	15
Bulk Density	(Mg/m ³)	2.17
Dry Density	(Mg/m ³)	1.89
Test Details		Single specimen
Latex membrane thickness	(mm)	0.3
Membrane correction	(kPa)	1.0
Axial displacement rate	(%/min)	2.0
Cell pressure	(kPa)	150
Strain at failure	(%)	18.6
Maximum Deviator Stress	(kPa)	782
Shear Stress Cu	(kPa)	391

Mode of failure



Orientation of the sample Vertical

Distance from top of the tube 100 mm

Sample type U

Checked and Approved by

JS

J Sturges (Ops Mgr)

Date: 02/05/2014

Project Number:

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Project Name:

KAO BUSINESS PARK, HARLOW
 Project Number 14.8039

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Quick Undrained Triaxial Compression Test

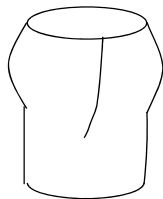
Borehole No: BH5
 Sample No: -
 Depth (m): 2.50

Description:
 Very stiff brown gravelly silty CLAY. Gravel is fine chalk nodules

Single Stage Specimen

Specimen Details		Single specimen
Specimen conditions		Undisturbed
Length	(mm)	201.9
Diameter	(mm)	101.4
Moisture Content	(%)	15
Bulk Density	(Mg/m ³)	2.12
Dry Density	(Mg/m ³)	1.85
Test Details		Single specimen
Latex membrane thickness	(mm)	0.3
Membrane correction	(kPa)	0.7
Axial displacement rate	(%/min)	2.0
Cell pressure	(kPa)	50
Strain at failure	(%)	10.9
Maximum Deviator Stress	(kPa)	418
Shear Stress Cu	(kPa)	209

Mode of failure



Orientation of the sample

Vertical

Distance from top of the tube

65 mm

Sample type

U

Checked and Approved by

JS

J Sturges (Ops Mgr)

Date: 02/05/2014

Project Number:

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 Project Number 14.8039

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Quick Undrained Triaxial Compression Test

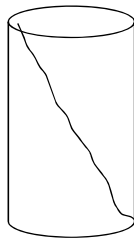
Borehole No: BH5
 Sample No: -
 Depth (m): 4.50

Description:
 Very stiff grey gravelly silty CLAY. Gravel is fine chalk nodules.

Single Stage Specimen

Specimen Details		Single specimen
Specimen conditions		Undisturbed
Length	(mm)	203.4
Diameter	(mm)	101.6
Moisture Content	(%)	15
Bulk Density	(Mg/m ³)	2.15
Dry Density	(Mg/m ³)	1.87
Test Details		Single specimen
Latex membrane thickness	(mm)	0.3
Membrane correction	(kPa)	0.8
Axial displacement rate	(%/min)	2.0
Cell pressure	(kPa)	90
Strain at failure	(%)	11.8
Maximum Deviator Stress	(kPa)	688
Shear Stress Cu	(kPa)	344

Mode of failure



Orientation of the sample Vertical

Distance from top of the tube 40 mm

Sample type U

Checked and Approved by

JS

J Sturges (Ops Mgr)

Date: 02/05/2014

Project Number:

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Project Name:

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 Project Number 14.8039

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Quick Undrained Triaxial Compression Test

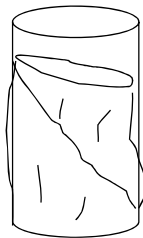
Borehole No: BH6
 Sample No: -
 Depth (m): 9.00

Description:
 Very stiff grey gravelly silty CLAY. Gravel is fine chalk nodules.

Single Stage Specimen

Specimen Details		Single specimen
Specimen conditions		Undisturbed
Length	(mm)	191.5
Diameter	(mm)	101.4
Moisture Content	(%)	14
Bulk Density	(Mg/m ³)	2.18
Dry Density	(Mg/m ³)	1.92
Test Details		Single specimen
Latex membrane thickness	(mm)	0.3
Membrane correction	(kPa)	1.0
Axial displacement rate	(%/min)	2.1
Cell pressure	(kPa)	180
Strain at failure	(%)	17.2
Maximum Deviator Stress	(kPa)	833
Shear Stress Cu	(kPa)	416

Mode of failure



Orientation of the sample	Vertical
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Distance from top of the tube	40 mm
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Sample type	U
-------------	---

Checked and Approved by

JS

J Sturges (Ops Mgr)

Date: 02/05/2014

Project Number:

GEO / 21158

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KAO BUSINESS PARK, HARLOW
Project Number 14.8039

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Quick Undrained Triaxial Compression Test

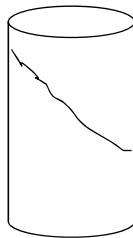
Borehole No: BH6
 Sample No: -
 Depth (m): 12.00

Description:
 Very stiff grey very gravelly silty CLAY. Gravel is fine to medium flint and chalk nodules.

Single Stage Specimen

Specimen Details		Single specimen
Specimen conditions		Undisturbed
Length	(mm)	202.4
Diameter	(mm)	102.1
Moisture Content	(%)	13
Bulk Density	(Mg/m ³)	2.25
Dry Density	(Mg/m ³)	1.99
Test Details		Single specimen
Latex membrane thickness	(mm)	0.3
Membrane correction	(kPa)	0.6
Axial displacement rate	(%/min)	2.0
Cell pressure	(kPa)	240
Strain at failure	(%)	9.4
Maximum Deviator Stress	(kPa)	634
Shear Stress Cu	(kPa)	317

Mode of failure



Orientation of the sample Vertical

Distance from top of the tube 40 mm

Sample type U

Checked and Approved by

JS

J Sturges (Ops Mgr)

Date: 02/05/2014

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 Project Number 14.8039

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Engineering Markets

**KAO Business Park,
Harlow**

Job Ref No. 14.8039

- Oedometer One-dimensional Consolidation Tests**

One-dimensional consolidation tests have been carried out in accordance with BS1377-8:1990

Sample from BH1 @ 15.00m bgl

The soil tested can be described as a stiff to very stiff dark brown CLAY.

