DISCHARGE OF CONDS
11/366/FUL

Factual & Environmental Report on the

Site Investigation undertaken for

Springfield Structural Engineering

at

Land adj. 8 Preston Gardens
Rayleigh
Essex

CSI Ref: 2801

On

Dated: September 2011

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Chelmer Site Investigations Laboratories Limited (CSI) have prepared this report in accordance with the Instructions of Springfields Structural Engineering under the terms of our appointment to undertake a site investigation on behalf of the client. The report is for the sole and specific use of the client, and CSI shall not be responsible for any purpose other than that for which it was prepared and provided. Should the client require to pass copies of the report to other parties for information, the whole of the report should be so copied, but no professional liability or warranty shall be extended to other parties by CSI in this connection without the explicit written agreement thereto by CSI.

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1.0 EXECUTIVE SUMMARY

Item	Comments	Risk
Site	No. 8 Preston Gardens, Rayleigh, Essex	
Grid Ref	580850 E, 191800 N	

Geology	The site is underlain by MADE GROUND, which in turn is underlain by the relatively impermeable London Clay stratum.	Low/ Medium
Groundwater	Groundwater was not struck during the current fieldwork. However, during the return monitoring visits groundwater was encountered at depths of between 6.80m and 7.00m below existing ground level.	Low
Landfill Gas	No remedial measures required.	Low
Contamination	Due to the elevated levels of PCBs recorded, it is recommended that the MADE GROUND is unsuitable to remain on site. In areas of proposed landscaping it is recommended that 600mm of material be excavated and replaced with 400mm of clean imported free draining material, together with a minimum of 200mm of TOPSOIL.	Low/Mediu m
Buried Concrete	Test results indicted both Class DS-1 and Class DS-3 conditions.	Medium
WAC Test	The result of the WAC Tests carried out at this site appear to indicate that the MADE GROUND beneath the site would be classified as 'Hazardous landfill' material.	Medium/Hig h

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2.0 INTRODUCTION & SCOPE OF WORKS

2.1 This report has been prepared by Chelmer Site Investigations Laboratories Limited (CSI) to the instructions of the Consulting Engineer for the Project, Springfields Structural Engineering.

2.2 The Client for the project was Mr & Mrs N Sparkes.

2.3 The site under consideration comprised a roughly rectangular piece of derelict land, located at No.8 Preston Gardens, Raleigh, Essex. At the time of the current survey, the site was found to be empty and generally covered by concrete hard standing at ground level. The current layout of the site is detailed on the appended Sketch Fieldwork Location Plan.

2.4 The approximate six-figure grid reference for the site is 580850 E, 191800 N.

2.5 It is understood that the proposed development at this site will comprise the construction of two new bungalows, together with associated private gardens.

2.6 A previous, limited, Phase 1 *Non-Intrusive* investigation into the site, has been carried out by URS, the findings of which are contained within the appended Desk Study Report, the results of which have helped provide the basis for this subsequent Phase 2 *Intrusive* site investigation.

2.7 This Phase 2 *Intrusive* site investigation has now been commissioned to provide information on the sub-soil conditions on site together with laboratory testing and reporting, in order to enable a ***preliminary contamination assessment*** to be carried out.

2.8 Geotechnical factual information has also been provided at the request of the Consulting Engineer.

2.9 In addition, a gas monitoring survey was also to be carried out across the site during the current intrusive investigation work.

2.10 This report presents the work carried out and discusses the findings

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3.0 PREVIOUS DESK STUDY FINDINGS

3.1 A previous Desk Top Study was carried out by URS Corporation Limited (URS), the findings of which are contained within the appended report and has been used to provide the basis for this subsequent Phase 2 *Intrusive* site investigation.

3.2 Based on available aerial photographs the site was considered to be derelict and appeared to be covered by concrete hardstanding. The site is located within a residential area in the north of Rayleigh. The site was found to be surrounded by residential houses, and bounded to the east-southeast by a railway line. Recreational areas were located 100m east and 200m northwest of the site. A warehouse was also noted, at a distance of approximately 90m to the northeast of the site.

3.3 A review of the relevant BGS map for the area indicated that the site is underlain by London Clay, overlying the Lambeth Group, Thanet Sand and Upper Chalk. In addition to the lithologies indicated on the map, MADE GROUND, associated with foundations, buries services, development of the site and the nearby railway line is considered likely to overlie the London Clay. The London Clay is classified by the Environmental Agency as a Non Aquifer of negligible leaching potential.

3.4 Two groundwater abstractions were identified within a 1 km radius of the site.

3.5 An unidentified surface water feature, 'likely to be partially cullverted, was also indentified at a distance of approximately 70m to the southwest of the site. The River Crouch is located at a distance of approximately 3km from the site, with tributaries to the river located at closer distances (up to 500m).

3.6 The site has been considered to be in an area of **LOW** environmental sensitivity due to the underlying Non-Aquifer and no classified surface water features within 500m of the site.

3.7 The potential for ground contamination from historical site activities is considered to be **MODERATE** given that the property was once used as an electric sub-station, a known source of PCBs.

3.8 A number of historical off-site sources of contamination were identified in the close vicinity, such as the adjacent railway and brick/tile works. These activities are less likely to pose a potential risk to the subject site irrespective of their close proximity.

3.9 A number of current off-site sources of potential contamination including Recorded, Historical and Local Authority Landfill Sites; Carpet, curtain and upholstery cleaning services and cladding suppliers. Assuming that these facilities are being operated in accordance with the appropriate legislative requirements, they have not been considered to present a risk of significant contamination due to their distance from the subject site.

3.10 The overall risk of liability from soil or groundwater contamination are therefore considered to be moderate for the site in relation to future residential use, due to the potential presence of near surface on-site contaminants, in particular PCBs.

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3.11 Therefore, URS concluded that is was unlikely that planning conditions would require an intrusive investigation. However, they did recommend that consideration be given to management of waste from potentially contaminated soil generated during the construction phase.

3.12 URS also highlighted that the potential presence of asbestos within the existing MADE GROUND and concrete sub-structures should be dealt with during any future investigations.

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4.0 FIELDWORK & FINDINGS

4.1 All fieldwork was generally executed in accordance with the recommendations given in British Standard BS 5930:1999, "Code of Practice for Site Investigations", contamination sampling was undertaken in accordance with BS 10175 : 2001, "Code of Practice for the Investigation of Potentially Contaminated Sites".

4.2 Borehole and trial pit locations are indicated on the appended *Sketch Fieldwork Location Plan.*

4.3 Fieldwork was undertaken on the 28th September 2011 and comprised the following elements:

CFA Boreholes

4.4 Two Continuous Flight Augered (CFA) boreholes (BH1 & BH2) were carried out to depths of 8.00m and 15.00m depth respectively. BH1 was drilled towards the front of the site, within the north-east section of the site. Borehole BH2 was located midway along the western boundary.

4.5 Disturbed and bulk samples were taken from the CFA boreholes at regular depth intervals within each stratum and when a change of strata was encountered.

4.6 Standard Penetration Tests (SPT's) provide additional information on the consistency of the material encountered. The appended Penetration Tests versus Depth Profile plots the 'N' values against depth for the boreholes at this site.

4.7 Upon completion of borehole BH2 a combined groundwater/gas monitoring standpipe was installed to a depth of 8.00m below existing ground level.

4.8 The gas monitoring installation comprised of a 1 metre length of plain 50mm diameter HDPE pipe followed by slotted geotextile wrapped HDPE pipe, capped at the base. A cement/bentonite seal was installed from 1.00m to ground level and each installation was finished with a gas valve on top of the pipe and a lockable stopcock cover.

4.9 Full details of the borehole findings are given on the appended borehole record sheets.

Hand Excavated Trial Pits

4.10 In addition to the boreholes discussed above, three hand excavated trial pits (TP1-TP3) were carried out at various locations across the site in order to provide additional geotechnical information and samples for testing.

4.11 Full details of the trial pit findings are given on the appended trial pit record sheets.

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Landfill Gas Monitoring

4.12 Following the initial site work, three return gas/groundwater monitoring visits were undertaken to the installation fitted within borehole BH2 on the 6th, 17th and 24th October 2011.

4.13 The barometric pressure was recorded together with the level of Carbon Dioxide, Oxygen and Methane within the boreholes. In addition, gas flow measurements were taken and the depth to groundwater recorded.

4.14 Full details of the readings are included on the appended Gas/Groundwater Monitoring Record Sheet.

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5.0 GROUND CONDITIONS

5.1 According to information published by the British Geological Survey the underlying geology at this site is shown as being the London Clay stratum.

London Clay

5.2 It is thought that the London Clay formation was deposited during a period of sea inundation in the area up to 200m in depth. The London Clay can be up to 150m thick beneath south Essex thinning across London to about 90m near Reading.

5.3 The formation consists of mainly dark blue to brown grey clay containing variable amounts of fine-grained sand and silt. London Clay generally weathers to an orange-brown colour with pockets of silty fine sand.

5.4 The formation is particularly susceptible to swelling and shrinking when subjected to moisture content changes. In addition, gypsum (selenite) crystals and pyrite nodules are commonly found throughout the formation. London Clay consists mainly of dark bluish grey to brownish grey clay containing variable amounts of fine-grained sand and silt. When exposed to the weathering process its upper regions oxidise to brown in colour.

5.5 It usually contains selenite crystals, often grouped in bands or layers, which are thought to have originated from the decomposition of shell fragments. London Clay contains clay minerals in the form of illite, kaolinite and smectite. The presence of smectite renders the London Clay particularly susceptible to heave caused by alternate wetting and drying near the surface. In addition, weathering and possible slight transportation of semi-frozen material "en-masse" in glacial or peri-glacial regions can occur. This action often completely destroys the structure of the material and can involve a serious loss of strength. As the materials are based on local constituents, the lithology of the deposit is often similar to that of the parent strata.

5.6 Full details of the ground conditions encountered during this initial investigation can be summarised from the boreholes as follows:

Depth From (m)	Depth To (m)	Description
0.00	0.30/0.50	MADE GROUND
0.30/0.50	6.80/6.90	Weathered London Clay
6.80/6.90	15.00+	London Clay

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5.7 It should be noted that the depths of MADE GROUND recorded above are those encountered within the boreholes undertaken during the current work. Owing to the variable nature and unknown deposition criteria of MADE GROUND it is possible that deeper or more extensive areas of MADE GROUND may exist at this site, which has not been revealed by the current work.

5.8 Groundwater was encountered during the initial fieldwork, however during the return monitoring visits the groundwater level was recorded at depths of between 6.80m and 7.00m below existing ground level.

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6.0 LABORATORY TESTING

6.1 The following geotechnical and contamination tests have been carried out on samples recovered from the boreholes and at this site.

6.2 Unless otherwise stated, the geotechnical tests have generally been carried out in accordance with the recommendations given in British Standard 1377:1990, "Methods of Test for Soils for Civil Engineering Purposes".

6.3 The chemical testing was carried out in accordance with standard industry methods in a UKAS approved laboratory which is also currently accredited in accordance with MCERTS for the majority of its testing. Further information regarding this accreditation is available on request together with a full list of test methods if required.

6.4 *Natural Moisture Content Tests*

The natural moisture contents have been determined for eight samples of the material encountered at various depths beneath the site.

For the samples tested the natural moisture contents for these samples was found to range between 25% and 34%.

The moisture content versus depth profile has been appended.

6.5 *Atterberg Limits*

The Atterberg Limits have been determined for two samples collected and tested from the London Clay stratum encountered beneath the site.

For the samples tested, the liquid limit (LL) was found to range between 72% and 78%, the plastic limit (PL) between 27% and 28% and the plasticity index (PI) from 45 to 50.

These results indicate that the samples tested from beneath the site would be classified as being of 'very high' plasticity (CV). In addition, this material would, as expected fall into the 'high' shrinkage potential category in accordance with the National House Building Councils (NHBC) classification system given in Part 4 of their Standards.

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6.6 *pH and Sulphate Tests*

The pH and sulphate contents have been determined for two samples recovered from the boreholes at various depths.

The pH was found to range between 6.5 and 6.6 and the sulphate content, on a 2:1 water:soil extract between <0.01g/l and 1.82 g/l .

6.7 *Chemical Analysis*

A total of five soil samples have taken from the MADE GROUND encountered at this site were selected and tested for a range of commonly occurring contaminants and indicators of contamination including those given by the Contaminated Land Exposure Assessment (CLEA).

The contamination suite undertaken at this site includes speciated **P**oly**A**romatic **H**ydrocarbon (PAH) and speciated **T**otal **P**etroleum **H**ydrocarbon (TPH).

No groundwater was encountered during the initial investigation and therefore, none was has been tested.

In addition to the above four superficial samples were collected and tested from across the site for **P**oly**C**hlorinated **B**iphenyls.

PCB's are a class of organic compounds (specifically organochlorides) with 2 to 10 chlorine atoms attached to biphenyl, which is a molecule composed of two benzene rings. The chemical formula for PCBs is $C_{12}H_{10-x}Cl_x$.

Four near surface samples have also been screened for Asbestos content.

6.8 *Waste Classification Tests*

In addition to the above a sample of MADE GROUND encountered across the site has been selected and tested for **W**aste **A**cceptance **C**riteria (WAC) in accordance with BS EN 12457 Part 3.

