Geo-Environmental

GROUND INVESTIGATION REPORT

for the land at

LOWFIELD ROAD, CAVERSHAM

READING RG4 6NL

on behalf of

READING BOROUGH COUNCIL

Report:	**GROUND INVESTIGATION REPORT**
Site:	**LOWFIELD ROAD, CAVERSHAM, READING RG4 6NL**
Client:	**READING BOROUGH COUNCIL**
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EXECUTIVE SUMMARY		
Site Details	Site Address	Lowfield Road, Caversham, Reading, RG4 6NL
	National Grid Reference	473030, 175880
	Site Area	0.54Ha (approx.)
	Form of Development	Construction of a number of low rise residential units with communal landscaping areas, car parking, utilisation of an existing access road and associated development infrastructure.
Encountered Conditions	Scope of works	The investigation comprised an intrusive investigations and laboratory testing to inform a geotechnical and geo-environmental assessment. A Desk Study has previously been carried out by Geo-Environmental for the site (GE15373/DSR/MAR16).
	Ground Conditions	The ground conditions generally comprised a mantle of Topsoil and/or Made Ground (WS4 only) overlying sand, silts and clays of the Lambeth Group over the White Chalk Subgroup.
	Groundwater	Groundwater was not encountered within any of the exploratory holes during the investigation or within the return gas and groundwater monitoring visit undertaken.
Geotechnical Considerations	Foundations	Conventional foundations are considered to be suitable for the ground conditions encountered within the exploratory holes. A minimum founding depth of 0.9m bgl is recommended based on the volume change potential of the cohesive Lambeth Group on the site. Plots in proximity to trees may require deeper foundations depending on distance from the tree, volume change potential of the strata and water demand of the tree(s). A net allowable bearing capacity of 125kPa is recommended for the sandy silt and stiff to very stiff clay of the Lambeth Group.
	Floor Slabs	Suspended floor slabs are recommended due to the presence of shrinkable soils at shallow depth across the site.
	Excavations	Excavations are likely to remain stable in the short to medium term, however may require support and battering back to a safe angle where left open for prolonged periods. The soils of the Lambeth Group may also be subject to rapid softening or running sands when exposed to water. Ground works should be designed in such a manner to avoid man entry into excavations.
	Pavements	With reference to TRRL LR1132 it is recommended that an equilibrium suction index CBR of 3% should be assumed for proposed formation level.
	Drainage	Falling head permeability testing was undertaken within WS1 with a preliminary permeability of 1.15 x 10^{-6}m/s estimated. The use of soakaways extending into competent White Chalk Subgroup is likely to be effective. Where soakaways are proposed it is recommended that soakage testing in line with BRE365 be undertaken.
	Buried Concrete	Buried concrete for shallow foundations should be designed to Class DS1 (AC1).
Environmental Considerations	Human Health	In the absence of any specific pollutant linkages, no risk mitigation measures are considered to be required in this respect.
	Groundwater	In the absence of any specific pollutant linkages, no risk mitigation measures are considered to be required.
	Ground Gases	In the absence of any specific pollutant linkages, no risk mitigation measures are considered to be required.
	Radon Gas	No radon protection measures are required.
	Built Environment	It is anticipated that standard water supply pipe would be suitable on this site.
	Waste Disposal	Initial testing indicates that the natural soils to be disposed of would comprise inert waste.

Further Action: • If abnormal conditions are encountered, Geotechnical/Geo-Environmental advice should be sought to determine a suitable source of action.
This Executive Summary is intended to provide a brief summary of the main findings and conclusions of the investigation. For detailed information, the reader is referred to the main report ref. GE15373/GIR/DEC16.

1.0 INTRODUCTION

1.1 General

Geo-Environmental Services Limited (Geo-Environmental) was instructed by Reading Borough Council to undertake an investigation of the geotechnical and geo-environmental factors pertaining to proposed development at Land off Lowfield Road, Caversham, Reading, RG4 6NL (the site). The site's location is presented in Figure 1.

1.2 Form of Development

The proposed development is understood to comprise the construction of number of low-rise residential units with communal landscaping areas, car parking, utilisation of an existing access road and associated development infrastructure.

1.3 Objectives

The data from the geotechnical investigation was to form the basis of an interpretation with respect to foundation design, pavement construction, concrete specification, excavation stability and other pertinent construction issues.

A previous Phase 1 assessment has been undertaken on the site by Geo-Environmental. As part of this element of work on the site a Preliminary Risk Assessment (PRA) was undertaken as part of the desk study in accordance with CLR11, in order to identify any specific requirement for and scope of any further assessment. The objective of the risk assessments was to evaluate the risks posed to the proposed redevelopment, adjacent land uses and the wider environment, in the context of likely planning requirements, immediate liabilities under the Environment Act 1990 and risks posed to Controlled Waters under the Water Resources Act from the site and in line with the proposed redevelopment.

1.4 Standards and References

Where practicable, the ground investigation and subsequent geotechnical and environmental assessments were undertaken in accordance with the following documents and guidance.

- National Planning Policy Framework – March 2012
- Planning Policy Statement 23 – Planning and Pollution Control;
- Model Procedures for the Management of Contaminated Land, CLR11, DEFRA and Environment Agency 2004;
- Environment Agency Guidance on Requirements for Land Contamination Reports, Version 1 dated July 2005;
- BS10175:2011+A1:2013 - Investigation of Potentially Contaminated Sites - Code of Practice, BSI 2013;
- BS5930: 2015 - Code of Practice for Site Investigations, BSI 2015;
- EN ISO 14688 Geotechnical Investigation and Testing Part 1-2002 and Part 2-2004;
- BS1377: 1990 - Soils for Civil Engineering Purposes, BSI1990;
- NHBC Standards Chapter 4.1 Land Quality - Managing Ground Conditions, September 1999;
- NHBC Standards Chapter 4.2 Building Near Trees;
- CIRIA C665 – Assessing risks posed by hazardous ground gases to buildings (2007);
- NHBC 10627-R01(04)- Guidance on evaluation of development proposals on sites where methane and carbon dioxide are present (2007);

- BS8485:2015 Code of practice for the characterisation and remediation from ground gas in affected developments.

1.5 Conditions

This report does not purport to be a "Geotechnical Design Report" as defined in Clause 2.8 of Eurocode 7 (Geotechnical Design BS EN 1997-1:2004) and some of the data used to support this preliminary geotechnical assessment may not be fully compliant with that design code. It is considered possible that further detailed ground investigations could be required to facilitate the detailed geotechnical design process and should be carried out on a structure specific basis if necessary.