Load Stage	Stress Range, dp in kN/m²	Coefficient of Compressibility, m_v in m²/MN	Coefficient of Consolidation, c_v in m²/yr
1	0 - 300	0.20	29.14
2	300 - 600	0.05	0.66
3	600 - 1200	0.03	0.47
4	1200 - 2400	0.02	0.47
5	2400 - 300	-0.22	0.43

Engineering Markets

**KAO Business Park,
Harlow**

Job Ref No. 14.8039

- Oedometer One-dimensional Consolidation Tests**

One-dimensional consolidation tests have been carried out in accordance with BS1377-8:1990

Sample from BH5 @ 7.50m bgl

The soil tested can be described as a stiff to very stiff dark grey CLAY with inclusions of coarse gravel sized pieces of chalk.

Load Stage	Stress Range, dp in kN/m²	Coefficient of Compressibility, m_v in m²/MN	Coefficient of Consolidation, c_v in m²/yr
1	0 - 150	0.19	1.16
2	150 - 300	0.05	2.84
3	300 - 600	0.03	2.27
4	600 - 1200	0.02	4.33
5	1200 - 150	-0.15	2.03

**KAO Business Park,
Harlow**

Job Ref No. 14.8039

- **Oedometer One-dimensional Consolidation Tests**

One-dimensional consolidation tests have been carried out in accordance with BS1377-8:1990

Sample from BH6 @ 3.50m bgl

The soil tested can be described as a stiff to very stiff light grey brown CLAY with inclusions of coarse gravel sized pieces of chalk.

Load Stage	Stress Range, dp in kN/m²	Coefficient of Compressibility, m_v in m²/MN	Coefficient of Consolidation, c_v in m²/yr
1	0 - 70	0.43	30.06
2	70 - 140	0.08	4.45
3	140 - 280	0.06	8.22
4	280 - 560	0.04	3.94
5	560 - 70	-0.33	1.84

TEST RESULT SHEET

Contract : KAO Business Park

Job No. : 14.8039

Client : Harlow Properties

Sample No. & Depth: WS6 0.65m

Natural Moisture Content	W%	19%
--------------------------	----	-----

Sample No. & Depth: WS6 1.5m

Natural Moisture Content	W%	18%
--------------------------	----	-----

Sample No. & Depth: WS7 0.5m

Natural Moisture Content	W%	19%
--------------------------	----	-----

Sample No. & Depth: WS7 1.5m

Natural Moisture Content	W%	17%
--------------------------	----	-----

Sample No. & Depth: WS7 2.5m

Natural Moisture Content	W%	16%
--------------------------	----	-----

Sample No. & Depth: WS8 1.0m

Natural Moisture Content	W%	18%
--------------------------	----	-----

Sample No. & Depth: WS8 2.0m

Natural Moisture Content	W%	16%
--------------------------	----	-----

Sample No. & Depth: WS8 3.0m

Natural Moisture Content	W%	18%
--------------------------	----	-----

Sample No. & Depth: WS10 1.0m

Natural Moisture Content	W%	16%
--------------------------	----	-----

Sample No. & Depth: WS10 2.0m

Natural Moisture Content	W%	16%
--------------------------	----	-----

TEST RESULT SHEET

Contract : KAO Business Park

Job No. : 14.8039

Client : Harlow Properties

Sample No. & Depth:		WS11 0.5m
Natural Moisture Content	W%	16%

Sample No. & Depth:		WS11 1.5m
Natural Moisture Content	W%	16%

Sample No. & Depth:		WS12 0.5m
Natural Moisture Content	W%	6%

Sample No. & Depth:		WS12 1.5m
Natural Moisture Content	W%	14%

Sample No. & Depth:		WS12 2.5m
Natural Moisture Content	W%	16%

Sample No. & Depth:		WS13 1.0m
Natural Moisture Content	W%	17%

Sample No. & Depth:		WS13 2.0m
Natural Moisture Content	W%	15%

Sample No. & Depth:		WS14 1.0m
Natural Moisture Content	W%	19%

Sample No. & Depth:		WS14 2.0m
Natural Moisture Content	W%	19%

Sample No. & Depth:		WS14 2.5m
Natural Moisture Content	W%	20%

TEST RESULT SHEET
Contract : KAO Business Park

Job No. : 14.8039

Client : Harlow Properties

Sample No. & Depth:		WS15 1.0m
Natural Moisture Content	W%	19%

Sample No. & Depth:		WS15 2.0m
Natural Moisture Content	W%	17%

Sample No. & Depth:		WS15 2.5-3.0m
Natural Moisture Content	W%	15%

Sample No. & Depth:		WS16 1.0m
Natural Moisture Content	W%	30%

Sample No. & Depth:		WS16 2.0m
Natural Moisture Content	W%	16%

Sample No. & Depth:		WS18 1.0m
Natural Moisture Content	W%	16%

Sample No. & Depth:		WS18 1.5m
Natural Moisture Content	W%	16%

Sample No. & Depth:		WS18 2.0m
Natural Moisture Content	W%	16%

Sample No. & Depth:		WS19 1.0m
Natural Moisture Content	W%	16%

Sample No. & Depth:		WS19 2.0m
Natural Moisture Content	W%	16%

Sample No. & Depth:		WS19 3.0m
Natural Moisture Content	W%	16%



Alan Taylor
Constructive Evaluation Ltd
Unit 5 (Top Floor)
Vinnetrow Business Park
Vinnetrow Road
Runcton
Chichester
PO20 1QH



QTS Environmental Ltd
Unit 1
Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Kent
ME17 2JN
t: 01622 850410
russell.jarvis@qtsenvironmental.com

QTS Environmental Report No: 14-20964

Site Reference: KAO Business Park

Project / Job Ref: 14.8039

Order No: 14.8039/AT

Sample Receipt Date: 14/04/2014

Sample Scheduled Date: 15/04/2014

Report Issue Number: 1

Reporting Date: 23/04/2014

Authorised by:

Russell Jarvis
Director

On behalf of QTS Environmental Ltd

Authorised by:

Kevin Old
Director

On behalf of QTS Environmental Ltd



QTS Environmental Ltd
Unit 1, Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Maidstone
Kent ME17 2JN
Tel : 01622 850410