Full details of the results are given on the appended result sheets

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7.0 DISSCUSION & RECOMMENDATIONS

PROPOSED DEVELOPMENT & SCOPE OF WORKS

7.1 As discussed within Section 1 above, it is understood that the proposed development at this site will comprise the construction of two new bungalows, together with associated private gardens.

7.2 A previous Phase 1 *Non-Intrusive* investigation into the site was carried out by a different company, URS, the results of which are contained within the appended Report and have provided the basis for this subsequent Phase 2 *Intrusive* site investigation.

7.3 The Phase 1 investigation comprised a limited 'Desk Study' and included a remote Walkover Survey, an Environmental Disclosure Report and a Historical Map Search.

7.4 This Phase 2 *Intrusive* site investigation has now been commissioned to provide information on the sub-soil conditions on site together with laboratory testing and reporting, in order to enable a ***preliminary contamination assessment*** to be carried out.

7.5 In addition, a gas monitoring survey was also to be carried out across the site during the current intrusive investigation work.

7.6 Geotechnical factual information has also been provided at the request of the Consulting Engineer.

7.7 This report presents the work carried out and discusses the findings

BURIED CONCRETE

7.8 The results of the chemical analyses indicate that the samples tested would fall into Class DS-1 and Class DS-3 of the Building Research Establishments (BRE) classification system Special Digest Part 1:2005 "Concrete in aggressive ground".

LANDFILL GAS

7.9 During the return gas/groundwater monitoring visit, no methane or carbon dioxide gas emissions were detected within the installation fitted within borehole BH2.

7.10 CIRIA Publication C665 "Assessing Risks posed by Hazardous Ground gases to Buildings (Revised 2007) includes the NHBC "Traffic Light" system.

7.11 Therefore, in accordance with the NHBC "Traffic Light" system we would consider that the current site would be classified as GREEN and, therefore, no land borne gas remedial measures would be required at this site.

PRELIMINARY CONTAMINATION ASSESSMENT

7.12 Part IIA of the Environmental Protection Act 1990 contains the legislative framework for the regulation of contaminated land and this was implemented in the Contaminated Land (England) Regulations 2000. This legislation allows for the identification and remediation of land where contamination is causing unacceptable risks to human health or the wider environment. The approach adopted by the UK contaminated land policy is "suitable for use" which implies that the land should be suitable for its current use and made suitable for any known future use.

7.13 For this ***Preliminary Contamination Assessment*** the site has been modelled using the Source-Pathway-Receptor approach to produce a Conceptual Site Model.

Source *(substances or potential contaminants which may cause harm)*

Pathway *(a linkage route between the source and receptor)*

Receptor *(something which may be harmed by the source e.g. humans, plant life, groundwater etc.)*

7.14 Source

A thin band of MADE GROUND was encountered across the majority of the site during the current investigation, to a maximum depth of some 0.50m below existing ground level. Therefore, a total of five superficial samples were collected from the MADE GROUND stratum encountered across the site at various depths and tested for a range of commonly occurring contaminants and indicators of contamination given by the Contaminated Land Exposure Assessment (CLEA). The contamination suite undertaken at this site includes speciated PolyAromatic Hydrocarbon (PAH) and speciated Total Petroleum Hydrocarbon (TPH).

No groundwater was struck during the drilling of the boreholes carried out across the site and therefore none has been tested as part of this current investigation.

Results from the above samples are discussed below during this ***Preliminary Contamination Assessment***.

7.15 Pathways

Any contamination could reach the receptors by a number of routes although the most likely would be by contact with the soils either during construction or subsequently by users of landscaped areas.

The pathways needing to be considered, as discussed above, will depend on the land usage, and will include for, example; soil ingestion, inhalation of vapour and dust, and consumption of home-grown vegetables, where this is applicable.

7.16 Receptors

From the results of the desk study and the intended end site use the following potential receptors have been identified.

- Construction workers on the site likely to come into contact with the soils.
- Future occupiers of the residential units
- Structures
- Neighbours
- Groundwater

7.17 It should be noted that the CLEA software has limited functionality and contains algorithms, which the EA has publicly expressed its intention to update. As a consequence of this, some of the screening values generated by the CLEA software may not adequately reflect specific site conditions and in some instances are unduly conservative. In addition, it should also be noted that the figures given in the appended table are based on a 6% soil organic matter content.

7.18 The DEFRA/EA model has been developed on the basis of many critical assumptions about possible exposure to soil contamination and the development of conceptual exposure models to describe different land uses as follows:

Residential with plant uptake	Mainly refers to residential gardens in which vegetables are grown.
Residential without plant uptake	Refers to areas which have gardens (e.g. blocks of flats) but without vegetable uptake.
Open Spaces	Areas of open space only – not allocated for any specific usage.
Commercial /Industrial	Commercial/industrial usage where there are open areas which are not hard surfaced.

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7.19 The Contaminated Land Exposure Assessment (CLEA) model was originally published in March 2002 as joint DEFRA/EA publications; Contaminated Land Research (CLR) Report CLR 10, with Reports CLR7, 8 and 9 as supporting documents, providing toxicity data and human tolerable daily intake (TDI) data to be used with this model. This model enabled the derivation of more site-specific values for contaminants present on a site, rather than the use of 'generic' values, which were previously used.

7.20 DEFRA/EA previously published a number of Soil Guideline Values (SGVs) for certain determinands, (common toxic metals), which were generic guideline criteria for assessing the risks to human health from chronic exposure to soil contamination for standard land-use functions. However, these were withdrawn in late 2008 and DEFRA/EA have now issued a new set of guidance documents. With regard to the Chelmer Site Investigations standard suite of tests, currently SGV figures have only been issued for Arsenic, Cadmium, Mercury, Nickel, Phenols and Selenium.

7.21 In the absence of currently published SGV values for the remaining contaminants, Messrs. W. S. Atkins have derived ATRISK^{soil} Soil Screening Values (SSVs) based on the new 2009 guidance (SC050021/SR3 (the CLEA Report) and SC050021/SR2 (the TOX report)) for commercial/industrial, residential without homegrown produce, residential with homegrown produce and allotment land uses. These have been based on the default assumptions provided in the CLEA report which it is understand will be used in the development of future Soil Guideline Values by DEFRA and the Environment Agency. Atkins SSVs have been derived in line with the new guidance using CLEA model v1.04. As the inhalation of vapour pathway contributes less than ten percent of total exposure, this is unlikely to significantly affect the combined assessment criterion and the SSV values used are the combined assessment criterion given by CLEA if free product is not observed.

7.22 The SGV and SSV levels represent "intervention" levels above which the levels of contamination may pose an unacceptable risk to the health of site-users such that further investigation and/or remediation is required.

7.23 Total Petroleum Hydrocarbons are considered in accordance with the fractions proposed by The Environment Agency, drawing on the TPHCWG methodology. These are contained in Table 4.2 – Petroleum hydrocarbon fractions for use in UK human health risk assessment, based on Equivalent Carbon (EC) number, contained in Science Report P5-080/TR3, *The UK Approach for Evaluating Human Health Risks from Petroleum Hydrocarbons in Soils.*

7.24 At this site the proposed development will consist of two new residential buildings together with associated private garden, contamination results have been compared against the ***Residential with Plant Uptake usage*** criteria.

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ASSESSMENT OF RESULTS

7.25 From the five samples tested from across the site, no determinands exceeded the CLEA Soil Guideline Values (SGV) or ATRISK Contaminated Land Screening Values (SSV) for *Residential with Plant Uptake usage.*

7.26 Following the recommendations by URS outlined within the previous Desk Top Study a number of near surface soil samples were screened for Asbestos content, with a result that none was found.

7.27 In addition to the above, due to the previous site use a number of samples were collected and tested from various locations for PCB content. Elevated levels were recorded within 50% of the samples tested.

7.28 PCBs were widely used as dielectric and coolant fluids, for example in transformers, capacitors, and electric motors. Due to PCBs' toxicity and classification as a persistent organic pollutant, PCB production was banned by the United States Congress in 1979 and by the Stockholm Convention on Persistent Organic Pollutants in 2001. Concerns about the toxicity of PCBs are largely based on compounds within this group that share a structural similarity and toxic mode of action with dioxin. Toxic effects such as endocrine disruption and neurotoxicity are also associated with other compounds within the group.

Discussion

Based on the limited number of chemical tests carried out to date, the MADE GROUND should be considered unsuitable to remain on site due to elevated PCBs. At this stage allowance should be made for this material to be removed off site.

The maximum depth of MADE GROUND encountered across the site was recorded to be 0.50m and therefore it may will be that during the development of the site this amount of material will be removed from site anyway.

We would recommend that in landscaped areas a minimum of 200mm of TOPSOIL underlain by 400mm of "clean" imported material should be used with any MADE GROUND removed as necessary to achieve this thickness of "clean material.

Any excavated material at this site can be considered to pose a low hazard to groundworkers as far as Health and Safety is concerned. However, due to the elevated levels of PCB encountered, we would recommend that standard Health and Safety precautions be taken with regard to ground workers at this site and these should include PPE equipment such as gloves, overalls etc and normal washing facilities available on-site.

Care should be taken when removing any gullies or interceptors that may be on site as these may contain residual contaminants. We recommend that any resulting excavations be inspected to assess any potentially contaminated soils.

A careful watch should be kept for any contaminated or suspect materials that may be encountered during the development works. If such material is discovered, a suitably qualified person should assess the risk and further advise any remedial measures.

7.29 As always, the above recommendations are based on a selected number of representative samples and further testing may be required if any significant contamination is suspected or encountered during ground works.

7.30 With regard to the installation of any future water supply pipe work, reference should be made to the Water Regulations Advisory Service information and guidance note. The Selection of Materials for Water Supply Pipes to be Laid in Contaminated Land. It is recommended that the results of the contamination testing undertaken on the site should be provided to the water supplier in order to ensure that any pipe provided complies with their requirements.

7.31 In addition, with regard to topsoil it should be noted that chemical testing is undertaken in order to assess risks to human health. The testing is not intended to provide information about the quality of any soil as a growing medium and should such information be required further samples will need to be collected and tested against a suitable suite of topsoil quality determinands.

WASTE ACCEPTANCE CRITERIA (WAC) TESTS

7.32 One EN 14473/02 Waste Acceptance Criteria (WAC) test has been undertaken during the current work and the certificate pertaining to this is appended to this report.

7.33 Due to the levels of TOC recorded, the results of the WAC test indicates that the sample tested would probably be classified as "*Hazardous waste Landfill Material*".

7.34 However, it should be noted that Chelmer Site Investigations Laboratories Limited are not a licensed landfill operator and we therefore strongly recommend that the WAC data should be presented to potential Waste Management Companies in order for them to confirm the waste classification of surplus soils to be removed from this site and to determine its acceptability at appropriate landfill sites for disposal/treatment.

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a) This report has been prepared for the purpose of providing advice to the client pursuant to its appointment of Chelmer Site Investigations Laboratories Limited (CSI) to act as a consultant.
b) Save for the client no duty is undertaken or warranty or representation made to any party in respect of the opinions, advice, recommendations or conclusions herein set out.
c) All work carried out in preparing this report has used, and is based upon, our professional knowledge and understanding of the current relevant English and European Community standards, approved codes of practice, technology and legislation.
d) Changes in the above may cause the opinion, advice, recommendations or conclusions set out in this report to become inappropriate or incorrect. However, in giving its opinions, advice, recommendations and conclusions, CSI has considered pending changes to environmental legislation and regulations of which it is currently aware. Following delivery of this report, we will have no obligation to advise the client of any such changes, or of their repercussions.
e) CSI acknowledges that it is being retained, in part, because of its knowledge and experience with respect to environmental matters. CSI will consider and analyse all information provided to it in the context of our knowledge and experience and all other relevant information known to us. To the extent that the information provided to us is not inconsistent or incompatible therewith, CSI shall be entitled to rely upon and assume, without independent verification, the accuracy and completeness of such information.
f) The content of this report represents the professional opinion of experienced environmental consultants. CSI does not provide specialist legal advice and the advice of lawyers may be required.
g) In the Summary and Recommendations sections of this report, CSI has set out our key findings and provided a summary and overview of our advice, opinions and recommendations. However, other parts of this report will often indicate the limitations of the information obtained by CSI and therefore any advice, opinions or recommendations set out in the Executive Summary, Summary and Recommendations sections ought not to be relied upon unless they are considered in the context of the whole report.
h) The assessments made in this report are based on the ground conditions as revealed by walkover survey and/or intrusive investigations, together with the results of any field or laboratory testing or chemical analysis undertaken and other relevant data, which may have been obtained including previous site investigations. In any event, ground contamination often exists as small discrete areas of contamination (hot spots) and there can be no certainty that any or all such areas have been located and/or sampled.
i) There may be special conditions appertaining to the site, which have not been taken into account in the report. The assessment may be subject to amendment in light of additional information becoming available.
j) Where any data supplied by the client or from other sources, including that from previous site investigations, have been used it has been assumed that the information is correct. No responsibility can be accepted by CSI for inaccuracies within the data supplied by other parties.
k) Whilst the report may express an opinion on possible ground conditions between or beyond trial pit or borehole locations, or on the possible presence of features based on either visual, verbal or published evidence this is for guidance only and no liability can be accepted for the accuracy thereof.
l) Comments on groundwater conditions are based on observations made at the time of the investigation unless otherwise stated. Groundwater conditions may vary due to seasonal or other effects.
m) This report is prepared and written in the context of the agreed scope of work and should not be used in a different context. Furthermore, new information, improved practices and changes in legislation may necessitate a reinterpretation of the report in whole or part after its original submission.
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p) This report is issued on the condition that CSI will under no circumstances be liable for any loss arising directly or indirectly from subsequent information arising but not presented or discussed within the current Report.
q) In addition CSI will not be liable for any loss whatsoever arising directly or indirectly from any opinion within this report.