The data collected from the investigations have been used to provide an interpretation of the geotechnical and/or environmental conditions pertaining to the site. The recommendations and opinions expressed in this report are based on the data obtained. Geo-Environmental takes no responsibility for conditions that either have not been revealed in the available records, or that occur between or under points of physical investigation. Whilst every effort has been made to interpret the conditions, such information is only indicative and liability cannot be accepted for its accuracy.

It should be noted that in particular the concentrations and levels of mobile liquid and gaseous materials are likely to vary with time. The results obtained may therefore only be representative of the conditions at the time of sampling. This report should not be taken as any guarantee that a site is free of hazardous or potentially contaminative materials.

Information contained in this report is intended for the use of the Client and Geo-Environmental can take no responsibility for the use of this information by any party for uses other than that described in this report. Geo-Environmental makes no warranty or representation whatsoever express or implied with respect to the use of this information by any third party. Geo-Environmental does not indemnify the Client or any third parties against any dispute or claim arising from any finding or other result of this investigation report or any consequential losses.

Assessment criteria or other parameters developed for the evaluation of contamination on this site are based on a number of assumptions regarding exposure and toxicology. Exposure to contaminants and levels of adverse effects may therefore vary. Whilst reasonable care and expertise has been employed in the development of such criteria, no liability is accepted in this respect. Other criteria or guidance on the development of assessment criteria may be published in the future and no liability is accepted in this respect.

2.0 DESK STUDY

A desk study was previously undertaken for the site by Geo-Environmental, ref, GE15373/DSR/MAR16. Whilst a summary of pertinent information is presented below, the previous report should be referred to for more detail. The general land use and environmental setting of the site have remained broadly unchanged since this report was prepared and thus the findings of the site phase 1 desk study for the site are considered to remain valid for the site.

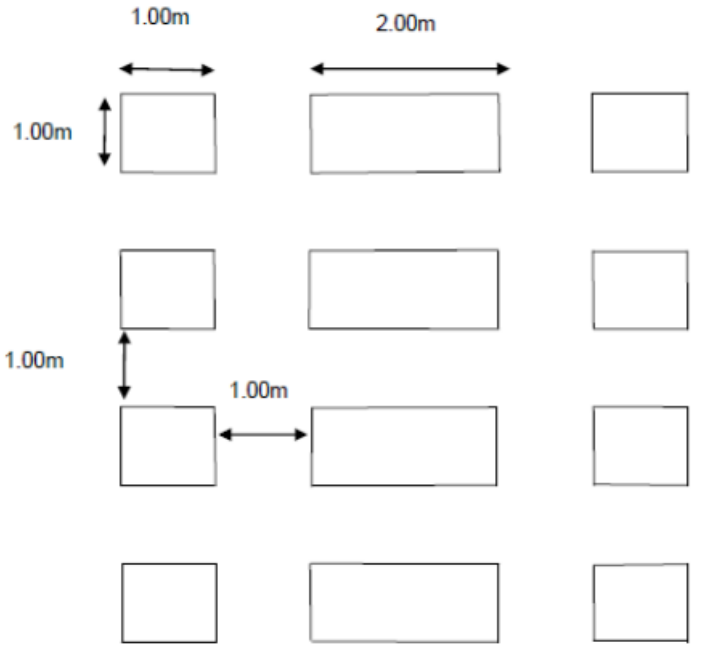
Comments made in the following sections regarding possible ground conditions on the site are based purely on the desk study assessment.

2.1 Site Description

The site comprised a roughly rectangular (136m X 36m) shaped parcel of land, which sloped gently from north-north-east to south-south-west, extended to 0.54Ha and was located at NGR 473030,175880.

At the time of the site investigation works the site entrance was secured by heras fencing with a wooden fence surrounding the main body of the site. Vegetation comprising weeds was present across the site.

The site was understood formerly to have been a mobile home park and concrete foundations were noted to be present across the site presumably following the removal of the mobile homes. The site was split in two by an access road off Cadogan Close. The western portion of the site exhibited four sets of foundations blocks (comprising two rows of square blocks approx. 1m x 1m with a row of rectangular blocks between the two square blocks (1m x 2m) and raised 0.30m above ground level. Each set was set 6m apart. (See Drawing 1 below). A gap of 17m was identified between the southern of the four blocks and the next set of foundation blocks. The foundation type was noted to change to concrete slabs (approx. 6m x 10m) for four sets followed by one more set of raised concrete block foundations all approximately equally spaced (6m).



Drawing 1: Foundation Layout

A similar layout was observed on the eastern portion of the site where four sets of block foundations and two concrete slabs were present to the north of the intersecting access road located at roughly the same footprint as

the opposite side). However off-set to the south by approx. 2m, two further concrete slab foundations were identified to the southern side of the access road on the eastern portion.

Overhead powerlines entered the site from adjacent to the roadway from Lowfield Road to the east. An electrical box (presumed to be a former transformer, substation or the like) was present on the left hand side of the site entrance. The electrical box was noted to be intact, however all cables appeared to be disconnected. A number of propane canisters were located adjacent to the electrical box.

A pedestrian pathway was present running along the southern and eastern boundaries of the site and a shallow slope of 0.50m height was noted at the intersection of the pathway in the south-east corner of the site.

An embankment was present extending in a north-south orientation along the eastern boundary between the pathway and the site boundary. The embankment was approximately 1.60-1.80m in height, 14.00m wide and ran the length of the eastern boundary with a break in the middle where the access road intersected it at c.90°. The embankment was covered by a mix of mature and semi-mature trees and scrub and was littered with a variety of rubbish (including brick fragments, concrete, wood, plastic, glass, fibre-glass, metals, old fridges, television sets and old mattresses). The embankment turned sharply at the north-eastern corner of the site boundary (90°) and continued running adjacent to the northern boundary of the site.

Access to the site was off Lowfield Road. The site access road (Cadogan Close) extended approx. 30m into the site before a T-junction. The roadway extended approx. 63m north and 42m south from the T-junction.