Soil Analysis Certificate					
QTS Environmental Report No: 14-20964	Date Sampled	07/04/14	07/04/14	07/04/14	07/04/14
Constructive Evaluation Ltd	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: KAO Business Park	TP / BH No	WS6	WS7	WS8	WS9
Project / Job Ref: 14.8039	Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied
Order No: 14.8039/AT	Depth (m)	0.65	0.20	1.00	0.50
Reporting Date: 23/04/2014	QTSE Sample No	100716	100717	100718	100719

Determinand	Unit	RL	Accreditation					
Asbestos Screen	N/a	N/a	ISO17025	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected
pH	pH Units	N/a	MCERTS	7.9	8.1	8.0	8.0	8.0
Total Cyanide	mg/kg	< 2	NONE	< 2	< 2	< 2	< 2	< 2
W/S Sulphate as SO ₄ (2:1)	g/l	< 0.01	NONE	0.06	0.06	0.05	0.07	0.05
Organic Matter	%	< 0.1	NONE	0.8	3.5	0.4	0.7	1.1
Arsenic (As)	mg/kg	< 2	MCERTS	11	15	9	11	9
Cadmium (Cd)	mg/kg	< 0.5	MCERTS	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Chromium (Cr)	mg/kg	< 2	MCERTS	21	22	11	20	20
Copper (Cu)	mg/kg	< 4	MCERTS	14	16	9	13	12
Lead (Pb)	mg/kg	< 3	MCERTS	12	29	5	8	8
Mercury (Hg)	mg/kg	< 1	NONE	< 1	< 1	< 1	< 1	< 1
Nickel (Ni)	mg/kg	< 3	MCERTS	22	22	13	20	20
Selenium (Se)	mg/kg	< 3	NONE	< 3	< 3	< 3	< 3	< 3
Zinc (Zn)	mg/kg	< 3	MCERTS	45	52	27	43	39
Total Phenols (monohydric)	mg/kg	< 2	NONE	< 2	< 2	< 2	< 2	< 2

Analytical results are expressed on a dry weight basis where samples are dried at less than 30°C

Analysis carried out on the dried sample is corrected for the stone content

The samples have been examined to identify the presence of asbestiform minerals by polarising light microscopy and dispersion staining technique to In-House Procedures QTSE600 Determination of Asbestos in Bulk Materials; Asbestos in Soils/Sediments (fibre screening and identification)

This report refers to samples as received, and QTS Environmental Ltd, takes no responsibility for the accuracy or competence of sampling by others.

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Asbestos Analyst: Javeed Malik

RL: Reporting Limit

Pinch Test: Where pinch test is positive it is reported "Loose Fibres - PT" with type(s).

Subcontracted analysis ⁽⁵⁾



QTS Environmental Ltd
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Soil Analysis Certificate						
QTS Environmental Report No: 14-20964	Date Sampled	07/04/14	08/04/14	09/04/14	09/04/14	09/04/14
Constructive Evaluation Ltd	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: KAO Business Park	TP / BH No	WS11	WS12	WS12	WS13	WS13
Project / Job Ref: 14.8039	Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Order No: 14.8039/AT	Depth (m)	0.30	0.50	1.00	0.80	1.20
Reporting Date: 23/04/2014	QTSE Sample No	100721	100722	100723	100724	100725

Determinand	Unit	RL	Accreditation					
Asbestos Screen	N/a	N/a	ISO17025	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected
pH	pH Units	N/a	MCERTS	7.8	8.4	8.7	8.3	8.3
Total Cyanide	mg/kg	< 2	NONE	< 2	< 2	< 2	< 2	< 2
W/S Sulphate as SO ₄ (2:1)	g/l	< 0.01	NONE	0.03	0.02	0.10	0.04	0.02
Organic Matter	%	< 0.1	NONE	3	1	1.1	0.9	0.7
Arsenic (As)	mg/kg	< 2	MCERTS	14	15	14	12	10
Cadmium (Cd)	mg/kg	< 0.5	MCERTS	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Chromium (Cr)	mg/kg	< 2	MCERTS	28	35	24	25	26
Copper (Cu)	mg/kg	< 4	MCERTS	19	21	15	15	14
Lead (Pb)	mg/kg	< 3	MCERTS	36	19	11	12	9
Mercury (Hg)	mg/kg	< 1	NONE	< 1	< 1	< 1	< 1	< 1
Nickel (Ni)	mg/kg	< 3	MCERTS	22	40	26	23	20
Selenium (Se)	mg/kg	< 3	NONE	< 3	< 3	< 3	< 3	< 3
Zinc (Zn)	mg/kg	< 3	MCERTS	60	65	40	36	43
Total Phenols (monohydric)	mg/kg	< 2	NONE	< 2	< 2	< 2	< 2	< 2

Analytical results are expressed on a dry weight basis where samples are dried at less than 30°C

Analysis carried out on the dried sample is corrected for the stone content

The samples have been examined to identify the presence of asbestiform minerals by polarising light microscopy and dispersion staining technique to In-House Procedures QTSE600 Determination of Asbestos in Bulk Materials; Asbestos in Soils/Sediments (fibre screening and identification)

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Asbestos Analyst: Javeed Malik

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Pinch Test: Where pinch test is positive it is reported "Loose Fibres - PT" with type(s).

Subcontracted analysis ⁽⁵⁾



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Soil Analysis Certificate						
QTS Environmental Report No: 14-20964	Date Sampled	09/04/14	09/04/14	09/04/14	08/04/14	08/04/14
Constructive Evaluation Ltd	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: KAO Business Park	TP / BH No	WS14	WS14	WS14	WS15	WS15
Project / Job Ref: 14.8039	Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Order No: 14.8039/AT	Depth (m)	0.30	0.60	1.00	0.50	1.00
Reporting Date: 23/04/2014	QTSE Sample No	100726	100727	100728	100729	100730