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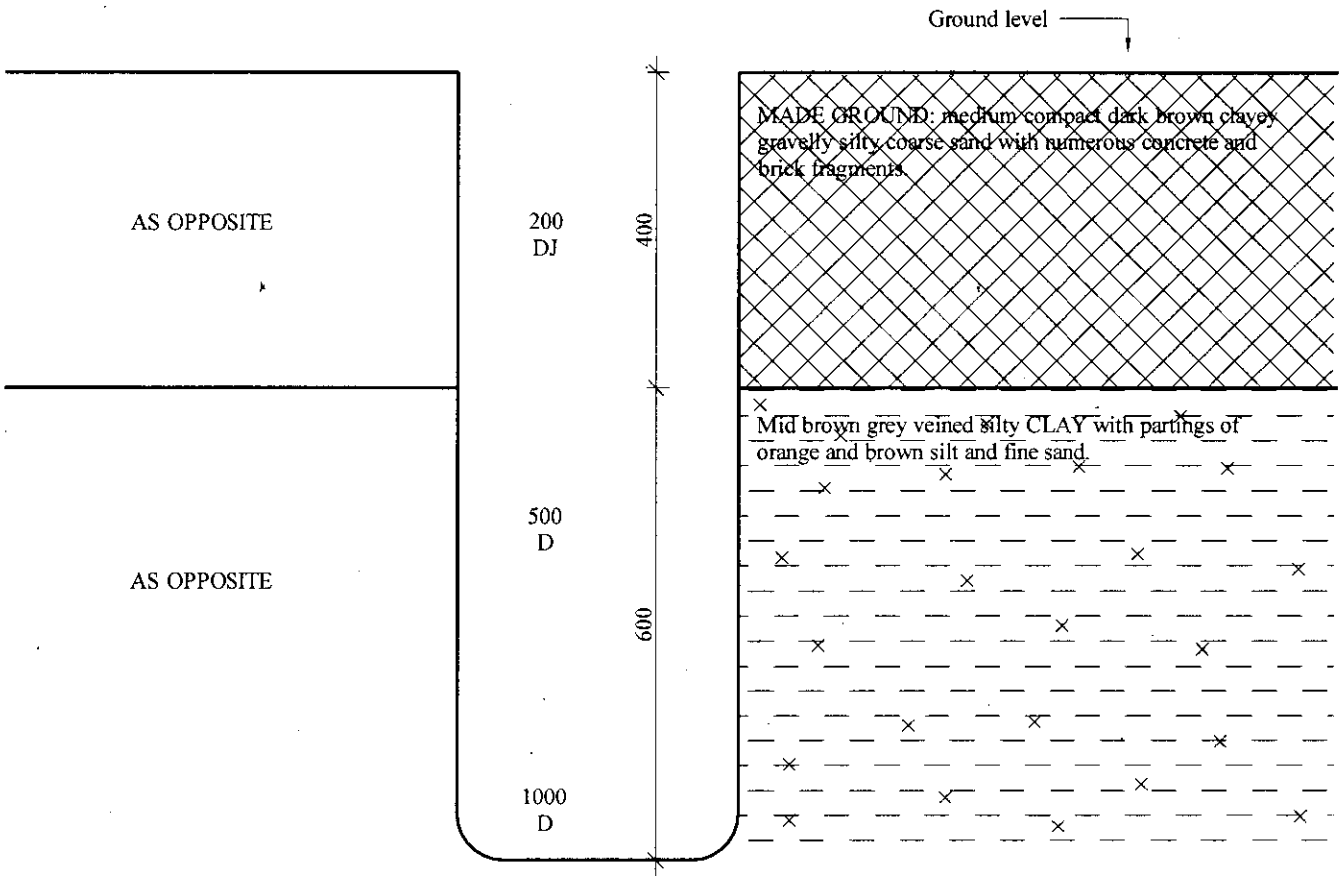
Email: info@siteinvestigations.co.uk Website: www.siteinvestigations.co.uk

Client:	Codecombat Ltd	**Scale:**	N.T.S.	**Sheet No:**	1 of 1	**Date:**	28.9.11
Location:	Land adj. 8 Preston Gardens Rayleigh, Essex	**Job No:**	2801	**Trial Pit No:**	1	**Weather:**	Fine
Excavation Method:	Hand tools			**Drawn by:**	MM	**Checked by:**	ME



TRIAL PIT ENDS AT 1000mm

Remarks:

Key:
- **D** Small disturbed sample
- **B** Bulk disturbed sample
- **U** Undisturbed sample (U100)
- **N** Standard Penetration Test Blow Count
- **J** Jar sample
- **V** Pilcon Vane (kPa)
- **M** Mackintosh Probe
- **W** Water Sample

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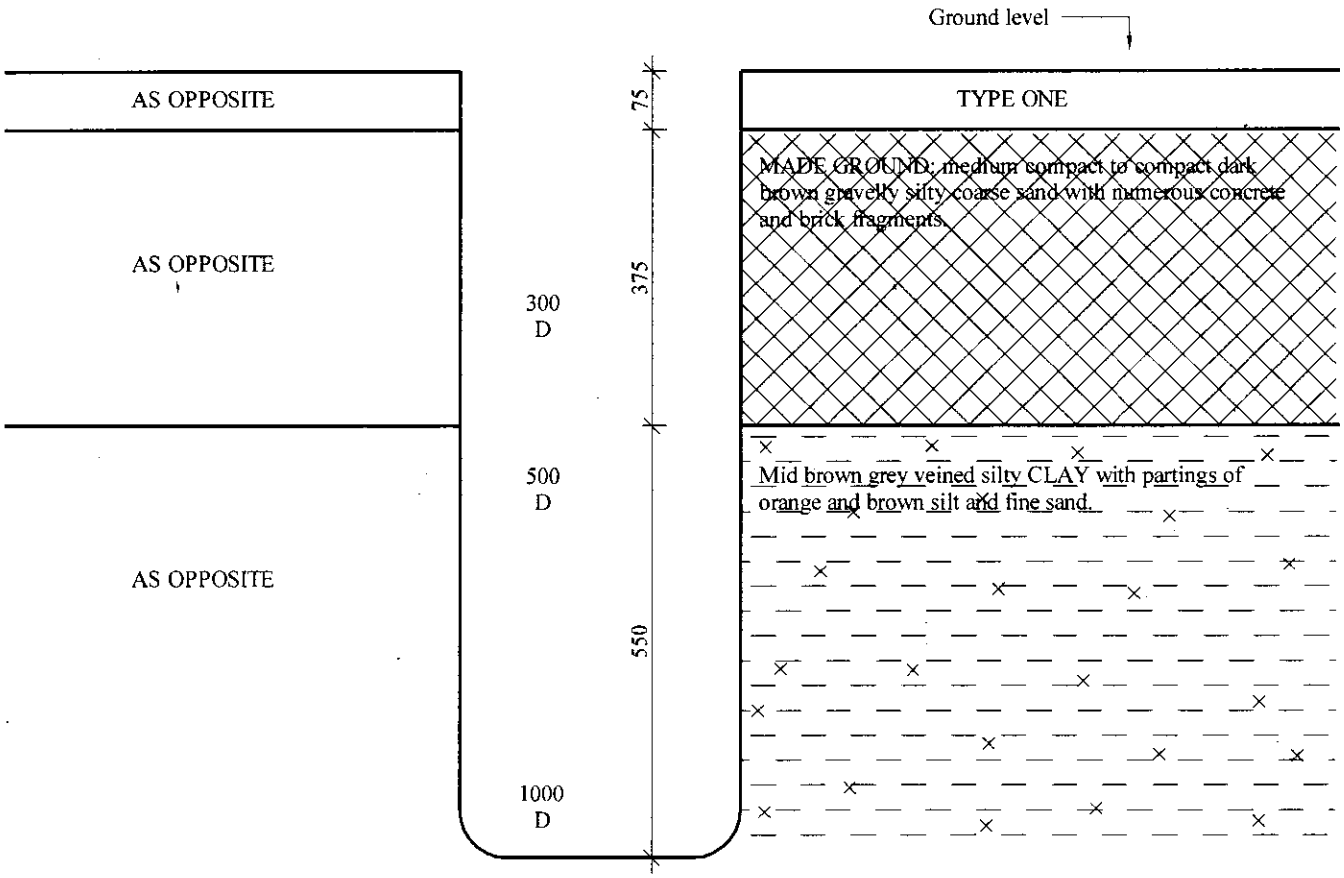
Client:	Codecombat Ltd	**Scale:**	N.T.S.	**Sheet No:**	1 of 1	**Date:**	28.9.11
Location:	Land adj. 8 Preston Gardens Rayleigh, Essex	**Job No:**	2801	**Trial Pit No:**	2	**Weather:**	Fine
Excavation Method:	Hand tools			**Drawn by:**	MM	**Checked by:**	ME



TRIAL PIT ENDS AT 1000mm

Remarks:

Key:
D Small disturbed sample
B Bulk disturbed sample
U Undisturbed sample (U100)
N Standard Penetration Test Blow Count
J Jar sample
V Pilcon Vane (kPa)
M Mackintosh Probe
W Water Sample

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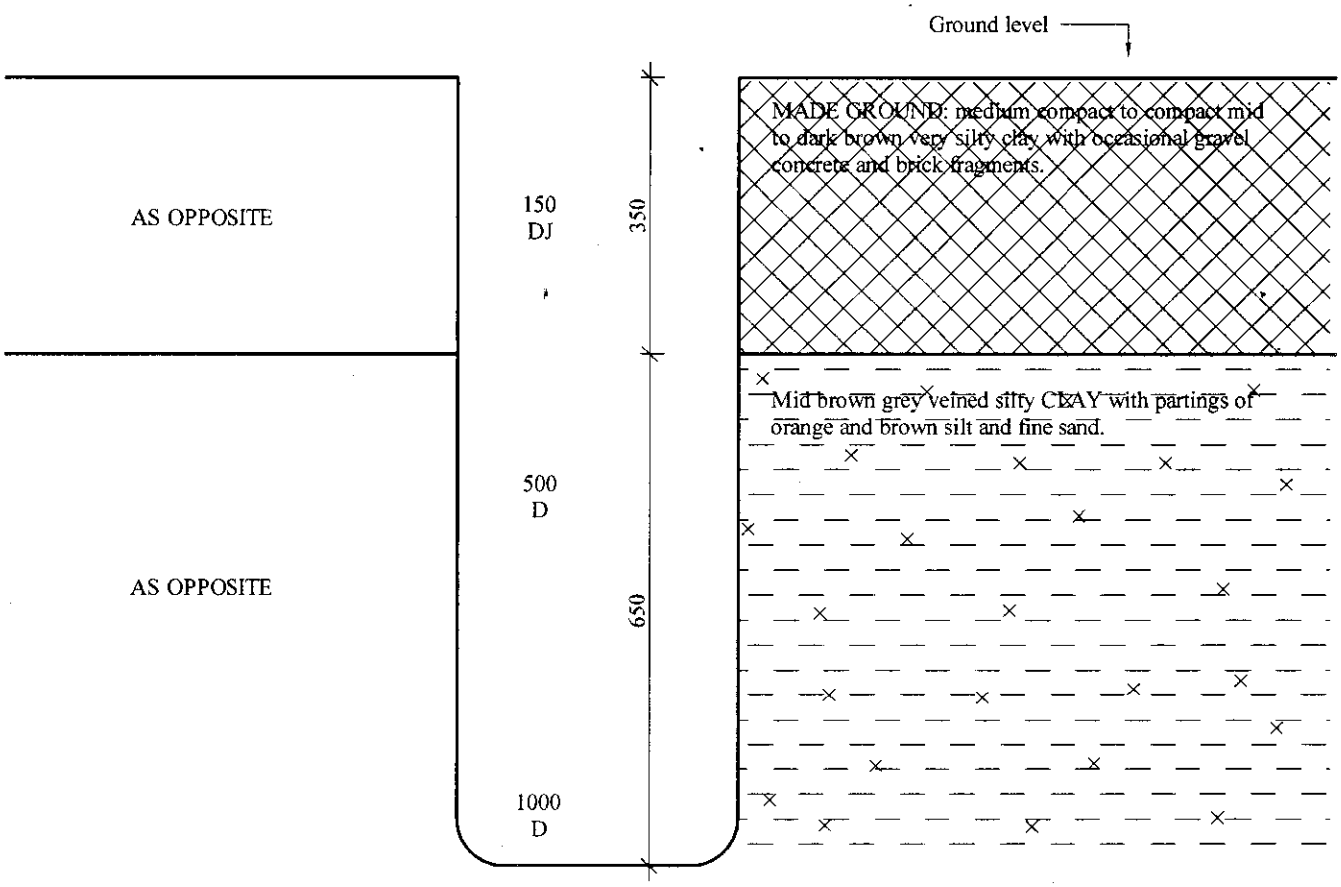
Client:	Codecombat Ltd	**Scale:**	N.T.S.	**Sheet No:**	1 of 1	**Date:**	28.9.11
Location:	Land adj. 8 Preston Gardens Rayleigh, Essex	**Job No:**	2801	**Trial Pit No:**	3	**Weather:**	Fine
Excavation Method:	Hand tools			**Drawn by:**	MM	**Checked by:**	ME



TRIAL PIT ENDS AT 1000mm

Remarks:

Key:
- **D** Small disturbed sample
- **B** Bulk disturbed sample
- **U** Undisturbed sample (U100)
- **N** Standard Penetration Test Blow Count
- **J** Jar sample
- **V** Pilcon Vane (kPa)
- **M** Mackintosh Probe
- **W** Water Sample

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Client: Codecombat Ltd	Scale: N.T.S.	Sheet No: 1 of 2	Weather: Fine	Date: 28.9.11
Site: Land adj. 8 Preston Gardens, Rayleigh, Essex	Job No: 2801	Borehole No: 1	Boring method: GEO 205 (150mm Ø) C.F.A.	