The surrounding area comprised primarily residential developments to the east and south. The north of the site was bounded by an area of overgrown scrub with an open field area further north, comprising part of Caversham Park. The site was bounded to the west by a semi-mature tree lined hedgerow between the site and a cemetery. Adjacent to the south-western boundary were a number of soil stockpiles, i.e. presumably of excess grave arisings which were cornered off by fencing (approx. 10m x 28m).

Information provided by Reading Borough Council highlighted that there have been incidents of local residents setting fire to propane canisters, which were identified located adjacent to the mains electrical box on site, evidence of which could be seen on site. It is understood that existing services into the site run along the access road (Cadogan Close) from Lowfield Road and are currently disconnected.

2.2 Geology

British Geological Survey (BGS) geological mapping indicated the geology underlying the site to comprise Chalk from the Seaford and Newhaven Chalk Formation (White Chalk Subgroup). The area is also subject to superficial deposits comprising clay, silt and sand of the Lambeth Group which may be overlying the Chalk on site. Given the site has previously been developed there is the potential that Made Ground may also be present on the site at shallow depth. A review of British Geological Survey boreholes records was undertaken, boreholes located approximately 300m to the south of the site show the Lambeth Group to vary in thickness from 3.2m to 5.0+m in the vicinity of the site.

BS5930:2015 defines **Made Ground** as anthropogenic ground in which the material has been placed without engineering control and/or manufactured by man in some way, such as through crushing or washing, or arising from an industrial process. Great variations in material type, thickness and degree of compaction invariably occur and there can be deleterious or harmful matter, as well as potentially methanogenic organic material.

The **Lambeth Group** comprises a mixture of stiff to hard red, blue/grey and brown mottled clays with basal beds of sand and gravel which vary greatly both laterally and vertically. The basal beds are often green in colour due to the presence of glauconite. Locally, these sediments are cemented with calcium carbonate, iron oxides and

silica to form materials with relatively high strength.

The **White Chalk Subgroup** is a soft white friable microporous limestone composed of coccolith biomicrites with a varying proportion of larger shell fragments. Flint characterises the White Chalk Subgroup, occurring as nodular courses, tabular beds and linings to fractures.

At various levels clay sized material occurs as marl seams and partings. Close to the surface the upper few metres are invariably discoloured brown, due to leaching from the overlying strata. The interface with any overlying stratum is invariably extremely irregular as a result of localised weathering and general solution. Weathering by frost action may extend to a depth of several metres.

Occasional erosional features, such as pipes, swallow holes and solution cavities, usually infilled with drift deposits, are found in the chalk, sometimes manifesting themselves at the surface as shallow circular depressions. Solution features may be reactivated by the concentrated ingress of water from leaking drains or soakaways. Reactivation may lead to surface collapse. The geological records held by the BGS for the area suggest a limited thickness of Lambeth Group overlying the Chalk, as such the potential for solution features in the vicinity of the site should be assessed further.

2.3 Hydrogeology

With reference to the Phase 1 Desk Study the superficial deposits but are likely to be classified as a Secondary 'A' Aquifer, whilst the Chalk was classified as a Principal Aquifer.

Secondary 'A' Aquifers comprise permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers.

Principal Aquifers are layers of rock or drift deposits that have high intergranular and/or fracture permeability and usually provide a high level of water storage. They may support water supply and/or river base flow on a strategic scale.

The soil cover in the vicinity of the site was classified as being of high leaching potential (U), as soil information for restored mineral workings and urban areas is based on fewer observations than other areas and as such as worst case vulnerability classification is assumed until proved otherwise.

According to information provided from the Environment Agency within the desk study the site was indicated to be located within Source Protection Zone II (outer zone) and Zone III (Total Catchment) for Playhatch with regard to the protection of a groundwater abstraction for potable supply. A source Protection Zone I was also identified 427m to the east of the site.

Based on experience of similar sites, it was anticipated groundwater would be present at depth with the potential for shallow perched water within the depth of influence of the proposed development, being of limited volume and discontinuous within the more cohesive soils.

2.4 Hydrology

The desk study identified the closest surface water feature approximately 406m to the north-west comprising a tertiary river. Mapping indicated that the site was not located within an area at risk of flooding or extreme flooding from sea or rivers.

2.5 Ground Gases and Radon

The desk study identified that the site was located in an area where <1% of homes are above the Action Level as defined by Public Health England and the BGS. No radon protective measures are therefore necessary in the construction of new houses or extensions.

With respect to landfill and waste management facilities no such sites were identified within 1km of the site, however the subject site itself was identified as falling within the labelled boundary of a cemetery. The historical mapping of the site undertaken as part of the desk study identified a number of areas of unknown filled ground associated with the former quarrying activities identified within 1km of the site, the closest of which was identified 463m to the south of the site.

2.6 Historical Land Uses

The desk study identified that the site had remained as open space as part of a field network until 1985 when the site was labelled as a cemetery with the access for Reading Cemetery expanding onto the central western portion of the site. No further changes were recorded until 2006 when the site was noted to have been developed as a 'Mobile Homes Park' with associated access as per the present day layout. The surrounding land uses were noted to have remained as open space and woodland prior to being developed for residential use (from 1900) and a cemetery (1938). A former gravel pit and old chalk pit were recorded between 550m and 800m to the south and south west of the site.

2.7 Previous Ground Investigations

Geo-Environmental has previously undertaken a Phase 1 Desk Study for the site but was not aware of any previous intrusive investigations having been undertaken on the subject site.

2.8 Potential Contamination

The site's previous use is shown by historical mapping reviewed as part of the desk study to have comprised open space, prior to the expansion of the Reading Crematorium and Cemetery to the west is 1985 when the site was labelled as a cemetery and the path network for the cemetery shown to have expanded on to the central western portion of the site. It is unclear as to whether burial actually occurred on the subject site itself or whether this was just land within the ownership boundary of the cemetery. Subsequently, the site was developed as a mobile home park. The use of the land as a cemetery type of land use is not covered by the National House Building Council (NHBC), Environment Agency (EA) and Chartered Institute of Environmental Health (CIEH) publication '*Guidance for the Safe Development of Housing on Land Affected by Contamination*' (2008), which provides a summary of industrial profiles (1995 - 1996) published by the former Department of the Environment (DoE) (now part of the Department for Environment, Food and Rural Affairs [DEFRA]).

However, it is possible that the former uses of the site, including a cemetery and the previous development of the site together with the adjacent land use as a cemetery could have resulted in localised impact and potential contaminants could include ammoniacal nitrogen, sodium, potassium, magnesium, coliforms, heavy metals, organic pollutants such as poly-aromatic hydrocarbons (PAH), petroleum hydrocarbons/oils), inorganic compounds.