Determinand	Unit	RL	Accreditation					
Asbestos Screen	N/a	N/a	ISO17025	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected
pH	pH Units	N/a	MCERTS	8.3	8.1	8.0	7.9	8.0
Total Cyanide	mg/kg	< 2	NONE	< 2	< 2	< 2	< 2	< 2
W/S Sulphate as SO ₄ (2:1)	g/l	< 0.01	NONE	0.23	0.07	0.08	0.09	0.02
Organic Matter	%	< 0.1	NONE	2	1.8	1.9	2.1	1.3
Arsenic (As)	mg/kg	< 2	MCERTS	11	13	15	11	12
Cadmium (Cd)	mg/kg	< 0.5	MCERTS	< 0.5	< 0.5	< 0.5	0.8	< 0.5
Chromium (Cr)	mg/kg	< 2	MCERTS	15	34	35	26	24
Copper (Cu)	mg/kg	< 4	MCERTS	24	16	17	20	14
Lead (Pb)	mg/kg	< 3	MCERTS	368	43	41	33	25
Mercury (Hg)	mg/kg	< 1	NONE	< 1	< 1	< 1	< 1	< 1
Nickel (Ni)	mg/kg	< 3	MCERTS	13	29	35	20	22
Selenium (Se)	mg/kg	< 3	NONE	< 3	< 3	< 3	< 3	< 3
Zinc (Zn)	mg/kg	< 3	MCERTS	198	71	98	56	41
Total Phenols (monohydric)	mg/kg	< 2	NONE	< 2	< 2	< 2	< 2	< 2

Analytical results are expressed on a dry weight basis where samples are dried at less than 30°C

Analysis carried out on the dried sample is corrected for the stone content

The samples have been examined to identify the presence of asbestiform minerals by polarising light microscopy and dispersion staining technique to In-House Procedures QTSE600 Determination of Asbestos in Bulk Materials; Asbestos in Soils/Sediments (fibre screening and identification)

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Asbestos Analyst: Javeed Malik

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Soil Analysis Certificate					
QTS Environmental Report No: 14-20964	Date Sampled	08/04/14	08/04/14	08/04/14	08/04/14
Constructive Evaluation Ltd	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: KAO Business Park	TP / BH No	WS16	WS17	WS18	WS19
Project / Job Ref: 14.8039	Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied
Order No: 14.8039/AT	Depth (m)	0.60	0.25	0.70	0.20
Reporting Date: 23/04/2014	QTSE Sample No	100731	100732	100733	100734

Determinand	Unit	RL	Accreditation					
Asbestos Screen	N/a	N/a	ISO17025	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected
pH	pH Units	N/a	MCERTS	7.9	7.8	8.0	8.0	7.8
Total Cyanide	mg/kg	< 2	NONE	< 2	< 2	< 2	< 2	< 2
W/S Sulphate as SO ₄ (2:1)	g/l	< 0.01	NONE	0.04	0.02	0.10	0.04	0.06
Organic Matter	%	< 0.1	NONE	1.4	4.2	0.9	2.9	0.8
Arsenic (As)	mg/kg	< 2	MCERTS	16	12	11	12	13
Cadmium (Cd)	mg/kg	< 0.5	MCERTS	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Chromium (Cr)	mg/kg	< 2	MCERTS	40	31	23	26	21
Copper (Cu)	mg/kg	< 4	MCERTS	22	20	12	61	17
Lead (Pb)	mg/kg	< 3	MCERTS	26	35	9	52	10
Mercury (Hg)	mg/kg	< 1	NONE	< 1	< 1	< 1	< 1	< 1
Nickel (Ni)	mg/kg	< 3	MCERTS	28	17	20	37	25
Selenium (Se)	mg/kg	< 3	NONE	< 3	< 3	< 3	< 3	< 3
Zinc (Zn)	mg/kg	< 3	MCERTS	57	66	41	105	44
Total Phenols (monohydric)	mg/kg	< 2	NONE	< 2	< 2	< 2	< 2	< 2

Analytical results are expressed on a dry weight basis where samples are dried at less than 30°C

Analysis carried out on the dried sample is corrected for the stone content

The samples have been examined to identify the presence of asbestiform minerals by polarising light microscopy and dispersion staining technique to In-House Procedures QTSE600 Determination of Asbestos in Bulk Materials; Asbestos in Soils/Sediments (fibre screening and identification)

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Asbestos Analyst: Javeed Malik

RL: Reporting Limit

Pinch Test: Where pinch test is positive it is reported "Loose Fibres - PT" with type(s).

Subcontracted analysis ⁽⁵⁾



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Soil Analysis Certificate - Speciated PAHs						
QTS Environmental Report No: 14-20964	Date Sampled	07/04/14	07/04/14	07/04/14	07/04/14	07/04/14
Constructive Evaluation Ltd	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: KAO Business Park	TP / BH No	WS6	WS7	WS8	WS9	WS10
Project / Job Ref: 14.8039	Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Order No: 14.8039/AT	Depth (m)	0.65	0.20	1.00	0.50	0.70
Reporting Date: 23/04/2014	QTSE Sample No	100716	100717	100718	100719	100720

Determinand	Unit	RL	Accreditation					
Naphthalene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthylene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Fluorene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Phenanthrene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Anthracene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Fluoranthene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	0.18	< 0.1
Pyrene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	0.20	< 0.1
Benzo(a)anthracene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	0.11	< 0.1
Chrysene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(b)fluoranthene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(k)fluoranthene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(a)pyrene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Indeno(1,2,3-cd)pyrene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Dibenz(a,h)anthracene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(ghi)perylene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Total EPA-16 PAHs	mg/kg	< 1.6	MCERTS	< 1.6	< 1.6	< 1.6	< 1.6	< 1.6

Analytical results are expressed on a dry weight basis where samples are dried at less than 30°C



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Soil Analysis Certificate - Speciated PAHs						
QTS Environmental Report No: 14-20964	Date Sampled	07/04/14	08/04/14	09/04/14	09/04/14	09/04/14
Constructive Evaluation Ltd	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: KAO Business Park	TP / BH No	WS11	WS12	WS12	WS13	WS13
Project / Job Ref: 14.8039	Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Order No: 14.8039/AT	Depth (m)	0.30	0.50	1.00	0.80	1.20
Reporting Date: 23/04/2014	QTSE Sample No	100721	100722	100723	100724	100725

Determinand	Unit	RL	Accreditation					
Naphthalene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthylene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Fluorene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Phenanthrene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Anthracene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Fluoranthene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Pyrene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(a)anthracene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Chrysene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(b)fluoranthene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(k)fluoranthene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(a)pyrene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Indeno(1,2,3-cd)pyrene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Dibenz(a,h)anthracene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(ghi)perylene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Total EPA-16 PAHs	mg/kg	< 1.6	MCERTS	< 1.6	< 1.6	< 1.6	< 1.6	< 1.6