Depth Mtrs.	Description of Strata	Thick-ness	Legend	Sample	Test Type Result	Root Information	Depth to Water	Depth Mtrs
G.L.	MADE GROUND: medium compact dark brown gravelly silty coarse sand with numerous concrete brick fragments and shards of glass.	0.3				Roots of live and dead appearance to 5mmØ to 0.3m.		
0.3	Stiff mid brown grey veined silty CLAY with partings of orange and brown silt and fine sand claystone nodules and crystals.	1.6		D		Roots of live appearance to 2mm Ø to 1.1m. ↓ Hair and fibrous roots to 1.6m. ↓ No roots observed below 1.6m.		0.5
				D				1.0
				D	150 SPT 07, 03, 03, 04, 04 N = 14			1.5
1.9				D				2.0
				D				2.5
				D	150 SPT 11, 05, 05, 05, 05 N = 20			3.0
	Stiff mid brown grey veined silty CLAY with partings of brown silt and fine sand claystone nodules and crystals.	3.8		D				3.5
				D				4.0
				D	150 SPT 15, 06, 07, 05, 06 N = 24			4.5
				D				5.0
				D				5.5
5.7	Stiff dark brown as above.	1.1		D	150 SPT 15, 06, 06, 07, 06 N = 25			6.0

Drawn by: MM **Approved by:** ME

Remarks:

CONTINUED ON SHEET 2 OF 2

Key: T.D.T.D. Too Dense to Drive
D Small Disturbed Sample J Jar Sample
B Bulk Disturbed Sample V Pilcon Van (kPa)
U Undisturbed Sample (U100) M Mackintosh Probe
W Water Sample N Standard Penetration Test Blow Count

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Client:	Codecombat Ltd	Scale:	N.T.S.	Sheet No:	2 of 2	Weather:	Fine	Date:	28.9.11
Site:	Land adj. 8 Preston Gardens, Rayleigh, Essex	Job No:	2801	Borehole No:	1	Boring method:	GEO 205 (150mm Ø) C.F.A.		

Depth Mtrs.	Description of Strata	Thick-ness	Legend	Sample	Test Type Result	Root Information	Depth to Water	Depth Mtrs
6.8								
	Stiff mid grey silty CLAY with partings of grey silt and fine sand and crystals.	3.6		D				7.0
					150 SPT 15, 06, 06, 06, 06 N = 24			7.5
				D				8.0
					150 SPT 17, 06, 07, 07, 07 N = 27			9.0
				D				10.0
10.4								
	Very stiff as above.	4.6			150 SPT 19, 09, 08, 08, 09 N = 34			10.5
				D				11.0
					150 SPT 20, 09, 09, 09, 09 N = 36			12.0
				D				13.0
					150 SPT 19, 10, 09, 09, 09 N = 37			13.5
				D				14.0
15.0								
	Borehole ends at 15.0m			D	150 SPT 21, 10, 10, 10, 11 N = 41			15.0

Drawn by: MM **Approved by:** ME

Remarks: Borehole dry and open on completion.

Key: T.D.T.D. Too Dense to Drive
D Small Disturbed Sample J Jar Sample
B Bulk Disturbed Sample V Pilcon Van (kPa)
U Undisturbed Sample (U100) M Mackintosh Probe
W Water Sample N Standard Penetration Test Blow Count

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Client: Codecombat Ltd	**Scale:** N.T.S.	**Sheet No:** 1 of 1	**Weather:** Fine	**Date:** 28.9.11
Site: Land adj. 8 Preston Gardens, Rayleigh, Essex	**Job No:** 2801	**Borehole No:** 2	**Boring method:** GEO 205 (150mm Ø) C.F.A.	

Depth Mtrs.	Description of Strata	Thick-ness	Legend	Sample	Test Type Result	Root Information	Depth to Water	Depth Mtrs
G.L.	MADE GROUND: soft moist mid to dark brown silty clay with numerous fine gravel and occasional brick fragments.	0.5		DJ D		Roots of live appearance to 2mm Ø to 0.4m.		0.4
0.5	Firm mid brown grey veined silty CLAY with partings of brown silt and fine sand.	0.7		D		Roots of live appearance to 1mm Ø to 1.3m.		0.5 1.0
1.2				D	150 SPT 06, 03, 03, 04, 06 N = 16	No roots observed below 1.3m.		1.5
				D				2.0
				D				2.5
				D	150 SPT 09, 03, 05, 04, 04 N = 16			3.0
				D				3.5
	Stiff mid brown grey veined silty CLAY with partings of orange and brown silt and fine sand claystone nodules and crystals.	5.7		D				4.0
				D	150 SPT 14, 06, 06, 06, 06 N = 24			4.5
				D				5.0
				D				5.5
				D	150 SPT 15, 06, 07, 06, 06 N = 25			6.0
6.9				D				7.0
	Stiff mid grey silty CLAY with partings of grey silt and fine sand and crystals.	1.1			150 SPT 16, 05, 07, 06, 07 N = 25			7.5
8.0				D				8.0
	Borehole ends at 8.0m							

Drawn by: MM **Approved by:** ME

Remarks: Standpipe installed to 8.0m.
Borehole dry and open on completion.

Key: T.D.T.D. Too Dense to Drive
D Small Disturbed Sample J Jar Sample
B Bulk Disturbed Sample V Pilcon Van (kPa)
U Undisturbed Sample (U100) M Mackintosh Probe
W Water Sample N Standard Penetration Test Blow Count

Chelmer Geotechnical Laboratories

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Laboratory Testing Results

Job No: CGL02354
Client: Codecombat Ltd CSI Ref: 2801
Site: Land Adj 8 Preston Gardens Rayleigh

Received: 28.09.11
Tested: 30.09.11
Complete: 04.10.11

Sample Ref BH / Sample No	Sample Ref Depth (m)	Type	Moisture Content (%) [1]	Soil Fraction >0.425mm (%) [2]	Liquid Limit (%) [3]	Plastic Limit (%) [4]	Plasticity Index (%) [5]	Liquidity Index [5]	Modified Plasticity Index (%) [6	Soil Class [7]	Filter Paper Contact Time (h) [8]	Soil Sample Suction (kPa)	In situ Shear Vane Strength (kPa) [9]	Organic Content (%) [10]	pH Value [11]	Sulphate Content (g/l) SO_3 [12]	Sulphate Content (g/l) SO_4 [13]	Class [14]
1/020362	1.0	D	25	<5											6.6	0.00	0.00	DS-1
1/020363	2.0	D	31	<5	72	27	45	0.09	45	CV								
1/020364	3.0	D	31	<5														
1/020365	4.0	D	34	<5														

Test Methods / Notes

[1] BS 1377 : Part 2 : 1990, Test No 3.2
[2] Estimated if <5%, otherwise measured
[3] BS 1377 : Part 2 : 1990, Test No 4.4
[4] BS 1377 : Part 2 : 1990, Test No 5.3
[5] BS 1377 : Part 2 : 1990, Test No 5.4
[6] BRE Digest 240 : 1993
[7] BS 5930 : 1981 : Figure 31 - Plasticity Chart for the classification of fine soils
[8] In-house method S9a adapted from BRE IP 4/93
[9] Values of shear strength were determined in situ by Chelmer Site Investigations using a Pilcon hand vane or Geonor vane (GV).
[10] BS 1377 : Part 3 : 1990, Test No 4
[11] BS 1377 : Part 2 : 1990, Test No 9
[12] BS 1377 : Part 3 : 1990, Test No 5.6
[13] $SO_4 = 1.2 \times SO_3$
[14] BRE Special Digest One (Concrete in Aggressive Ground) 2005
Note that if the SO_4 content falls into the DS-4 or DS-5 class, it would be prudent to consider the sample as falling into the DS-4m or DS-5m class respectively unless water soluble magnesium testing is undertaken to prove otherwise

Key

D	Disturbed sample
B	Bulk sample
U	U100 (undisturbed sample)
W	Water sample
ENP	Essentially Non-Plastic by inspection
U/S	Underside Foundation

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Laboratory Testing Results

Job No: CGL02354 Received: 28.09.11

Client: Codecombat Ltd CSI Ref: 2801 Tested: 30.09.11

Site: Land Adj 8 Preston Gardens Rayleigh Complete: 04.10.11

Sample Ref.		Type	Moisture Content	Soil Fraction	Liquid Limit	Plastic Limit	Plasticity Index	Liquidity Index	Modified Plasticity Index	Soil Class	Filter Paper Contact Time	Soil Sample Suction	In situ Shear Vane Strength	Organic Content	pH Value	Sulphate Content (g/l)		Class
BH / Sample No	Depth (m)		(%) [1]	>0.425mm (%) [2]	(%) [3]	(%) [4]	(%) [5]	[5]	(%) [6]	[7]	(h) [8]	(kPa)	(kPa) [9]	(%) [10]	[11]	SO_3 [12]	SO_4 [13]	[14]
2/020366	1.0	D	33	<5	78	28	50	0.11	50	CV								
2/020367	2.0	D	33	<5											6.5	1.52	1.82	DS-3
2/020368	3.0	D	30	<5														
2/020369	4.0	D	30	<5														

Test Methods / Notes

[1] BS 1377 : Part 2 : 1990, Test No 3.2

[2] Estimated if <5%, otherwise measured

[3] BS 1377 : Part 2 : 1990, Test No 4.4

[4] BS 1377 : Part 2 : 1990, Test No 5.3

[5] BS 1377 : Part 2 : 1990, Test No 5.4

[6] BRE Digest 240 : 1993

[7] BS 5930 : 1981 : Figure 31 - Plasticity Chart for the classification of fine soils

[8] In-house method S9a adapted from BRE IP 4/93

[9] Values of shear strength were determined in situ by using a Pilcon hand vane or Geonor vane (GV).

[10] BS 1377 : Part 3 : 1990, Test No 4

[11] BS 1377 : Part 2 : 1990, Test No 9

[12] BS 1377 : Part 3 : 1990, Test No 5.6

[13] $SO_4 = 1.2 \times SO_3$

[14] BRE Special Digest One (Concrete in Aggressive Ground) 2005

Note that if the SO_4 content falls into the DS-4 or DS-5 class, it would be prudent to consider the sample as falling into the DS-4m or DS-5m class respectively unless water soluble magnesium testing is undertaken to prove otherwise

Key

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U	U100 (undisturbed sample)
W	Water sample
ENP	Essentially Non-Plastic by inspection
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Moisture Content and Shear Strength Profiles

Client: Codecombat Ltd CSI Ref: 2801

Site: Land Adj 8 Preston Gardens Rayleigh

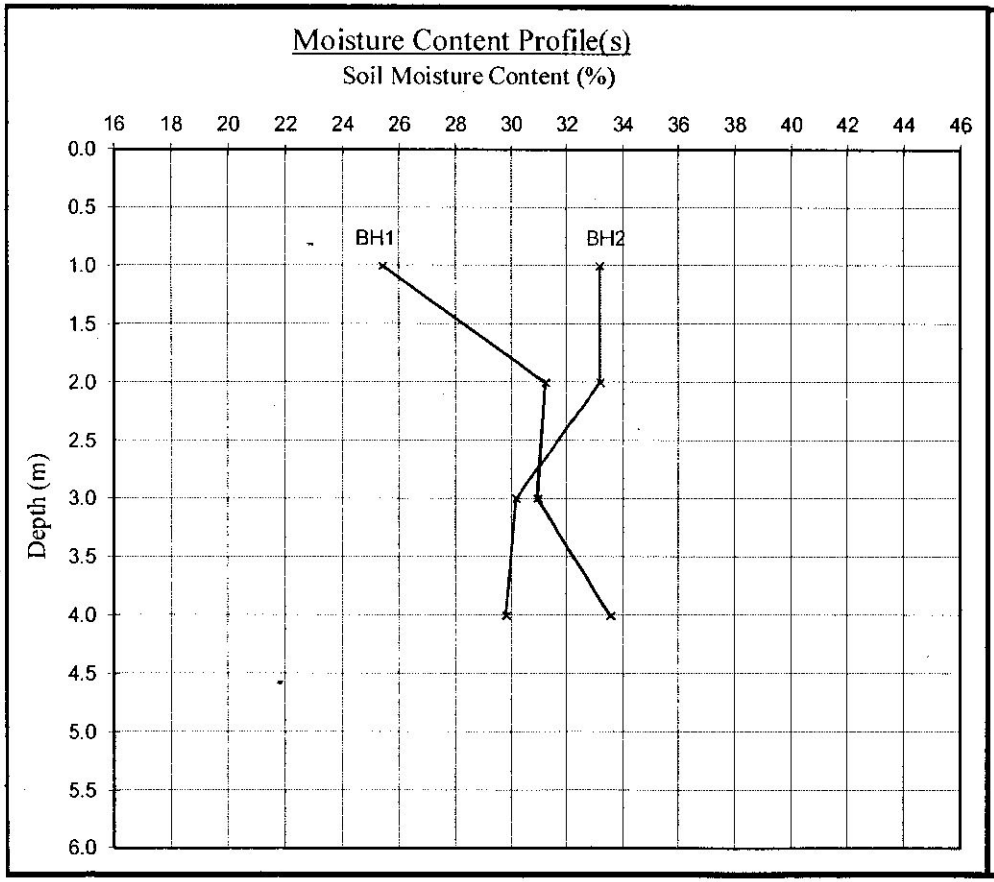
Note : Unless specifically noted the profiles have not been related to a site datum.