In addition the material used to construct the embankments on site is unknown, as such there remains the possibility that Made Ground could have been utilised in their construction, which may present a source of contamination on the site.

2.9 Ground Gas Summary

The desk study for the site identified the presence of a cemetery to the west of the site and potentially on part of the subject site itself. Although the main portion of the cemetery was identified as being down gradient topographically of the subject site, a potential risk of ground gases may exist from the adjacent land use and associated contaminants.

As such it was considered that a period of ground gas monitoring and assessment was required in relation to the proposed development to fully assess the site. In line with current good practice a period of spot monitoring was recommended.

3.0 PRELIMINARY ASSESSMENT

Based on the findings of the previous desk study undertaken by Geo-Environmental, the following sections summarise the anticipated geotechnical and environmental factors likely to impact the site.

3.1 Potential Geotechnical Issues

The following factors that might impact the geotechnical condition of the site were identified as part of the previous desk study undertaken by Geo-Environmental for the site:

- The possible presence of mining cavities and solution features beneath the site and implications for foundation design.
- The possible presence of Made Ground (e.g. varying depth and/or composition) which if encountered may affect the foundation design and construction.
- The presence of laterally and vertically variable strata and the impact these could have on further construction.
- The suitability of shallow soils as a bearing stratum for conventional foundations.
- Consideration of the volume change potential of any cohesive soils and the affect this could have on foundations should superficial deposits be encountered onsite.
- The possible presence of aggressive ground conditions (sulphates) which may affect the foundation design and construction.
- The possible presence of perched and shallow groundwater beneath the site.

3.2 Preliminary Environmental Conceptual Site Model & Risk Assessment

3.2.1 Methodology

A Preliminary Risk Assessment ('PRA') and Conceptual Site Model ('CSM') have been prepared in accordance with CLR11 based on information obtained as part of the desk study. Possible risks associated with potential sources of contamination and sensitive receptors identified have been qualitatively assessed following a source-pathway-receptor ('Pollutant Linkage') approach in accordance with current UK protocols.

A risk of harm may only exist where a plausible pollutant linkage is present, and where the quantity or concentration of a contaminant is sufficient so as to pose harm. Under the statutory definition, "Contamination" may only strictly exist where contaminants pose a risk of harm to a receptor. The risk classification has been assessed in accordance with CIRIA C552 (Rudland et al., 2001). A summary of how the risks are derived and their definitions are presented in Tables 3.1 and 3.2.

		Consequence			
		Severe	Medium	Mild	Minor
Probability	High Likelihood	Very high risk	High risk	Moderate risk	Moderate/low risk
	Likely	High risk	Moderate risk	Moderate/low risk	Low risk
	Low Likelihood	Moderate risk	Moderate/low risk	Low risk	Very low risk
	Unlikely	Moderate/low risk	Low risk	Very low risk	Very low risk

Table 3.1 Risk Ratings Matrix

Risk Rating	Definitions
Very high risk	There is a high probability that severe harm could arise to a designated receptor from an identified hazard, OR, there is evidence that severe harm to a designated receptor is currently happening. This risk, if realised, is likely to result in a substantial liability. Urgent investigation (if not already undertaken) and remediation are likely to be required.
High risk	Harm is likely to arise to a designated receptor from an identified hazard Realisation of the risk is likely to present a substantial liability. Urgent investigation (if not already undertaken) is required and remediation works may be necessary in the short term and are likely over the longer term.
Moderate risk	It is possible that harm could arise to a designated receptor from an identified hazard. However, it is either relatively unlikely that any such harm would be severe, or if any harm were to occur it is more likely that the harm would be relatively mild.
Moderate to low risk	It is possible that harm could arise to a designated receptor from an identified hazard. However, it is unlikely that any such harm would be severe, or if any harm were to occur it is probable that the harm would be relatively mild.
Low risk	It is possible that harm could arise to a designated receptor from an identified hazard, but it is likely that this harm, if realised, would at worst normally be mild.
Very low risk	There is low possibility that harm could arise to a receptor. In the event of such harm being realised it is not likely to be severe.

Table 3.2 Risk Rating Definitions

3.2.2 Summary of Plausible Sources

Possible sources of contamination identified from the desk study are summarised in Table 3.3.

Source	Description	Contaminants
Made Ground and shallow soils	The general quality of Made Ground and shallow soils could be impacted by the presence of contamination in view of the site's previous development and former uses.	Possible elevated concentrations of metals, metalloids, TPH and PAH compounds, sulphate and asbestos in the Made Ground and shallow soils.
Impacted soils and/or groundwater (Cemetery)	The quality of soils on site may have been impacted by the presence of a cemetery to the west of the site and on the subject site if actually utilised for burials. The boundary of the cemetery is mapped as extending onto the subject site.	Possible elevated chlorides, sulphates, ammoniacal nitrogen, sodium, potassium, magnesium and coliforms with the soils and groundwater.
Ground gases/vapours	In view of the cemetery identified in the vicinity there is the potential for ground gases and vapours to be present.	Methane, carbon dioxide, depleted oxygen, volatile organic compounds (VOC).

Table 3.3 Possible Sources of Contamination

3.2.3 Summary of Plausible Pathways

The plausible pathways which relate to the potential sources identified in Table 3.3 are summarised in Table 3.4.

Pathway	Description
Direct Contact	Ingestion of soil particles, inhalation of soil derived dust (including tracked back dust), dermal contact.
Inhalation	Inhalation of soil dust both inside and outside of buildings.
	Inhalation of ground gas/vapours within buildings.
Vertical & Lateral Migration	Contaminant movement both vertically through leaching/gravity and horizontally along preferential pathways, e.g. services trenches, or with groundwater.
Shallow Groundwater	Shallow groundwater or perched water may be present within the Made Ground which could result in the vertical and lateral migration of contaminants.
Chemical Attack	Attack of buried plastics and concrete by aggressive ground conditions.
Flooding	The Envirocheck reports state the site is not within an area at risk of flooding.

Table 3.4 Possible Contamination Pathways

3.2.4 Summary of Plausible Receptors

Potential receptors associated with the site and its development are summarised in Table 3.5.