Analytical results are expressed on a dry weight basis where samples are dried at less than 30°C



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Soil Analysis Certificate - Speciated PAHs						
QTS Environmental Report No: 14-20964	Date Sampled	09/04/14	09/04/14	09/04/14	08/04/14	08/04/14
Constructive Evaluation Ltd	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: KAO Business Park	TP / BH No	WS14	WS14	WS14	WS15	WS15
Project / Job Ref: 14.8039	Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Order No: 14.8039/AT	Depth (m)	0.30	0.60	1.00	0.50	1.00
Reporting Date: 23/04/2014	QTSE Sample No	100726	100727	100728	100729	100730

Determinand	Unit	RL	Accreditation					
Naphthalene	mg/kg	< 0.1	MCERTS	0.21	< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthylene	mg/kg	< 0.1	MCERTS	0.31	< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthene	mg/kg	< 0.1	MCERTS	0.57	< 0.1	< 0.1	< 0.1	< 0.1
Fluorene	mg/kg	< 0.1	MCERTS	0.92	< 0.1	< 0.1	< 0.1	< 0.1
Phenanthrene	mg/kg	< 0.1	MCERTS	10.50	0.20	0.22	< 0.1	< 0.1
Anthracene	mg/kg	< 0.1	MCERTS	2.93	< 0.1	< 0.1	< 0.1	< 0.1
Fluoranthene	mg/kg	< 0.1	MCERTS	17.70	0.74	0.74	< 0.1	< 0.1
Pyrene	mg/kg	< 0.1	MCERTS	13.50	0.60	0.62	< 0.1	< 0.1
Benzo(a)anthracene	mg/kg	< 0.1	MCERTS	6.79	0.25	0.28	< 0.1	< 0.1
Chrysene	mg/kg	< 0.1	MCERTS	5.86	0.25	0.25	< 0.1	< 0.1
Benzo(b)fluoranthene	mg/kg	< 0.1	MCERTS	5.46	0.23	0.22	< 0.1	< 0.1
Benzo(k)fluoranthene	mg/kg	< 0.1	MCERTS	2	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(a)pyrene	mg/kg	< 0.1	MCERTS	4.18	0.15	0.16	< 0.1	< 0.1
Indeno(1,2,3-cd)pyrene	mg/kg	< 0.1	MCERTS	2.15	< 0.1	< 0.1	< 0.1	< 0.1
Dibenz(a,h)anthracene	mg/kg	< 0.1	MCERTS	0.28	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(ghi)perylene	mg/kg	< 0.1	MCERTS	1.44	< 0.1	< 0.1	< 0.1	< 0.1
Total EPA-16 PAHs	mg/kg	< 1.6	MCERTS	74.8	2.4	2.5	< 1.6	< 1.6

Analytical results are expressed on a dry weight basis where samples are dried at less than 30°C



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Soil Analysis Certificate - Speciated PAHs

QTS Environmental Report No: 14-20964	Date Sampled	08/04/14	08/04/14	08/04/14	08/04/14	08/04/14
Constructive Evaluation Ltd	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: KAO Business Park	TP / BH No	WS16	WS17	WS18	WS19	WS19
Project / Job Ref: 14.8039	Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Order No: 14.8039/AT	Depth (m)	0.60	0.25	0.70	0.20	0.90
Reporting Date: 23/04/2014	QTSE Sample No	100731	100732	100733	100734	100735

Determinand	Unit	RL	Accreditation					
Naphthalene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthylene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthene	mg/kg	< 0.1	MCERTS	0.12	< 0.1	< 0.1	< 0.1	< 0.1
Fluorene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Phenanthrene	mg/kg	< 0.1	MCERTS	1.63	< 0.1	< 0.1	0.23	< 0.1
Anthracene	mg/kg	< 0.1	MCERTS	0.38	< 0.1	< 0.1	< 0.1	< 0.1
Fluoranthene	mg/kg	< 0.1	MCERTS	3.18	< 0.1	< 0.1	0.51	< 0.1
Pyrene	mg/kg	< 0.1	MCERTS	2.41	< 0.1	< 0.1	0.42	< 0.1
Benzo(a)anthracene	mg/kg	< 0.1	MCERTS	1.37	< 0.1	< 0.1	0.22	< 0.1
Chrysene	mg/kg	< 0.1	MCERTS	1.35	< 0.1	< 0.1	0.33	< 0.1
Benzo(b)fluoranthene	mg/kg	< 0.1	MCERTS	1.92	< 0.1	< 0.1	0.43	< 0.1
Benzo(k)fluoranthene	mg/kg	< 0.1	MCERTS	0.67	< 0.1	< 0.1	0.16	< 0.1
Benzo(a)pyrene	mg/kg	< 0.1	MCERTS	1.57	< 0.1	< 0.1	0.30	< 0.1
Indeno(1,2,3-cd)pyrene	mg/kg	< 0.1	MCERTS	1.10	< 0.1	< 0.1	0.27	< 0.1
Dibenz(a,h)anthracene	mg/kg	< 0.1	MCERTS	0.13	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(ghi)perylene	mg/kg	< 0.1	MCERTS	0.82	< 0.1	< 0.1	0.23	< 0.1
Total EPA-16 PAHs	mg/kg	< 1.6	MCERTS	16.6	< 1.6	< 1.6	3.1	< 1.6

Analytical results are expressed on a dry weight basis where samples are dried at less than 30°C



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Soil Analysis Certificate - TPH CWG Banded

QTS Environmental Report No: 14-20964	Date Sampled	07/04/14	07/04/14	07/04/14	07/04/14	07/04/14
Constructive Evaluation Ltd	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: KAO Business Park	TP / BH No	WS6	WS7	WS8	WS9	WS10
Project / Job Ref: 14.8039	Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Order No: 14.8039/AT	Depth (m)	0.65	0.20	1.00	0.50	0.70
Reporting Date: 23/04/2014	QTSE Sample No	100716	100717	100718	100719	100720