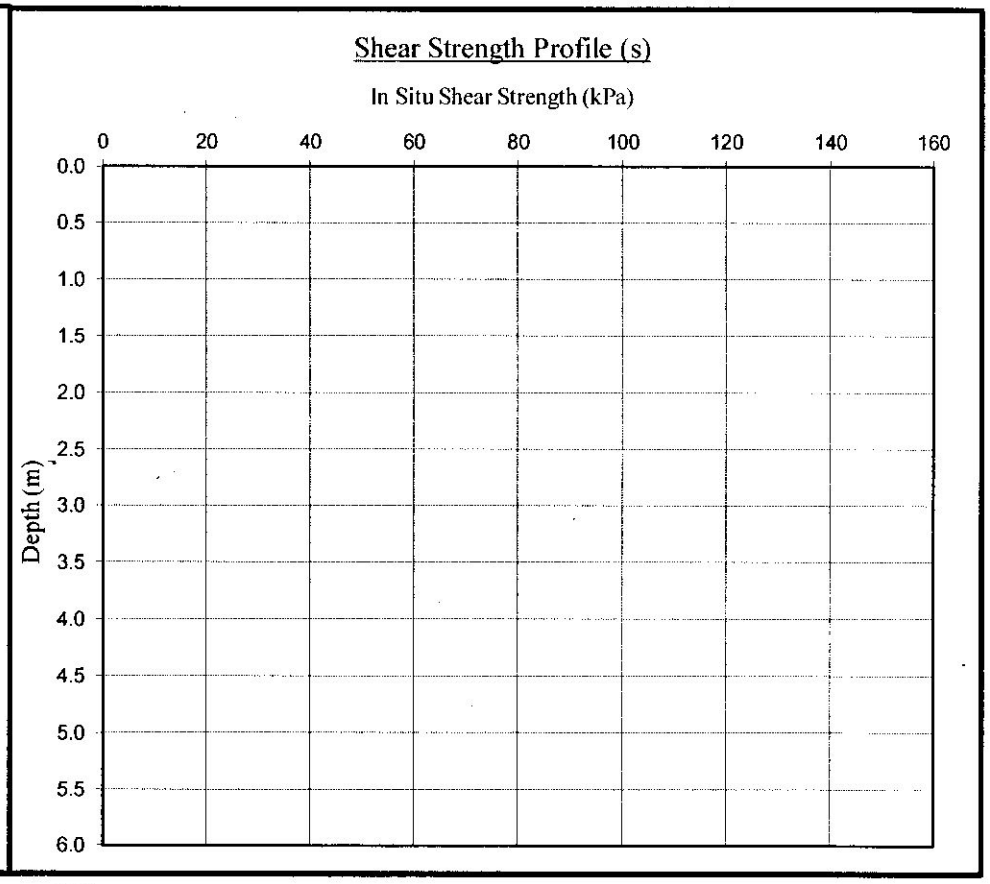
Job No: CGL02354

Received: 28.09.11

Tested: 30.09.11

Complete: 04.10.11





Notes

1. If the Soil Fraction > 0.425mm exceeds 5% the Equivalent Moisture Content of the remainder (calculated in accordance with BS 1377: Part 2 : 1990, cl.3.2.4 note 1) is also plotted and the alternative profile additionally shown as an appropriately coloured broken line.
2. If plotted, 0.4 LL and PL+2 (after Driscoll, 1983) should only be applied to London Clay (and similarly overconsolidated clays) at shallow depths.

Note

Unless otherwise stated, values of Shear Strength were determined in situ by Chelmer Site Investigations using a Pilcon Hand Vane the calibration of which is limited to a maximum reading of 140 kPa.

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Contamination Test Results on Soil Samples

Location: No.8 Preston Gardens, Rayleigh, Essex				Date : October 2011				Job No. : 2801		Sheet 1 of 1	
Borehole No.	Units	TP1	TP2	TP3	BH1	BH2		*ATRISK Contaminated Land Screening Values (SSV) derived using CLEA v1.04 for 6% SOM*			
Sample No.		D1	D1	D1	D1	D1					
Depth (m)		0.20	0.30	0.15	0.25	0.40					
Material Type		MADE GROUND	MADE GROUND	MADE GROUND	MADE GROUND	MADE GROUND		*Residential with plant uptake*	*Residential without plant uptake*	*Allotments*	*Commercial/ Industrial*
Aromatic Hydrocarbons (mg/kg)	>C5-C7	<0.01	<0.01	<0.01	<0.01	<0.01		*0.06*	*0.07*	*0.07*	*7.37*
	>C7-C8	<0.01	<0.01	<0.01	<0.01	<0.01		*14.9*	*15.2*	*106*	*1780*
	>C8-C10	<5	<5	<5	<5	<5		*23.7*	*24.1*	*53.2*	*2700*
	>C10-C12	<5	<5	<5	<5	<5		*132*	*147*	*71.3*	*36800*
	>C12-C16	<5	<5	<5	<5	<5		*452*	*700*	*132*	*38000*
	>C16-C21	<5	<5	<5	<5	<5		*804*	*1330*	*288*	*28400*
	>C21-C35	<5	<5	<5	37	6		*1220*	*1330*	*1550*	*28400*
Aliphatic Hydrocarbons (mg/kg)	>C5-C6	<0.01	<0.01	<0.01	<0.01	<0.01		*26.1*	*26.1*	*4250*	*>1000000*
	>C6-C8	<0.01	<0.01	<0.01	<0.01	<0.01		*87.8*	*87.9*	*13900*	*>100000*
	>C8-C10	<5	<5	<5	<5	<5		*14.5*	*14.5*	*1780*	*86700*
	>C10-C12	<5	<5	<5	<5	<5		*87.7*	*87.8*	*7460*	*94600*
	>C12-C16	<5	<5	<5	<5	<5		*4010*	*4050*	*13300*	*95300*
	>C16-C35	<5	<5	<5	20	<5		*88200*	*88900*	*281000*	*>1000000*
TOTAL TPH	mg/kg	<5	<5	<5	57	6					
Naphthalene	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5		*8.71*	*9.22*	*23.4*	*22700*
Acenaphthylene	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5		-	-	-	-
Acenaphthene	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5		*2130*	*4770*	*612*	*106000*
Fluorene	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5		*1930*	*3100*	*725*	*72100*
Phenanthrene	mg/kg	<0.5	<0.5	<0.5	0.700	<0.5		-	-	-	-
Anthracene	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5		*18300*	*24000*	*10400*	*545000*
Fluoranthene	mg/kg	1.30	<0.5	<0.5	2.30	<0.5		*2160*	*3210*	*924*	*72700*
Pyrene	mg/kg	1.10	<0.5	<0.5	2.00	<0.5		*1550*	*2400*	*620*	*54500*
Benz(a)anthracene	mg/kg	0.60	<0.5	<0.5	1.20	<0.5		*18*	*18.2*	*76.8*	*218*
Chrysene	mg/kg	0.80	<0.5	<0.5	1.60	<0.5		*2280*	*2330*	*6360*	*22000*
Benzo(b)fluoranthene	mg/kg	0.90	<0.5	<0.5	1.40	<0.5		*24.1*	*24.4*	*93*	*223*
Benzo(k)fluoranthene	mg/kg	0.90	<0.5	<0.5	1.60	<0.5		*244*	*246*	*1100*	*2240*
Benzo(a)pyrene	mg/kg	0.90	<0.5	<0.5	1.30	<0.5		*2.43*	*2.46*	*10.3*	*22.3*
Indeno(123-cd)pyrene	mg/kg	0.90	<0.5	<0.5	1.40	<0.5		*23.9*	*24.3*	*84.9*	*222*
Dibenz(ah)anthracene	mg/kg	<0.5	<0.5	<0.5	0.80	<0.5		*2.4*	*2.42*	*12.3*	*22.4*
Benzo(ghi)perylene	mg/kg	0.90	<0.5	<0.5	1.20	<0.5		*248*	*249*	*1630*	*2250*
TOTAL PAH	mg/kg	8.1	<0.5	<0.5	15.3	<0.5					
Cyanide (Free)	mg/kg	<1	<1	<1	<1	<1		*34*	*34*	*34*	*34*
pH	unit	8.4	8.3	7.9	8.5	7.8		-	-	-	-
Copper (Total)	mg/kg	250	27	34	48	24		*4020*	*8370*	*1110*	*109000*
Lead (Total)	mg/kg	134	42	33	78	33		*322*	*444*	*180*	*6830*
Zinc (Total)	mg/kg	543	202	200	160	143		*17200*	*46800*	*3990*	*917000*
								LQM/CIEH Generic Assessment Criteria			
Chromium (Total)	mg/kg	28	20	60	21	30		*3000*	*3000*	*34600*	*30400*
Chromium (Hexavalent)	mg/kg	<2	<2	<2	<2	<2		*4.3*	*4.3*	*2.1*	*35*
								CLEA Soil Guideline Values (SGV)			
Arsenic (Total)	mg/kg	17.1	8.1	18.2	7.4	12.5		*32*	*32*	*43*	*640*
Cadmium (Total)	mg/kg	0.5	<0.5	<0.5	0.6	<0.5		*10*	*10*	*1.8*	*230*
Mercury (Total)	mg/kg	1.1	<0.5	<0.5	<0.5	<0.5		*170*	*170*	*80*	*3600*
Nickel (Total)	mg/kg	22	15	36	15	25		*130*	*130*	*230*	*1800*
Phenols (Total)	mg/kg	<1	<1	<1	<1	<1		*420*	*420*	*280*	*3200*
Selenium (Total)	mg/kg	1.8	0.7	1.5	1.1	1.9		*350*	*350*	*120*	*13000*
Moisture Content	%	9.1	3.2	12.3	8.8	23.7		-	-	-	-
Stones	%	21.70	37.50	4.4	32.0	14.0		-	-	-	-

Key
PAH - Polyaromatic Hydrocarbons
TPH - Total Petroleum Hydrocarbons
- Not determined

Result exceeds ATRISK screening value
Result exceeds EQS/CIEH generic assessment criteria
Result exceeds CLEA Soil Guideline Value (SGV)

Results of PCB Tests on Soil Samples

Chelmer Site Investigations,
Unit 15, East Hanningfield Industrial Estate, Old Church Road,
East Hanningfield, Essex CM3 8AB
Telephone: 01245 400930 Fax: 01245 400933
Email: info@siteinvestigations.co.uk Website: www.siteinvestigations.co.uk

Location : No.8 Preston Gardens, Rayleigh, Essex

Date : October 2011 | **Job No. : 2801**

Borehole No.	TP2	TP3	BH1	BH2
Sample No.	D1	D1	D1	D1
Depth (m)	0.30	0.15	0.25	0.40
Determinand				
PCB 28	<10	<10	<10	<10
PCB 52	<10	<10	13	<10
PCB 101	10	<10	42	<10
PCB 118	<10	<10	38	<10
PCB 138	14	<10	54	<10
PCB 153	<10	<10	36	<10
PCB 180	<10	<10	15	<10
Total	24	<10	198	<10

Remarks

Asbestos Identification

Chelmer Site Investigations,
Unit 15, East Hanningfield Industrial Estate, Old Church Road,
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Telephone: 01245 400930 Fax: 01245 400933
Email: info@siteinvestigations.co.uk Website: www.siteinvestigations.co.uk

Location : No.8 Preston Gardens, Rayleigh, Essex

Date : October 2011 | **Job No. : 2801**

Borehole No.			TP1	TP2	TP3	BH2				
Sample No.										
Depth (m)			0.20	0.30	0.15	0.40				
Not Detected			X	X	X	X				
Detected										

Remarks

No asbestos detected within any of the samples tested.