Receptor	Description	Comments
End Users	Residents/occupants of the proposed development.	The proposed development comprises housing with communal soft landscaped areas, roads and car parking.
Soft Landscaping	Possible areas of planting including possible awns, shrubs, trees, etc.	Communal soft landscaped areas are proposed.
Built Environment	Buried concrete for foundations and plastics for potable water supply pipes may be laid in contact with contaminated soils.	Aggressive ground conditions and depths of Made Ground may be present beneath the site.

Receptor	Description	Comments
Adjacent Land Users	Sensitive land uses identified within the immediate vicinity.	Adjacent land use to the east and south is primarily residential. Land use to the north is scrub land and an open field and the land to the west a cemetery.
Groundwater	Controlled waters contained within the aquifer(s) beneath the site.	The site overlies a Principal Aquifer and is within an SPZII.
Surface Water	Controlled Waters within lakes, rivers, and ponds, etc., or coastal waters.	No surface water was identified on site. The nearest surface water body identified was located approximately 406m to the north-west of the site. Surface water has not been considered further.
Ecological Receptors	Sensitive areas of ecological significance.	In view of the nature of the proposed development it is considered that the site is unlikely to have any significant impact with respect to the environmentally sensitive land uses identified in Table 3. As such, these have not been considered further as part of this assessment.

Table 3.5 Possible Receptors of Contamination

Site workers involved in the preparation and construction of the development have not been considered further in this assessment as the Principal Contractor is duty bound under the current CDM Regulations to undertake their own risk assessments with respect to their employees.

Whilst the above sources and receptors have been identified, Table 3.6 summarises the identified plausible pollution linkages and a qualitative assessment of the risks based on the previous desk study undertaken for the site.

Potential Source/media	Potential Receptors	Potential Pathways	Likelihood	Consequence	Risk and Justification
Contaminants of Concern **(Made Ground and Shallow Soils)**	End users	Direct and/or indirect contact	Likely	Mild	**Moderate to Low** End users are likely to come into contact with soils via direct contact in areas of soft landscaping. However landscaping would be completed within uncontaminated soils in the near surface root zone. The consequence is likely to be mild.
	Soft Landscaping	Root Uptake	Likely	Minor	**Low** Areas of soft landscaping are proposed. However landscaping would be completed within uncontaminated soils in the near surface root zone. The consequence is likely to be minor.
	Adjacent land users	Direct or indirect contact	Low	Mild	**Low** Adjacent land users are unlikely to come into contact with soils, due to the nature of the site location and surrounding land use. The consequence is likely to be mild.
	Water supply pipes	Direct contact	Likely	Mild	**Moderate to Low** Water supply pipes could come into contact with impacted soils depending upon depth of installation and extent of soil impact. The consequence is likely to be mild.
	Buildings and infrastructure	Direct contact	Likely	Minor	**Low** Foundations will be placed within potentially aggressive soils (e.g. sulphate). However the consequence is anticipated to be minor.
	Groundwater	Vertical migration	Likely	Mild	**Moderate to Low** The site is underlain by a Principal Aquifer and is within an SPZII. It is anticipated that Lambeth Group deposits will be present beneath the site, which would help mitigate any impact to the chalk aquifer beneath the site. The use of SUDS on site as part of the proposed development should be fully assessed to ensure they are protective of groundwater resources located at depth beneath the site.

Potential Source/media	Potential Receptors	Potential Pathways	Likelihood	Consequence	Risk and Justification
Contaminants of Concern (Cemetery)	End users	Inhalation	Likely	Mild	**Moderate to Low** End users are likely to come into contact with soils via direct contact in areas of communal landscaping. However landscaping would be completed within uncontaminated soils in the near surface root zone. The consequence is likely to be mild.
	Soft Landscaping	Root Uptake	Likely	Minor	**Low** Areas of soft landscaping are proposed. However landscaping would be completed within uncontaminated soils in the near surface root zone. The consequence is likely to be minor.
	Adjacent land users	Direct or indirect contact	Low	Mild	**Low** Adjacent land users are unlikely to come into contact with soils, due to the nature of the site location and surrounding land use. The consequence is likely to be mild.
	Water supply pipes	Direct contact	Likely	Mild	**Moderate to Low** Water supply pipes could come into contact with impacted soils depending upon depth of installation and extent of soil impact. The consequence is likely to be mild.
	Buildings and infrastructure	Direct contact	Likely	Minor	**Low** Foundations will be placed within potentially aggressive soils (e.g. sulphate). However the consequence is anticipated to be minor.
	Groundwater	Vertical migration	Likely	Mild	**Moderate to Low** The site is underlain by a Principal Aquifer and is within an SPZII. It is anticipated that Lambeth Group deposits will be present beneath the site, which would help mitigate any impact to the chalk aquifer beneath the site. The use of SUDS on site as part of the proposed development should be assessed in detail to ensure they are protective of groundwater resources located at depth beneath the site. The consequence is likely to be mild.

Potential Source/media	Potential Receptors	Potential Pathways	Likelihood	Consequence	Risk and Justification
Ground Gases and Vapours	End users	Inhalation	Likely	Mild	**Moderate to Low** Ingress of hazardous ground gas into buildings could occur and could result in significant harm where ground gases are identified on site or as migrating cross boundary onto the site from the adjacent cemetery. However the cemetery is located down topographical gradient of the site which might reduce the potential for gas migration onto the subject site, dependent on the gas composition, generation rate, preferential migration routes and other relevant factors. Incorporation of gas protection measures with the proposed new buildings could mitigate the risk of harm and thus the consequence (with protection measures in place) is considered mild.
	Buildings and infrastructure	Gas accumulation and potential explosion of flammable gases	Likely	Mild	**Moderate to Low** Ingress of hazardous ground gas into buildings could occur and could result in harm where ground gases are identified on site or as migrating cross boundary onto the site from the adjacent cemetery. However the cemetery is located down topographical gradient of the site. Incorporation of gas protection measures could mitigate the risk of harm and thus the consequence is considered mild.
	Adjacent land users	Inhalation	Low	Mild	**Low** Where potential migration of hazardous gases could occur and thus impact adjacent land users the site has been identified as primarily being an offsite source, therefore the development will need to ensure that if ground gases are identified, that service trenches are the like do not create preferential pathways.