Determinand	Unit	RL	Accreditation					
Aliphatic >C5 - C6	mg/kg	< 0.01	NONE	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aliphatic >C6 - C8	mg/kg	< 0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Aliphatic >C8 - C10	mg/kg	< 1	NONE	< 1	< 1	< 1	< 1	< 1
Aliphatic >C10 - C12	mg/kg	< 1	NONE	< 1	< 1	< 1	< 1	< 1
Aliphatic >C12 - C16	mg/kg	< 1	NONE	< 1	< 1	< 1	< 1	< 1
Aliphatic >C16 - C21	mg/kg	< 1	NONE	< 1	< 1	< 1	< 1	< 1
Aliphatic >C21 - C34	mg/kg	< 6	NONE	< 6	< 6	< 6	< 6	< 6
Aliphatic (C5 - C34)	mg/kg	< 12	NONE	< 12	< 12	< 12	< 12	< 12
Aromatic >C5 - C7	mg/kg	< 0.01	NONE	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aromatic >C7 - C8	mg/kg	< 0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Aromatic >C8 - C10	mg/kg	< 1	NONE	< 1	< 1	< 1	< 1	< 1
Aromatic >C10 - C12	mg/kg	< 1	NONE	< 1	< 1	< 1	< 1	< 1
Aromatic >C12 - C16	mg/kg	< 1	NONE	< 1	< 1	< 1	< 1	< 1
Aromatic >C16 - C21	mg/kg	< 1	NONE	< 1	< 1	< 1	< 1	< 1
Aromatic >C21 - C35	mg/kg	< 6	NONE	< 6	< 6	< 6	< 6	< 6
Aromatic (C5 - C35)	mg/kg	< 12	NONE	< 12	< 12	< 12	< 12	< 12
Total >C5 - C35	mg/kg	< 24	NONE	< 24	< 24	< 24	< 24	< 24

Analytical results are expressed on a dry weight basis where samples are dried at less than 30°C



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Soil Analysis Certificate - TPH CWG Banded

QTS Environmental Report No: 14-20964	Date Sampled	07/04/14	08/04/14	09/04/14	09/04/14	09/04/14
Constructive Evaluation Ltd	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: KAO Business Park	TP / BH No	WS11	WS12	WS12	WS13	WS13
Project / Job Ref: 14.8039	Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Order No: 14.8039/AT	Depth (m)	0.30	0.50	1.00	0.80	1.20
Reporting Date: 23/04/2014	QTSE Sample No	100721	100722	100723	100724	100725

Determinand	Unit	RL	Accreditation					
Aliphatic >C5 - C6	mg/kg	< 0.01	NONE	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aliphatic >C6 - C8	mg/kg	< 0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Aliphatic >C8 - C10	mg/kg	< 1	NONE	< 1	< 1	< 1	< 1	< 1
Aliphatic >C10 - C12	mg/kg	< 1	NONE	< 1	< 1	< 1	< 1	< 1
Aliphatic >C12 - C16	mg/kg	< 1	NONE	< 1	< 1	< 1	< 1	< 1
Aliphatic >C16 - C21	mg/kg	< 1	NONE	< 1	< 1	< 1	< 1	< 1
Aliphatic >C21 - C34	mg/kg	< 6	NONE	< 6	< 6	< 6	< 6	< 6
Aliphatic (C5 - C34)	mg/kg	< 12	NONE	< 12	< 12	< 12	< 12	< 12
Aromatic >C5 - C7	mg/kg	< 0.01	NONE	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aromatic >C7 - C8	mg/kg	< 0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Aromatic >C8 - C10	mg/kg	< 1	NONE	< 1	< 1	< 1	< 1	< 1
Aromatic >C10 - C12	mg/kg	< 1	NONE	< 1	< 1	< 1	< 1	< 1
Aromatic >C12 - C16	mg/kg	< 1	NONE	< 1	< 1	< 1	< 1	< 1
Aromatic >C16 - C21	mg/kg	< 1	NONE	< 1	< 1	< 1	< 1	< 1
Aromatic >C21 - C35	mg/kg	< 6	NONE	< 6	< 6	< 6	< 6	< 6
Aromatic (C5 - C35)	mg/kg	< 12	NONE	< 12	< 12	< 12	< 12	< 12
Total >C5 - C35	mg/kg	< 24	NONE	< 24	< 24	< 24	< 24	< 24

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Soil Analysis Certificate - TPH CWG Banded

QTS Environmental Report No: 14-20964	Date Sampled	09/04/14	09/04/14	09/04/14	08/04/14	08/04/14
Constructive Evaluation Ltd	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: KAO Business Park	TP / BH No	WS14	WS14	WS14	WS15	WS15
Project / Job Ref: 14.8039	Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Order No: 14.8039/AT	Depth (m)	0.30	0.60	1.00	0.50	1.00
Reporting Date: 23/04/2014	QTSE Sample No	100726	100727	100728	100729	100730

Determinand	Unit	RL	Accreditation					
Aliphatic >C5 - C6	mg/kg	< 0.01	NONE	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aliphatic >C6 - C8	mg/kg	< 0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Aliphatic >C8 - C10	mg/kg	< 1	NONE	< 1	< 1	< 1	< 1	< 1
Aliphatic >C10 - C12	mg/kg	< 1	NONE	< 1	< 1	< 1	< 1	< 1
Aliphatic >C12 - C16	mg/kg	< 1	NONE	< 1	< 1	< 1	< 1	< 1
Aliphatic >C16 - C21	mg/kg	< 1	NONE	3	< 1	< 1	< 1	< 1
Aliphatic >C21 - C34	mg/kg	< 6	NONE	28	< 6	< 6	< 6	< 6
Aliphatic (C5 - C34)	mg/kg	< 12	NONE	31	< 12	< 12	< 12	< 12
Aromatic >C5 - C7	mg/kg	< 0.01	NONE	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aromatic >C7 - C8	mg/kg	< 0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Aromatic >C8 - C10	mg/kg	< 1	NONE	< 1	< 1	< 1	< 1	< 1
Aromatic >C10 - C12	mg/kg	< 1	NONE	< 1	< 1	< 1	< 1	< 1
Aromatic >C12 - C16	mg/kg	< 1	NONE	< 1	< 1	< 1	< 1	< 1
Aromatic >C16 - C21	mg/kg	< 1	NONE	16	< 1	< 1	< 1	< 1
Aromatic >C21 - C35	mg/kg	< 6	NONE	77	< 6	< 6	< 6	< 6
Aromatic (C5 - C35)	mg/kg	< 12	NONE	93	< 12	< 12	< 12	< 12
Total >C5 - C35	mg/kg	< 24	NONE	124	< 24	< 24	< 24	< 24