Unit A2
Windmill Road
Ponswood Industrial Estate
St Leonards on Sea
East Sussex
TN38 9BY
Telephone (01424) 718618
Facsimile (01424) 729911

2683 2683

THE ENVIRONMENTAL LABORATORY LTD

Waste Acceptance Criteria **ANALYTICAL *RESULTS***							
Report No:	ANALYTICAL REPORT No. AR35149				Page 6 of 9		
					CLIENT:	Chelmer Site Investigations Ltd	
Project Name:	Location: Land Adj 8 Preston Gardens, Rayleigh						
Lab Reference	15356				Landfill Waste Acceptance Criteria Limits		
Sampling Date	28/09/11				Inert Waste Landfill	Stable Non-reactive HAZARDOUS waste in non-hazardous Landfill	Hazardous Waste Landfill
Sample ID	BH1/B4						
Depth	0.25						
Solid Waste Analysis							
TOC (%)	7.0				3%	5%	6%
Loss on Ignition (%)**	10.0				--	--	10%
BTEX (mg/kg)**	<0.01				6	--	--
Sum of PCBs (mg/kg)**	0.20				1	--	--
Mineral Oil (mg/kg)**	57				500	--	--
Total PAH (mg/kg)**	15.3				100	--	--
pH (Units)**	8.6				--	--	--
Acid Neutralisation Capacity (mol/kg)	<0.1				--	To be evaluated	To be evaluated
Eluate Analysis	2:1	8:1		Cumulative 10:1	Limit values for compliance leaching test using BS EN 12457-3 at L/S 10 l/kg (mg/kg)		
	mg/l	mg/l		mg/kg			
Arsenic*	0.023	0.007		<0.1	0.5	2	25
Barium*	0.036	0.009		<0.1	20	100	300
Cadmium*	<0.001	<0.001		<0.01	0.04	1	5
Chromium*	<0.005	<0.005		<0.1	0.5	10	70
Copper*	0.054	0.014		0.1	2	50	100
Mercury*	0.0001	<0.0001		<0.001	0.01	0.2	2
Molybdenum*	0.006	<0.005		<0.1	0.5	10	30
Nickel*	0.006	<0.005		<0.1	0.4	10	40
Lead*	0.015	0.006		<0.1	0.5	10	50
Antimony	0.030	0.007		0.07	0.06	0.7	5
Selenium	<0.005	<0.005		<0.01	0.1	0.5	7
Zinc*	0.035	0.017		0.1	4	50	200
Chloride*	19	21		139	800	15000	25000
Fluoride*	<1	<1		<1	10	150	500
Sulphate*	28	12		102	1000	20000	50000
TDS	460	200		1668	4000	60000	100000
Phenol Index	<0.5	<0.5		<0.5	1	-	-
DOC	60.2	34.5		266	500	800	1000
Leach Test Information							
pH *	8.3	8.1					
EC*	5	212					
Sample Mass (kg)	0.191						
Dry Matter (%)	92						
Moisture (%)	10						
Stage 1							
Volume Eluate L2 (litres)	0.333						
Filtered Eluate VE1 (litres)	0.204						

Results are expressed on a dry weight basis, after correction for moisture content where applicable
Stated limits are for guidance only and ELAB cannot be held responsible for any discrepencies with current legislation

*= UKAS accredited

** - MCERTS accredited test

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Client:	Codecombat Ltd	**Job No:**	2801	**Visit No:**	1	**Date:**	6.10.11
Site:	Land adj. 8 Preston Gardens, Rayleigh, Essex					**Weather:**	Fine
						Drawn By:	ME
						Checked By:	ME

GAS MONITORING RESULTS
gas results were obtained in situ using a GA2000 Gas Analyser.

Limitations	Range	Gas accuracy 0-5%	Gas accuracy 5-15%	Gas accuracy 15% Full Scale
CH_4%	0-100%	+/- 0.5%	+/- 1.0%	+/- 3.0%
CO_2	0-100%	+/- 0.5%	+/- 1.0%	+/- 3.0%
O_2	0-25%	+/- 1.0%	+/- 1.0%	+/- 1.0%
CO	0-2000ppm			
H_2S	0-500ppm			

RESULTS

BH NO.	Standpipe Depth (m)	CH_4%	LEL CH_4%	CO_2%	O_2%	CO ppm	H_2S ppm	Flow Rate l/h	Barometric Pressure mbar	Pressure Resolution +/- mbar
BH1	8.0m	00.00	00.00	00.0	20.8	0000	0000	+ 03.9	1006	+ 000.35

Notes

* ppm equals parts per million
* Instantaneous peak gas readings measured in a borehole can be elevated due to the disturbance factor.

Remarks:

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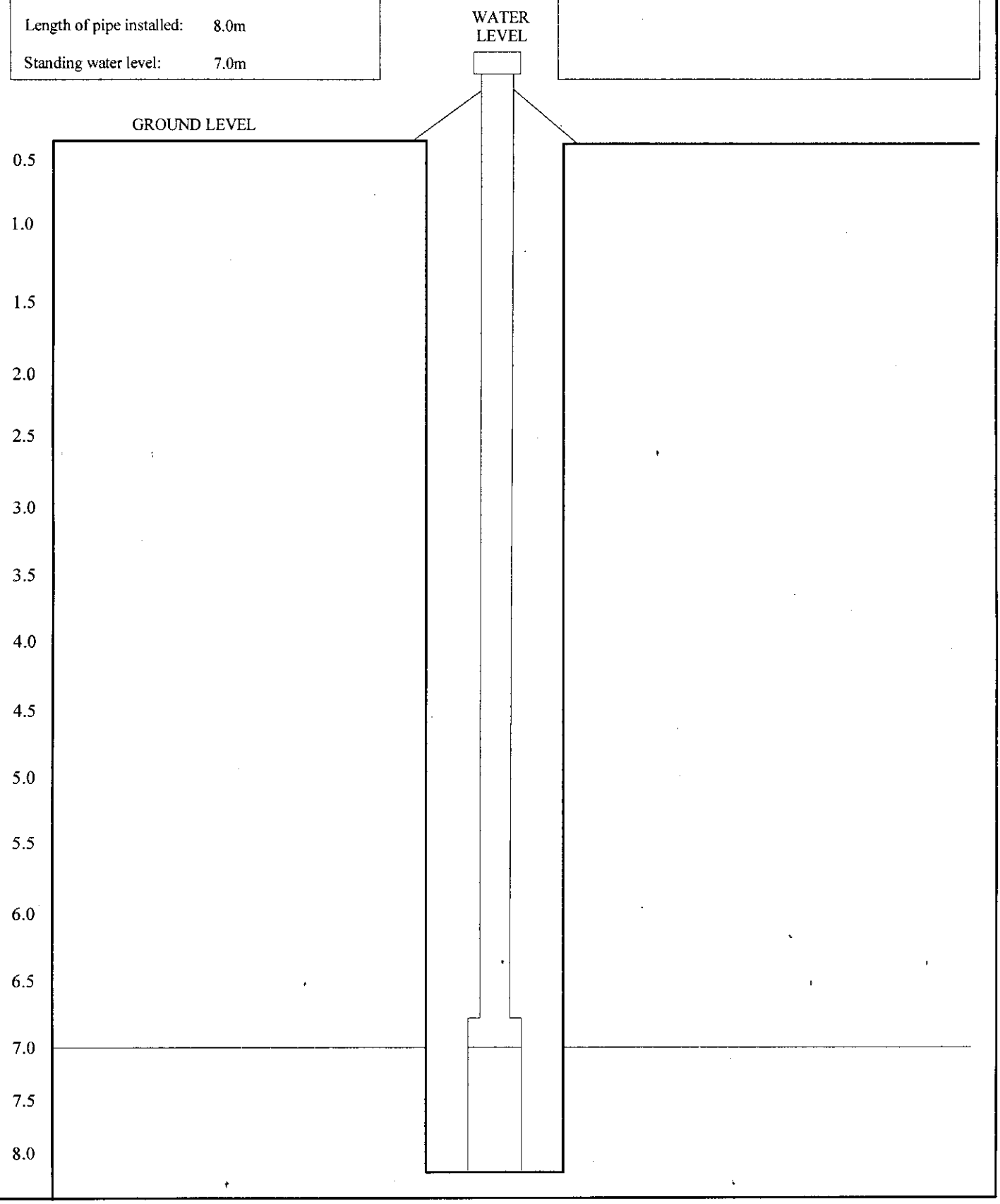
Client:	Codecombat Ltd	**Scale:**	N.T.S.	**Standpipe No:**	1 (BH2)	**Date:** 6.10.11	**Visit:** 1
Location:	Land adj. 8 Preston Gardens Rayleigh, Essex	**Job No:**	2801	**Weather:**	Fine	**Drawn by: ME**	**Checked by: ME**

Diameter standpipe: 65mmØ

Length of pipe installed: 8.0m

Standing water level: 7.0m

Comments: Standing water at 7.0m.



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Email: info@siteinvestigations.co.uk Website: www.siteinvestigations.co.uk

Client:	Codecombat Ltd	**Job No:**	2801	**Visit No:**	2	**Date:**	17.10.11
Site:	Land adj. 8 Preston Gardens, Rayleigh, Essex					**Weather:**	Fine
						Drawn By:	MM
						Checked By:	ME

GAS MONITORING RESULTS
gas results were obtained in situ using a GA2000 Gas Analyser.

Limitations	Range	Gas accuracy 0-5%	Gas accuracy 5-15%	Gas accuracy 15% Full Scale
CH_4%	0-100%	+/- 0.5%	+/- 1.0%	+/- 3.0%
CO_2	0-100%	+/- 0.5%	+/- 1.0%	+/- 3.0%
O_2	0-25%	+/- 1.0%	+/- 1.0%	+/- 1.0%
CO	0-2000ppm			
H_2S	0-500ppm			

RESULTS

BH NO.	Standpipe Depth (m)	CH_4%	LEL CH_4%	CO_2%	O_2%	CO ppm	H_2S ppm	Flow Rate l/h	Barometric Pressure mbar	Pressure Resolution +/- mbar
BH1	8.0m	00.00	00.00	00.0	20.9	0000	0000	+ 04.1	1017	+ 000.28

Notes

* ppm equals parts per million
* Instantaneous peak gas readings measured in a borehole can be elevated due to the disturbance factor.

Remarks:

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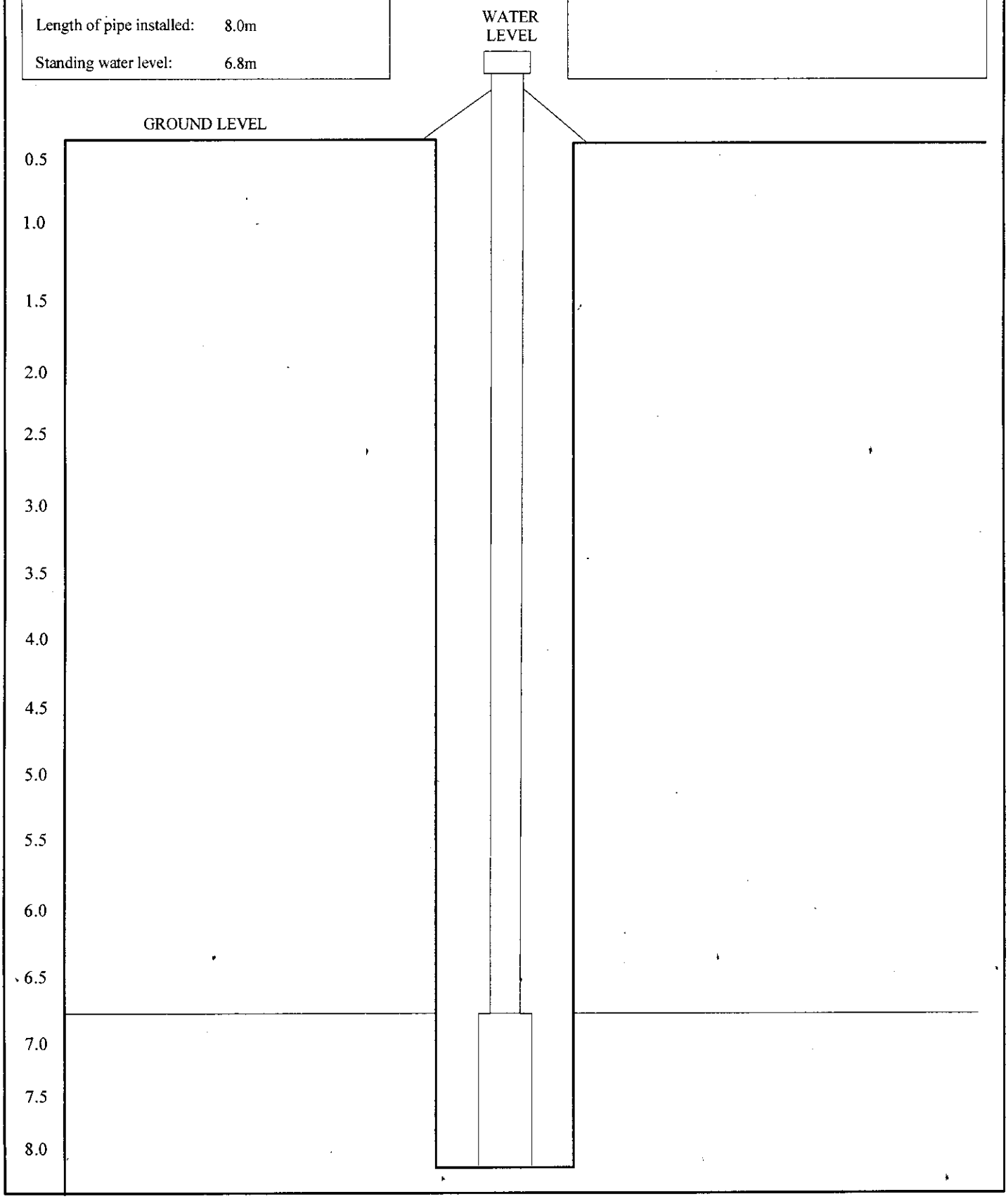
Client:	Codecombat Ltd	**Scale:**	N.T.S.	**Standpipe No:**	1 (BH2)	**Date:** 17.10.11	**Visit:** 2
Location:	Land adj. 8 Preston Gardens Rayleigh, Essex	**Job No:**	2801	**Weather:**	Fine	**Drawn by: MM**	**Checked by: ME**

Diameter standpipe: 65mmØ

Length of pipe installed: 8.0m

Standing water level: 6.8m

Comments: Standing water at 6.8m.