Table 3.6 Plausible Pollutant Linkages & Qualitative Risk Assessment

3.3 Preliminary Risk Assessment Summary

The potential pollutant linkages established within this preliminary risk assessment are not considered to prevent development on the subject site, but could require investigation and assessment to support further characterisation, calibration of the CSM and where/if necessary determine a remedial strategy to reduce, remove or otherwise control any risk within the site to key receptors.

3.4 Scope of Works

In summary, the following scope of works for the intrusive investigation was agreed with the Client.

- Attendance of a Geo-Environmental/Geotechnical Engineer to set out and supervise the intrusive investigation.
- The construction of 6No. window sample boreholes to depths of up to 4m bgl, together with in-situ testing and sampling.
- On site logging and sampling.
- In-situ shear strength testing using a hand penetrometer and/or hand shear vane.
- Falling head permeability testing within the window sampler borehole, to give an indicated of preliminary permeability.
- Installation of combined groundwater and ground gas monitoring wells within three of the window sample boreholes. (WS1, WS4 and WS6)
- Geotechnical laboratory testing on soil samples recovered from the exploratory holes to support the geotechnical assessment.
- Geochemical testing on selected soil samples to clarify the findings of the preliminary risk assessment and identify possible remediation requirements.
- Waste Acceptance Criteria (WAC) testing on selected soil samples. It is unclear at this stage whether the site would be developed on a zero waste basis, i.e. soils retained for re-use, and thus WAC testing has been undertaken to provide guidance.
- Provision of a Ground Investigation Report.

3.5 Investigation Strategy

The positioning of exploratory holes was determined on site to provide general coverage and target specific areas. Table 3.7 sets out the investigation strategy adopted.

Area of Concern	Investigation	Positions
General ground conditions	Exploratory holes located across the site, coupled with sampling and laboratory analysis.	All
Former Electricity Sub-Station	Exploratory holes located in close proximity to the sub-station to target potential source and provide coverage, coupled with sampling and laboratory analysis.	WS6
Coliforms within the soils adjacent to cemetery (samples to be collected at equivalent topography to neighbouring site)	Exploratory holes located across the site, coupled with sampling and laboratory analysis.	WS2, WS3 and WS4
Potential contamination of near surface soils	Exploratory holes located to provide coverage of the site, coupled with sampling and laboratory analysis.	All
Permeability	Falling Head soakage testing	WS1

Area of Concern	Investigation	Positions
General gassing regime	Spot monitoring within wells located across the site.	WS1, WS4 and WS6

Table 3.7 Summary of the Investigation Strategy

Soil samples were collected and placed into amber jars and cool boxes on site for transit to the office, where they were stored under chilled conditions (<4°C) prior to final transportation in cool boxes to the laboratory by their in-house courier. Both the geotechnical and contamination testing were undertaken by UKAS accredited laboratories. Contamination testing of soil samples was also undertaken in accordance with accredited MCERTs protocols. Samples were stored in temperature controlled conditions from sampling until receipt at the laboratory from which time sample preparation and storage was determined by testing requirements and in line with laboratory's protocols.

4.0 ENCOUNTERED CONDITIONS

A factual record of the conditions encountered during the physical investigation of the site is presented in the following sections.

For further details of the ground conditions, reference should be made to the exploratory hole logs presented in Appendix B, the geotechnical testing results in Appendix C, geochemical testing results in Appendix D and ground gas monitoring results in Appendix E.

The physical ground investigation works were undertaken on the 20th September 2016.

Unless stated otherwise, all depths are reported as metres below ground level (m bgl).

4.1 Soils

The ground conditions encountered were broadly consistent with those anticipated from the previous desk study undertaken for the site, i.e. a mantle of Topsoil and/or Made Ground overlying sand, silts and clays of the Lambeth Groups over the White Chalk Subgroup. The ground conditions are summarised in Table 4.1.

Top (m bgl)	Base (m bgl)	Description
0	0.05 - 0.20	TOPSOIL: Vegetation (brambles and weeds) over brown silt sandy CLAY with frequent fine to medium to coarse sub-rounded to sub-angular gravel of flint and frequent fine rootlets (live and decaying 1-4mm).
0.05	0.10	MADE GROUND (WS4 only): Type 1 sub-base comprising brown to medium to coarse sand and sub-angular to sub-rounded gravel of flint.
0.05 – 0.20	1.70 -3.10	LAMBETH GROUP: Firm to very stiff brown and light brown very silty slightly sandy CLAY and clayey SILT with occasional fine to medium sub-angular to sub-rounded gravel of flint. Occasional fine live roots to 0.9m bgl (1-2mm) and decaying roots to 1.2m bgl. With bands of light brown coarse SAND with occasional to frequent fine to medium sub-rounded to sub-angular gravel to cobble of flint.
1.70 -3.10	4.0+	WHITE CHALK SUBGROUP: Structureless white becoming off white CHALK comprising low density (becoming medium density with depth) clasts within an off white silt matrix. Matrix comprises 50-85% reducing with depth. Occasional fine flint gravel at between 2.8m and 3.5m bgl CIRIA Grade Dm becoming Dc.

Table 4.1 Summary of Ground Conditions

In general, no organoleptic evidence of potential contamination was encountered within WS4 where a thickness of Type 1 sub-base was encountered beneath the Topsoil in the area.

For more detailed descriptions at specific locations, reference should be made to the exploratory hole logs presented in Appendix B.

4.2 Groundwater

Groundwater was not encountered within any of the exploratory holes during the intrusive investigation or within the groundwater monitoring wells installed (WS1, WS4 and WS6) during the return gas and groundwater monitoring visits undertaken.

Given the geology and ground conditions identified groundwater is expected to be present at depth beneath the site.

It should also be noted that changes in groundwater levels do occur for a number of reasons including seasonal effects and variations in drainage. Such fluctuations may only be recorded by the measurement of the groundwater level within a series of standpipes or piezometers installed within appropriate response zones.

4.3 Obstructions

No obstructions were encountered within the exploratory holes. However, the presence of obstructions elsewhere on the site cannot be completely discounted.

4.4 Geotechnical Testing

Dynamic Probing was undertaken in three positions on site adjacent to WS1, WS2, WS4, in order to provide an assessment of the relative density of the materials encountered. Generally these results ranged between equivalent SPT 'N' values of N=8 to N=53, with the results demonstrating an overall trend of increasing N value (i.e. blow count) with depth throughout the Lambeth Group and then weakening slightly at the interface between the Lambeth Group and the White Chalk Formation. The results were also noted to be higher associated with the gravel bands encountered at varying depths.