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Soil Analysis Certificate - TPH CWG Banded

QTS Environmental Report No: 14-20964	Date Sampled	08/04/14	08/04/14	08/04/14	08/04/14	08/04/14
Constructive Evaluation Ltd	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: KAO Business Park	TP / BH No	WS16	WS17	WS18	WS19	WS19
Project / Job Ref: 14.8039	Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Order No: 14.8039/AT	Depth (m)	0.60	0.25	0.70	0.20	0.90
Reporting Date: 23/04/2014	QTSE Sample No	100731	100732	100733	100734	100735

Determinand	Unit	RL	Accreditation					
Aliphatic >C5 - C6	mg/kg	< 0.01	NONE	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aliphatic >C6 - C8	mg/kg	< 0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Aliphatic >C8 - C10	mg/kg	< 1	NONE	< 1	< 1	< 1	< 1	< 1
Aliphatic >C10 - C12	mg/kg	< 1	NONE	< 1	< 1	< 1	< 1	< 1
Aliphatic >C12 - C16	mg/kg	< 1	NONE	< 1	< 1	< 1	< 1	< 1
Aliphatic >C16 - C21	mg/kg	< 1	NONE	< 1	< 1	< 1	< 1	< 1
Aliphatic >C21 - C34	mg/kg	< 6	NONE	12	< 6	< 6	< 6	< 6
Aliphatic (C5 - C34)	mg/kg	< 12	NONE	12	< 12	< 12	< 12	< 12
Aromatic >C5 - C7	mg/kg	< 0.01	NONE	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aromatic >C7 - C8	mg/kg	< 0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Aromatic >C8 - C10	mg/kg	< 1	NONE	< 1	< 1	< 1	< 1	< 1
Aromatic >C10 - C12	mg/kg	< 1	NONE	< 1	< 1	< 1	< 1	< 1
Aromatic >C12 - C16	mg/kg	< 1	NONE	< 1	< 1	< 1	< 1	< 1
Aromatic >C16 - C21	mg/kg	< 1	NONE	2	< 1	< 1	< 1	< 1
Aromatic >C21 - C35	mg/kg	< 6	NONE	19	< 6	< 6	< 6	< 6
Aromatic (C5 - C35)	mg/kg	< 12	NONE	21	< 12	< 12	< 12	< 12
Total >C5 - C35	mg/kg	< 24	NONE	33	< 24	< 24	< 24	< 24

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Soil Analysis Certificate - BTEX / MTBE						
QTS Environmental Report No: 14-20964	Date Sampled	07/04/14	07/04/14	07/04/14	07/04/14	07/04/14
Constructive Evaluation Ltd	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: KAO Business Park	TP / BH No	WS6	WS7	WS8	WS9	WS10
Project / Job Ref: 14.8039	Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Order No: 14.8039/AT	Depth (m)	0.65	0.20	1.00	0.50	0.70
Reporting Date: 23/04/2014	QTSE Sample No	100716	100717	100718	100719	100720

Determinand	Unit	RL	Accreditation					
Benzene	ug/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	< 2
Toluene	ug/kg	< 5	MCERTS	< 5	< 5	< 5	< 5	< 5
Ethylbenzene	ug/kg	< 10	MCERTS	< 10	< 10	< 10	< 10	< 10
p & m-xylene	ug/kg	< 10	MCERTS	< 10	< 10	< 10	< 10	< 10
o-xylene	ug/kg	< 10	MCERTS	< 10	< 10	< 10	< 10	< 10
MTBE	ug/kg	< 5	MCERTS	< 5	< 5	< 5	< 5	< 5

Analytical results are expressed on a dry weight basis where samples are dried at less than 30°C



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Soil Analysis Certificate - BTEX / MTBE						
QTS Environmental Report No: 14-20964	Date Sampled	07/04/14	08/04/14	09/04/14	09/04/14	09/04/14
Constructive Evaluation Ltd	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: KAO Business Park	TP / BH No	WS11	WS12	WS12	WS13	WS13
Project / Job Ref: 14.8039	Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Order No: 14.8039/AT	Depth (m)	0.30	0.50	1.00	0.80	1.20
Reporting Date: 23/04/2014	QTSE Sample No	100721	100722	100723	100724	100725

Determinand	Unit	RL	Accreditation					
Benzene	ug/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	< 2
Toluene	ug/kg	< 5	MCERTS	< 5	< 5	< 5	< 5	< 5
Ethylbenzene	ug/kg	< 10	MCERTS	< 10	< 10	< 10	< 10	< 10
p & m-xylene	ug/kg	< 10	MCERTS	< 10	< 10	< 10	< 10	< 10
o-xylene	ug/kg	< 10	MCERTS	< 10	< 10	< 10	< 10	< 10
MTBE	ug/kg	< 5	MCERTS	< 5	< 5	< 5	< 5	< 5

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Soil Analysis Certificate - BTEX / MTBE						
QTS Environmental Report No: 14-20964	Date Sampled	09/04/14	09/04/14	09/04/14	08/04/14	08/04/14
Constructive Evaluation Ltd	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: KAO Business Park	TP / BH No	WS14	WS14	WS14	WS15	WS15
Project / Job Ref: 14.8039	Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Order No: 14.8039/AT	Depth (m)	0.30	0.60	1.00	0.50	1.00
Reporting Date: 23/04/2014	QTSE Sample No	100726	100727	100728	100729	100730

Determinand	Unit	RL	Accreditation					
Benzene	ug/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	< 2
Toluene	ug/kg	< 5	MCERTS	< 5	< 5	< 5	< 5	< 5
Ethylbenzene	ug/kg	< 10	MCERTS	< 10	< 10	< 10	< 10	< 10
p & m-xylene	ug/kg	< 10	MCERTS	< 10	< 10	< 10	< 10	< 10
o-xylene	ug/kg	< 10	MCERTS	< 10	< 10	< 10	< 10	< 10
MTBE	ug/kg	< 5	MCERTS	< 5	< 5	< 5	< 5	< 5