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Email: info@siteinvestigations.co.uk Website: www.siteinvestigations.co.uk

Client:	Codecombat Ltd	**Job No:**	2801	**Visit No:**	3	**Date:**	24.10.11
Site:	Land adj. 8 Preston Gardens, Rayleigh, Essex					**Weather:**	Fine
						Drawn By:	ME
						Checked By:	ME

GAS MONITORING RESULTS
gas results were obtained in situ using a GA2000 Gas Analyser.

Limitations	Range	Gas accuracy 0-5%	Gas accuracy 5-15%	Gas accuracy 15% Full Scale
CH_4%	0-100%	+/- 0.5%	+/- 1.0%	+/- 3.0%
CO_2	0-100%	+/- 0.5%	+/- 1.0%	+/- 3.0%
O_2	0-25%	+/- 1.0%	+/- 1.0%	+/- 1.0%
CO	0-2000ppm			
H_2S	0-500ppm			

RESULTS

BH NO.	Standpipe Depth (m)	CH_4%	LEL CH_4%	CO_2%	O_2%	CO ppm	H_2S ppm	Flow Rate l/h	Barometric Pressure mbar	Pressure Resolution +/- mbar
BH1	8.0m	00.01	00.02	0000	20.7	0000	0000	+ 03.9	0995	+ 000.33

Notes

* ppm equals parts per million
* Instantaneous peak gas readings measured in a borehole can be elevated due to the disturbance factor.

Remarks:

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Email: info@siteinvestigations.co.uk Website: www.siteinvestigations.co.uk

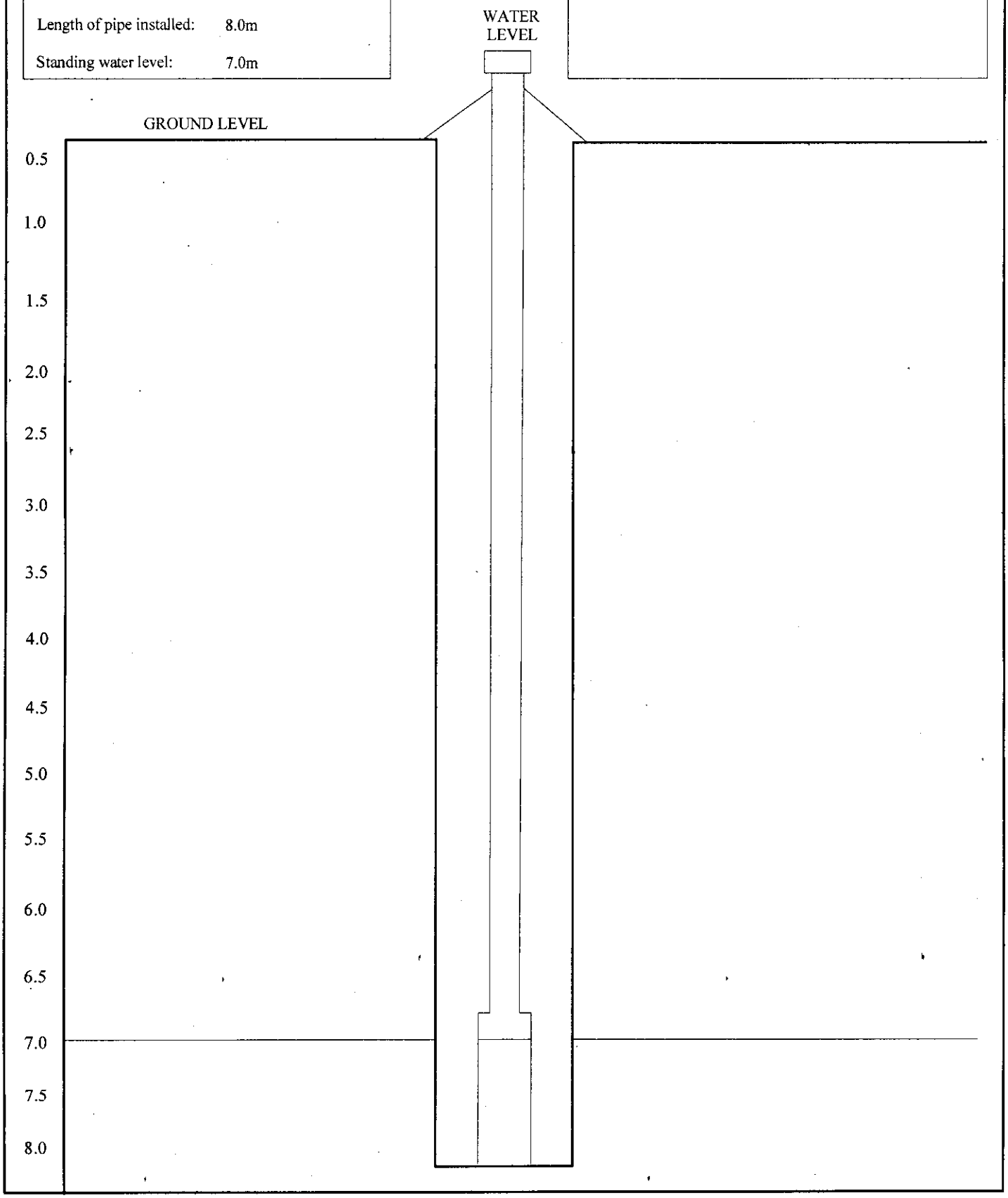
Client: Codecombat Ltd	**Scale:** N.T.S.	**Standpipe No:** 1 (BH2)	**Date:** 24.10.11	**Visit:** 3
Location: Land adj. 8 Preston Gardens Rayleigh, Essex	**Job No:** 2801	**Weather:** Fine	**Drawn by: ME**	**Checked by: ME**

Diameter standpipe: 60mmØ

Length of pipe installed: 8.0m

Standing water level: 7.0m

Comments: Standing water at 7.0m.



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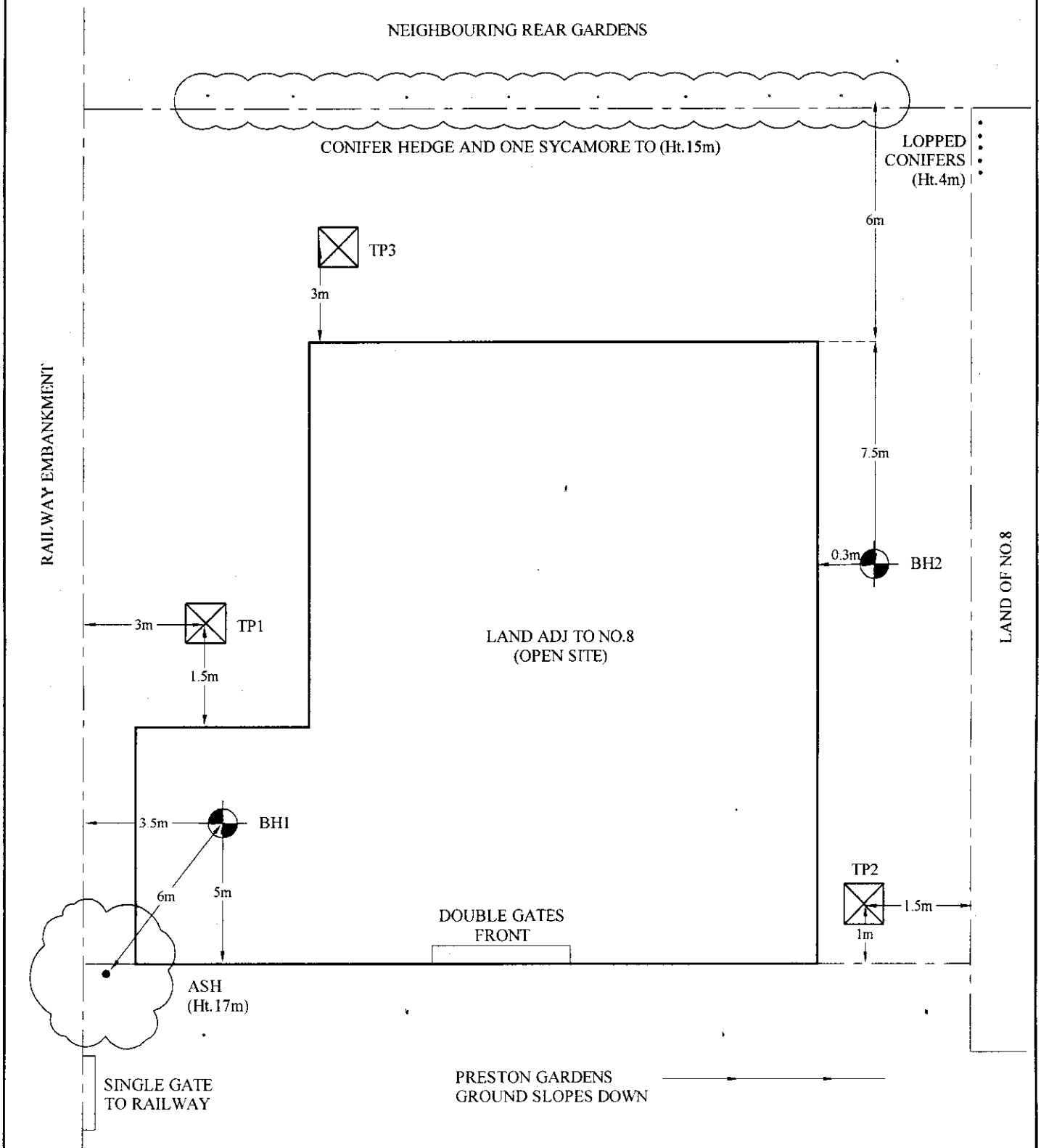
Telephone: 01245 400930 Fax: 01245 400933
Email: info@siteinvestigations.co.uk Website: www.siteinvestigations.co.uk

Client:	Codecombat Ltd	**Scale:**	N.T.S.	**Sheet:**	1 of 1	**Date:**	28.9.11
Location:	Land adj. 8 Preston Gardens Rayleigh, Essex	**Job No:**	2801	**Weather:**	Fine	**Drawn by:** MM	**Checked by:** ME



Notes: BH1 CARRIED OUT IN CHANNEL OF MADE GROUND WITH IN HARD STANDING.

On site tree identification for guidance only. Not authenticated.

Key:

Tree/Shrub | Borehole | Trial Pit | G Gully | Tree Stump | Rain Water/ Soil Pipe | MH Manhole

ATTEN - PAUL EDWARDS

From PAUL HUDSON.

2 SEP 2011

Network Rail Estates

Phase I Environmental Assessment Report at Preston Gardens, Rayleigh

06 February 2008
Draft

Issue No 1
49318244

Project Title:	Network Rail Estates
Report Title:	Phase I Environmental Assessment Report at Preston Gardens, Rayleigh
Project No:	49318244
Report Ref:	
Status:	Draft
Client Contact Name:	Nicholas Walsh
Client Company Name:	Network Rail Estates
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Document Production / Approval Record

Issue No: 1	Name	Signature	Date	Position
Prepared by	Paolo Donati		06/02/2008	Geoenvironmental Consultant
Checked by	Stefano Alba		06/02/2008	Managing Principal Consultant
Approved by	Stefano Alba		06/02/2008	Managing Principal Consultant

Document Revision Record

Issue No	Date	Details of Revisions
1	06/02/2008	Draft

LIMITATION

URS Corporation Limited (URS) has prepared this Report for the sole use of Network Rail Estates in accordance with the Agreement under which our services were performed. No other warranty, expressed or implied, is made as to the professional advice included in this Report or any other services provided by us. This Report may not be relied upon by any other party without the prior and express written agreement of URS. Unless otherwise stated in this Report, the assessments made assume that the sites and facilities will continue to be used for their current purpose without significant change. The conclusions and recommendations contained in this Report are based upon information provided by others and upon the assumption that all relevant information has been provided by those parties from whom it has been requested. Information obtained from third parties has not been independently verified by URS, unless otherwise stated in the Report.

Where assessments of works or costs required to reduce or mitigate any environmental liability identified in this Report are made, such assessments are based upon the information available at the time and are subject to further investigations or information which may become available. Costs may therefore vary outside the ranges quoted. No allowance has been made for changes in prices or exchange rates or changes in any other conditions which may result in price fluctuations in the future. Where assessments of works or costs necessary to achieve compliance have been made these are based upon measures which, in URS's experience, could normally be negotiated with the relevant authorities under present legislation and enforcement practice, assuming a pro-active and reasonable approach by site management.

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CONTENTS

EXECUTIVE SUMMARY

URS Corporation Limited (URS) was commissioned to conduct a Phase I Environmental Assessment Report for a site at Preston Gardens, Rayleigh, on behalf of Network Rail Estates. This report presents the key findings and potential environmental liabilities identified during the assessment.

Based on available aerial photographs the site is currently derelict and appears to be covered by concrete hardstanding. The site is located in a residential area in the north of Rayleigh. The site is surrounded by residential houses, and is bounded to the east-southeast by a railway line. Recreational areas are located 100m east and 200m northwest to the site. A warehouse is located approximately 90m northeast to the site (see site history).