A falling head permeability testing was undertaken within WS1. The test was undertaken with the test section extending into the White Chalk Subgroup. A preliminary soil permeability of 1.15×10^{-6}m/s was estimated from the test undertaken in WS1. Should the use of soakaways be proposed on the site it is recommended that full scale soakage testing in line with BRE365 be undertaken to confirm the assessment.

Geotechnical laboratory tests were undertaken on selected samples of the key strata encountered on this site. The results are summarised in Table 4.2 below.

Parameter	Lambeth Group	White Chalk Subgroup
Water content (%)	7 - 23	-
Liquid Limit (%)	43 - 59	-
Plastic Limit (%)	18 - 22	-
Plasticity Index Ip (%)	22 - 41	-
Modified Plasticity Index Ip' (%)	16 - 40	-
Soil grading	Clayey gravelly SAND and clayey very sandy GRAVEL	-
pH	7.18 – 7.52	7.53
Water soluble sulphate (g/l)	027 – 0.35	0.10

Table 4.2 Summary of Geotechnical Laboratory Test Results

4.5 Chemical Analysis

In order to assess the general chemical quality of the strata encountered, samples of soils recovered from the exploratory holes were submitted for analysis for a range of potential contaminants selected on the basis of the

findings of the desk study, Contaminated Land Strategy report and supported by CLR publication CLR8 and Environment Agency R&D66 publication.

The testing rationale included sampling and analysis to provide a general coverage of the subject site based on historic and/or recent use and to target specific sources identified as part of the desk study. Testing was undertaken for a broad range of commonly occurring contaminants including metals, metalloids, inorganic compounds, speciated TPH, PAH and asbestos.

Waste Acceptance Criteria was also undertaken on a selected soil sample to classify the shallow soils for the purpose of disposal.

4.6 Ground Gases and Vapours

Return ground gas monitoring were undertaken as part of the investigation and included spot monitoring of wells installed within the window sampler boreholes WS1, WS4 and WS6. These locations were selected to provide coverage of the site.

Six return gas and groundwater spot monitoring visits were undertaken to assess the current gassing regime at the site.

The spot monitoring did not detect any methane (i.e. 0.0%) and carbon dioxide was detected at concentrations in the range 0.0-3.9% and oxygen in the range 16.8-21.9%. A borehole flow of 0.1l/hr was detected within WS4 on the 11th and 22nd November 2016. No positive borehole flow was detected within any of the other wells during any of the monitoring rounds. Atmospheric pressure was falling on the 22nd of November and stable/high during the other monitoring visits on the 28th September, 19th October, 26th October, 11th November and 7th December 2016.

The implications of the gas monitoring data are considered in Section 6 of this report.

5.0 ENGINEERING CONSIDERATIONS

Subsequent to intrusive investigation of the site and receipt of the laboratory test results, the following geotechnical assessments have been made.

5.1 Conventional Foundations

Based on the ground and groundwater conditions encountered in the exploratory holes, it is considered that conventional shallow foundations will be suitable for the proposed development, with foundations passing through any Topsoil, Made Ground, root zones, desiccated ground or reworked ground to terminate in the sandy silt and clay of the Lambeth Group.

Geotechnical laboratory testing has shown the cohesive soils of the Lambeth Group typically to be of medium volume change potential as defined in NHBC Standards. Thus it is recommended that foundations are designed in accordance with the requirements for medium volume change potential, as defined in NHBC guidance and a minimum founding depth of 0.9m bgl is recommended where conventional foundations are constructed in clay soils.

In addition, a review of reported soil moisture contents and Atterberg Limits Test results indicated that the soils to a depth of c. 0.5-1.0m bgl could have been desiccated at the time of the investigation. This increased to c. 1.5m bgl at WS5. Given the apparent widespread nature of the possible desiccation it is considered that it may have been associated with the vegetation previously cleared on the site and partially attributable to the presence of trees around the site boundaries. In addition it is noted that the desiccation assessment is not conclusive but provides an indication of conditions at the time of testing.

Where foundations are proposed to be constructed within the zone of influence of trees, it is possible that foundations would need to be deepened to account for the presence and influence of the tree(s). Foundations which are proposed in proximity to trees should be designed in accordance with NHBC Standards Chapter 4.2, and design approaches 4.2B and 4.2C, which incorporate the water demand of trees and the distance of the tree from the nearest portion of foundation.

On the basis of ground conditions encountered and where conventional foundations are proposed, a net allowable bearing capacity of 125kPa is recommended for the sandy silt and stiff to very stiff clay of the Lambeth Group. Total settlement should remain within tolerable limits for the bearing capacities set out above.

Given the potential for foundation bases to span differing soil types, it is recommended that allowance is made for the inclusion of mesh reinforcement within foundations.

Exposure to water could result in softening of the clay soils forming the base of a foundation excavation, or the rapid onset of instability (e.g. running sand, slumping and wash out) within sand strata. Therefore, foundation excavations should be concreted or blinded as soon after excavation as possible. Where concreting could take place the following day it is recommended that excavations are not taken to full depth overnight and that the final 0.5m of cover is only removed immediately prior to concreting.

5.3 Floor Slabs

Given the presence of shrinkable soils across the site it is recommended that suspended floor slabs are constructed throughout the site.

5.4 Excavations

Excavations are likely to remain stable in the short to medium term, however may require support and battering back to a safe angle where left open for prolonged periods. The soils of the Lambeth Group may also be subject to rapid softening when exposed to water.

Ground works should be designed in such a manner to avoid man entry into excavations.

5.5 Pavements

With reference to TRRL LR1132, it is recommended that an equilibrium suction index CBR of 3% should be assumed for proposed formation level.

It should be noted that the soils at shallow depth would be prone to softening if exposed to standing water or un-made haul roads were used by construction traffic. This would result in a marked reduction in CBR.

Any hard or soft spots in the formation level may induce reflective cracking in the pavement and allowance should be made for removing hard or soft spots that may be present.

5.6 Sub-Surface Concrete

The results of the water soluble sulphate and pH analyses indicate that buried concrete (shallow foundations) should be designed in accordance with Class DS-1 of BRE Special Digest 1, with an ACEC class of AC-1, based on the mean value of the highest 20% of the dataset. The advice of this publication should be taken for the design and specification of all sub surface concrete.