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Soil Analysis Certificate - BTEX / MTBE						
QTS Environmental Report No: 14-20964	Date Sampled	08/04/14	08/04/14	08/04/14	08/04/14	08/04/14
Constructive Evaluation Ltd	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: KAO Business Park	TP / BH No	WS16	WS17	WS18	WS19	WS19
Project / Job Ref: 14.8039	Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Order No: 14.8039/AT	Depth (m)	0.60	0.25	0.70	0.20	0.90
Reporting Date: 23/04/2014	QTSE Sample No	100731	100732	100733	100734	100735

Determinand	Unit	RL	Accreditation					
Benzene	ug/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	< 2
Toluene	ug/kg	< 5	MCERTS	< 5	< 5	< 5	< 5	< 5
Ethylbenzene	ug/kg	< 10	MCERTS	< 10	< 10	< 10	< 10	< 10
p & m-xylene	ug/kg	< 10	MCERTS	< 10	< 10	< 10	< 10	< 10
o-xylene	ug/kg	< 10	MCERTS	< 10	< 10	< 10	< 10	< 10
MTBE	ug/kg	< 5	MCERTS	< 5	< 5	< 5	< 5	< 5

Analytical results are expressed on a dry weight basis where samples are dried at less than 30°C



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Soil Analysis Certificate - Sample Descriptions

QTS Environmental Report No: 14-20964

Constructive Evaluation Ltd

Site Reference: KAO Business Park

Project / Job Ref: 14.8039

Order No: 14.8039/AT

Reporting Date: 23/04/2014

QTSE Sample No	TP / BH No	Additional Refs	Depth (m)	Moisture Content (%)	Sample Matrix Description
100716	WS6	None Supplied	0.65	15.6	Green clay with vegetation
100717	WS7	None Supplied	0.20	14.6	Brown clayey loam with vegetation
100718	WS8	None Supplied	1.00	15	Light brown loamy clay with chalk
100719	WS9	None Supplied	0.50	13.7	Light grey clay with chalk
100720	WS10	None Supplied	0.70	14.1	Light grey clay with chalk
100721	WS11	None Supplied	0.30	21.1	Brown loamy clay with vegetation
100722	WS12	None Supplied	0.50	21.2	Brown clay
100723	WS12	None Supplied	1.00	17.4	Brown clay with chalk
100724	WS13	None Supplied	0.80	17.5	Green clay with chalk
100725	WS13	None Supplied	1.20	14.7	Green clay with chalk
100726	WS14	None Supplied	0.30	16.2	Brown loamy sand with brick and rubble
100727	WS14	None Supplied	0.60	27	Green clayey loam with rubble
100728	WS14	None Supplied	1.00	21.4	Green clayey loam with chalk
100729	WS15	None Supplied	0.50	13.6	Brown loamy clay with stones
100730	WS15	None Supplied	1.00	13.7	Brown clay with chalk
100731	WS16	None Supplied	0.60	19.1	Brown clay
100732	WS17	None Supplied	0.25	21.4	Brown clayey loam with rubble
100733	WS18	None Supplied	0.70	12.6	Green clay with chalk
100734	WS19	None Supplied	0.20	16.3	Green clay with chalk
100735	WS19	None Supplied	0.90	11.8	Green clay with chalk

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

Insufficient Sample ^{1/5}

Unsuitable Sample ^{1/5}



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Soil Analysis Certificate - Methodology & Miscellaneous Information

QTS Environmental Report No: 14-20964

Constructive Evaluation Ltd

Site Reference: KAO Business Park

Project / Job Ref: 14.8039

Order No: 14.8039/AT

Reporting Date: 23/04/2014

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

D Dried

AR As Received

APPENDIX F

Limitations

The Environment Agency has recently undertaken revision of the Soil Guideline Values (SGVs) which are partially complete. Where standards are available using the “new” approach, these have been utilised for correlative purposes. Where standards have not yet been revised, guidance following the “old” approach has been utilised. Please note that upon release of the remaining guidelines, the standards contained within this report may be subject to change. In addition, the second edition of the LQM CIEH guidance has now been released and will be utilised in favour of previously published guideline values.

The Client is advised that the conditions observed on site by Constructive Evaluation Limited at the time of the walkover survey are subject to change. Certain indicators of the presence of hazardous substances may have been latent at the time of the most recent site reconnaissance and they may subsequently have become noticeable.

The Client is advised that although every effort is made to identify suspect areas CE cannot be held responsible if buildings on site contain Asbestos. Additionally Engineers sent to site are not specially trained in this aspect of work: if further determination is required the expertise of a BHOS trainer surveyor should be sought.

Comments made relating to soil or groundwater conditions are obtained from the sources described within the text and observations made at the time of the walkover survey unless otherwise stated. Soil or groundwater conditions may vary as a result of seasonal fluctuations or other effects.

The accuracy of the map extracts can not be guaranteed and it should be noted that different conditions may have existed between the subsequent to the various map surveys. Therefore, there can be no certainty that all areas of contamination have been identified during the Phase 1 investigation.

Every effort is undertaken to provide information regarding the potential risks associated with flooding, however CE may not be party to information which the local Authority and Environment Agency may hold in relation to historical or flash flood events.

This assessment is to be regarded preliminary in nature and may be subject to amendment in light of additional information becoming available or statutory consultee review, including the Environment Agency, Local council and NHBC etc. The statutory consultees have not been contacted at this time:

The findings and opinions conveyed in this report are based on information obtained from a variety of sources, including that from previous Site investigations and chemical testing laboratories. Constructive Evaluation Limited has assumed that such information is correct. Constructive Evaluation Limited cannot and does not guarantee the authenticity or reliability of the information it has relied upon and can accept no responsibility for inaccuracies with the data supplied by other parties.

This report is written in the context of an agreed scope of work between Constructive Evaluation Limited and the Client and should not be used in a different context. In light of additional information becoming available, improved practices and changes in legislation amendment or re-interpretation of the assessment or report in whole or part may be necessary after its original submission.

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An ecological, topographical, archaeological, asbestos survey or service search was outside the scope of this report.