Environmental Setting and Site History

A review of the BGS Geological Map for the area indicates that the site is underlain by London Clay, overlying the Lambeth Group, Thanet Sand and Upper Chalk. In addition to the lithologies indicated on the map, Made Ground, associated with foundations, buried services, development of the site and the nearby railway line, is considered likely to overlie the London Clay. The London Clay is classified by the Environment Agency as a Non Aquifer of negligible leaching potential.

There are two groundwater abstractions identified within a 1 km radius of the site.

An unidentified surface water feature, likely to be partially culverted, is located approximately 70m southwest to the site. The River Crouch is located approximately 3km from the site, with tributaries to the river located at closer distances (up to 500m).

The site is considered to be located in an area of low environmental sensitivity due to the underlying Non-Aquifer and no classified surface water features within 500m of the site.

Soil and Groundwater Contamination

The potential for ground contamination from historical site activities is considered to be moderate given that the property was once used as electric sub-station, a known source of PCBs.

A number of *historical off-site* sources of contamination were identified in the close vicinity, such as the adjacent railway and brick / tile works. These activities are less likely to pose a potential risk to the subject site irrespective of their close proximity.

There are a number of *current off-site* sources of potential contamination including Recorded, Historical and Local Authority Landfill Sites; Carpet, curtain and upholstery cleaning services and cladding suppliers. Assuming that these facilities are being operated in accordance with the appropriate legislative requirements, they are not expected to present a risk of significant contamination due to their distance from the subject site.

The overall risk of liability from soil or groundwater contamination are therefore considered to be moderate for the site in relation to future residential use, due to the potential presence of near surface on-site contaminants, in particular PCBs.

Therefore, URS consider it likely that planning conditions will require an intrusive investigation.

Consideration should be given to management of waste from potentially contaminated soil generated during the construction phase.

Other Potential Environmental Liability Issues

The potential presence of asbestos within existing Made Ground and concrete sub-structures should be dealt during future investigations.

1. INTRODUCTION

1.1. General Introduction

URS Corporation Limited (URS) was commissioned to conduct a Phase I Environmental Assessment Report for a site at Preston Gardens, Rayleigh, on behalf of Network Rail Estates. This report presents the key findings and potential environmental liabilities identified during the assessment.

The work was performed in accordance with URS proposal P3051097 dated 08 January 2008, and amendments proposed in an email to Nicholas Walsh on 15 January 2008. The objectives and scope of this assessment are presented in the following sections.

1.2. Objectives

The primary objective of the Phase I Environmental Assessment was to identify significant potential environmental liabilities that may be associated with the acquisition and redevelopment of the subject site. Environmental liabilities in this context may derive from:

- Contamination due to past and current uses of the site and surrounding land; in the context of the environmental sensitivity of the site setting;
- Changes in land use; and
- Demands imposed by current or readily foreseeable environmental legislation.

1.3. Scope of Work

To meet the objectives, the following scope of work was performed:

Task 1 : Background information review, including regulatory information (where publicly available), an assessment of available historical, geological, hydrogeological, topographical maps and aerial photographs for the area.

Task 2 : Reporting.

2. DOCUMENTS AND WEB SITES REVIEWED

- Ordnance Survey Landranger 1:50,000 Map 178 (Thames Estuary, Rochester & Southend-on-Sea);
- BGS Map 258/259, Southend & Foulness (1:50,000), Solid and Drift Edition;
- National Rivers Authority Groundwater Vulnerability Map, Sheet 40, Thames Estuary (1:100,000);
- Landmark Information Group, EnviroCheck report Ref: 24021007_1_1 dated 14 January 2008;
- Environment Agency website: www.environment-agency.co.uk; and
- Aerial photographs from Google Earth and Windows Live Maps.

3. SITE DETAILS

3.1. Site Location and Description

Site Address	Preston Gardens, Rayleigh
Grid Reference	580850, 191800
Estimated Surface Area	Approximately 800 m²
Date property built	Electric sub-station present by 1962. Site currently derelict.
Description	Based on available aerial photographs the site is currently derelict and appears to be covered by concrete hardstanding.
Surroundings	The site is located in a residential area in the north of Rayleigh. A site layout plan provided by Network Rail Estates is shown on Figure 1. The site is surrounded by residential houses, and is bounded to the east-southeast by a railway line. Recreational areas are located 100m east and 200m northwest to the site. A warehouse is located approximately 90m northeast to the site (see site history).

3.2. Environmental Setting

Geology/ hydrogeology	A review of the BGS Geological Map for the area (Sheet 258/259, Southend & Foulness) indicates that the site is underlain by London Clay, overlying the Lambeth Group, Thanet Sand and Upper Chalk. The BGS geological map also shows the Claygate Beds located to the east of the railway bordering the site. From the geological cross sections included in the BGS map the thickness of the London Clay on the site area is approximately 100m. In addition to the lithologies indicated on the map, Made Ground, associated with foundations, buried services, development of the site and the nearby railway line, is considered likely to overlie the London Clay. The presence, composition and thickness of any Made Ground present cannot be determined by this Phase 1 study. The EA Groundwater Vulnerability Map (Sheet 40, Thames Estuary) for the area indicates that the site is classified as being on a Non Aquifer (London Clay), with soils of negligible leaching potential and likely to contain insignificant quantities of water. There are two groundwater abstractions identified within a 1 km radius of the site, approximately 900m and 930m to the north of the site, and used for fish farming.

	The site is not located within an EA designated Groundwater Source Protection Zone (SPZ).
Surface water and flood risk	According to the Envirocheck report an unidentified surface water feature is located approximately 70m southwest to the site. The latest historical and OS maps show this to be a partially culverted stream or canal flowing from the western border of the railway embankment towards the northwest. According to the available aerial photographs and OS maps, this stream appears to be flowing into a small pond located 150m west to the site. The available aerial photographs show this pond to be currently located within a private residential property. The River Crouch is located approximately 3km to the north of the site, and was classified by the EA as having River Quality C ('fairly good'). However, from the regulatory data included in the Envirocheck report, it appears that tributaries to the River Crouch are located at closer distances, up to 500m northwest of the site. The Rayleigh Brook and Nobletsgreen Ditch is located approximately 1km to the east of the site. This river was classified by the EA as having River Quality D ('fair'). There is one discharge consent within 500m, relating to discharge of unidentified surface water into a tributary of River Crouch. According to the Envirocheck report there are no recorded pollution incidents to controlled waters within 500m from the site. According to the Envirocheck report the site is not located in an area at risk from flooding.
Other sensitive receptors or hazards	An area of adopted green belt from Rochford District Council is indicated approximately 340m northeast to the site. A nitrate vulnerable zone for surface waters is indicated at approximately 850m southeast of the site.
Overall sensitivity	***LOW: the site is underlain by a Non-Aquifer, with no classified surface water features within 500m of the site. An unclassified surface water feature (appearing to be partially culverted) is present at approximately 70m southwest of the site.***

3.3. Site History & Potential for Significant Contamination

Historical Maps/Photographs Reviewed	Ordnance Survey Maps of the following scales 1:1250, 1:2500, 1:10,000 and 1:10,560 maps dated between 1874 and 2007 were reviewed.
History *On site*	The earliest plan of the site, dated 1874, indicates the site and surrounding areas to be occupied by open fields. The site first appears to be developed from 1962, and used as an electric

Off site	sub-station. The available historical maps do not indicate when the structure was decommissioned and the site became derelict. The existing railway line bordering the east of the site is first shown in the 1896 map, and named as G.E.R. Southend Line, running over an embankment. By 1898, the Rayleigh Brick and Tile Works were present approximately 90m to the northeast off the site, on the opposite side of the railway; clay pits extended as close as 20m to the east of the site. Clay pits were probably excavated on the Claygate Beds, a material used in construction for bricks and tiles and shown just to the east of the site on the available BGS map. Old gravel pits were also present approximately 350m northeast to the site. The 1923 map shows a well 200m northeast to the site, next to a rectangular pond to the east of the railway line. The 1939 map shows a large pond within the brickworks site, approximately 150m to the east off the site. By 1962 the majority of the main brickworks building had been demolished and the remaining was used as depository. The demolished area of the building was occupied by a clay pit. By 1973 the former brickworks site had been reclaimed and completely redeveloped into residential, with the exception of the remaining building still used as depository, and also shown on recent aerial photographs. The pond 150m to the east had been backfilled and was used as recreational area. An electric sub-station was present approximately 170m east to the site. The gravel pits to the northeast had also been backfilled and left as open fields. The residential areas around the site were developed approximately between 1938 and 1973. Unspecified works are shown on the 1973 and later maps approximately 450m northeast to the site. No relevant modifications on land use are shown on later maps.
Potential On-site Sources of Contamination (Historical)	The electricity substation present on site by 1962 represents a potential source of contamination, in particular of polychlorinated biphenyls (PCBs). Potential Made Ground may constitute an additional source of contamination.
Potential Off-Site Sources of Contamination (Historical)	**Within 0-250m** • Railway line (1896 – 2007), 5m E • Brick and Tile Works (1898 - 1973) 90m, NE • Depositories (1962 – 2007), 90m NE • Electric Sub-Station (1968 – 1993), 170m E **Within 250m-500m** • Gravel Pits (1923 - 1973), 350m NE • Unspecified Works (1973 – 2007), 450m NE

	500m-1km None relevant identified
Potential Off-Site Sources of Contamination (Current)	Consultation of the Environcheck database identified the following current off-site potential sources off contamination. *Landfill Sites:* BGS Recorded Landfill Site (640m NE) - unidentified type of waste; Historical Landfill Site (30m SE) - included inert waste, probably associated with a former clay pit; Historical Landfill Sites (400m E, 440m NE and 630m NE) - included inert, commercial and household waste; Historical Landfill Site (500m NE) - waste included liquid sludge; Local Authority Recorded Landfill Sites (30m SE, 370m E, 400m E, 450m NE) - unidentified waste; Local Authority Recorded Landfill Site (600m NE) - waste included excavated natural materials, license now inactive; BGS Recorded Mineral Site (490m NE) - sand and gravel, ceased. *Trade Directories within 500m:* Carpet, Curtain and Upholstery Cleaning (140m W and 310m NW); Cladding suppliers and installers (200m N).
Potential for Contamination	**MODERATE:** ***Site formerly used as electric sub-station, likely source of PCBs. Near land uses include railway line and brickworks***

3.4. Previous Reports and Documentation Reviewed

Previous Reports and Documentation Reviewed	No documentation was available for review and no previous reports were provided for consideration in this Phase I Assessment.

3.5. Other Environmental Liability Issues

Asbestos-Containing Materials (ACMs)	It is not known if the current concrete substructures or potential Made Ground at the site contain asbestos.

4. CONCLUSIONS AND RECOMMENDATIONS

4.1. General Conclusions

Soil and Groundwater Contamination	The potential for ground contamination from historical site activities is considered to be moderate given that the property was once used as electric sub-station, a known source of PCBs. A number of *historical* off-site sources of contamination were identified in the close vicinity, such as brick and tile works, and the adjacent railway. These activities are less likely to pose a potential risk to the subject site irrespective of their close proximity. There are a small number of *current* off-site sources of potential contamination including upholstery cleaners and cladding suppliers / installers, and recorded and historical landfill sites. Although, these facilities are not believed to pose significant risks to the site in relation to future uses, due to their distance and the absence of a relevant pathway of contamination (the site is underlain by a Non Aquifer). The overall risk of liability from soil or groundwater contamination are considered to be moderate for the site in relation to future residential use, due to the potential presence of near surface on-site contaminants, in particular PCBs. Therefore, URS consider it likely that planning conditions will require an intrusive investigation. Consideration should be given to management of waste from potentially contaminated soil generated during the construction phase.
Other Liability Issues	The potential presence of asbestos within existing Made Ground and concrete sub-structures should be dealt during future investigations.
Overall Environmental Risk	**MODERATE**

Appendix A - Envirocheck Report

Figures

Figure 1 – Site Layout Plan

Title
SITE LAYOUT PLAN
Location
PRESTON GARDENS, RAYLEIGH
Client
NETWORK RAIL ESTATES
URS
Approved
BA
Drawn
PD
Drg Size: A4
Ref:
Status: FINAL
Scale: NTS
Job No:
43318244
Date:
February 2008
FIGURE 1
Pond

Chelmer Site Investigations,
Unit 10, East Hanningfield Industrial Estate, Old Church Road,
East Hanningfield, Essex, CM3 8AB
Telephone: 01245 400930 Fax: 01245 400931
Email: info@site-investigations.co.uk Website: www.siteinvestigations.co.uk

REPORT NOTES

Equipment Used

Hand tools, Mechanical Concrete Breaker and Spade, Hand Augers, 100mm/150mm diameter Mechanical Flight Auger Rig, GEO205 Flight Auger Rig, Window Sampling Rig, and Large or Limited Access Shell & Auger Rig upon request and/or access permitting.

On Site Tests

By Pilcon Shear-Vane Tester (Kn/m^2) in clay soils, and/or Mackintosh Probe in granular soils or made ground and/or upon request Continuous Dynamic Probe Testing and Standard Penetration Testing.

Note:

Details reported in trial-pits and boreholes relate to positions investigated only as instructed by the client or engineer on the date shown.

We are therefore unable to accept any responsibility for changes in soil conditions not investigated i.e. variations due to climate, season, vegetation and varying ground water levels.

Full terms and conditions are available upon request.