5.7 Soakaways

A falling head permeability testing was undertaken within WS1. The test was undertaken with the test section extending into the White Chalk Subgroup. A preliminary soil permeability of 1.15×10^{-6}m/s was estimated from the test undertaken in WS1. As such it is considered that the uses of soakaways on site extending into the competent White Chalk Subgroup may be effective. Should the use of soakaways be proposed on the site it is recommended that full scale soakage testing in line with BRE365 be undertaken to confirm the assessment.

Subject to the findings of any further investigation and testing, it is recommended that a minimum offset of 10m is applied from any soakaways to buildings (proposed or existing). Alternatively, it may be possible to reduce the offset distance by discharging solely into competent chalk at depth, subject to Environment Agency and Building Control approval.

6.0 ENVIRONMENTAL CONSIDERATIONS

A Generic Quantitative Risk Assessment (GQRA) incorporating the results of the previous desk study undertaken by Geo-Environmental and ground investigation was undertaken, the findings of which are presented in the following sections.

As stated in Section 3, site workers involved in the preparation and construction of the development have not been considered further in this assessment as the Principal Contractor is duty bound under the current CDM Regulations to undertake their own risk assessments with respect to their employees.

6.1 Outline Risk Assessment

A number of plausible pollutant linkages were identified as part of the desk study. The investigation did not encounter conditions that warranted a revision of the preliminary Conceptual Site Model.

6.2 Ground Gases vs. End Users

The desk study previously undertaken for the site identified the presence of a cemetery to the west of the site and was mapped as potentially extending onto part of the subject site itself. Although the main portion of the cemetery was identified as being down gradient topographically of the subject site, a potential risk of ground gases may exist from the adjacent land use and associated contaminants.

The spot monitoring undertaken on site comprising six visits at approximately fortnightly intervals indicated the site's gassing regime, based on both hazardous gas flow and limiting concentrations, to be Characteristic Situation 1 (CIRIA and BS) and Green (NHBC) and thus based on the concentrations measured to date ground gas protection measures are not considered to be required.

6.3 Ground Gases vs. Soft Landscaping

In the absence of any plausible pollutant linkage for the proposed development areas, it is considered that no specific action is warranted in this respect.

6.4 Ground Gases vs. Adjacent Land Users

In the absence of any plausible pollutant linkage in relation to the proposed development and adjacent end users, it is considered that no specific action is warranted in this respect.

6.5 Soil Contamination vs. End Users – Residential Development

The presence of a possible contaminant does not necessarily imply that a site or area is contaminated or that there is any unacceptable risk to human health. A Preliminary Quantitative Risk Assessment has been undertaken in order to evaluate any unacceptable risks posed to human health with respect to the proposed redevelopment. It should be noted that this assessment is protective of the chronic long-term effects of contaminants, which is also likely to be protective of any possible immediate acute effects.

A quantitative risk assessment has been undertaken by comparing the results of the laboratory chemical testing of shallow soils against Site Specific Assessment Criteria (SSAC) generated using the Contaminated Land Exposure Assessment (CLEA) model v1.06 published by the Environment Agency, or against the Category 4 Screening Levels (C4SLs) published by DEFRA. Although the C4SLs were released for Part 2A use, the associated policy companion document for the C4SLs indicated that they may also be used for planning. Although the C4SLs represent a

marginally higher risk level than the SSACs (low risk rather than minimal risk) it is considered that the risk levels remain very low. Therefore, the final C4SLs are considered to be suitable to assess soils under the planning regime.

The exploratory holes were located to provide general coverage as well as information at specific locations as identified from the site walkover survey and/or conceptual site model. In the absence of deep Made Ground, or any organoleptic evidence of impacted soils at depth, analysis was undertaken on soil samples collected from shallow depth from these exploratory holes. In addition deeper samples were collected to assess the potential for coliforms associated with the adjacent cemetery located down topographical gradient of the site.

In the first instance the results of the sample analysis were compared to the Tier 1 screening criteria. All of the results were noted to be below the respective guideline for a proposed residential end use.

Coliforms, sodium, ammoniacal nitrogen, magnesium and potassium were also analysis to assess the risk from the neighbouring cemetery. Samples from WS2, WS3 and WS4 in closest proximity to the cemetery were sampled at depths between 0.7m and 3.5m bgl to account of the depth at which contaminant migration may occur due to the presence of the cemetery down topographical gradient of the site. The analysis did not identify the presence of coliforms in any of the samples. Magnesium was recorded in the range of 1430mg/kg to 2820mg/kg and results were noted to decrease with depth. Potassium was recorded between 178mg/kg and 2190mg/kg and was noted to reduce by an order of magnitude with depth. Ammoniacal Nitrogen was generally below or at the level of detection and sodium was noted to range from 340mg/kg to 753mg/kg and was noted to generally increase with depth. Whilst these concentrations might be attributable in part to the presence of a cemetery in close proximity to the site it is considered that they do not represent a risk to human health on the subject site and where identified generally reduced with depth. As such it is considered that no significant risk or presence of contamination has been identified on the site to data associated with the adjacent cemetery site.

In addition, it is noted that screening of soil samples did not identify the presence of asbestos in any of the samples analysed from the site.

Chemical analysis on Topsoil from across the site indicates that it would be suitable for retention and re-use in residential gardens, communal soft landscaping and open space. A minimum cover of 150mm of Topsoil is recommended for all such areas.

Should it be necessary to import further topsoil on to the development then, prior to importation, the chemical, physical and nutritional suitability should be verified. Importation of topsoil or subsoil from unverified or unsuitable sources would require their removal from site and replacement with suitable materials. As a matter of good practice, it is recommended that the location, approximate extent and thickness of any imported topsoil are recorded and presented in the Validated/Verification Report to be prepared by the Environmental Consultant.

6.6 Soil Contamination vs. Soft Landscaping

British Standard BS3882:2015 *Specification for topsoil and requirements for use* provides assessment criteria for a number of potentially phytotoxic contaminants in terms of new planting.

The results of the chemical analysis for determinants known to pose a potential phytotoxic risk to plant growth are summarised in Table 6.1, together with the respective adopted Generic Assessment Criteria (GAC) for plant growth. The compliance criteria set out in BS3882:2015 are pH dependent and thus the GAC used relate to the pH range measured on samples recovered from the site.

Determinant	Phytotoxicity GAC (mg/kg)			GAC Exceedances
	pH <6.0	pH 6.0-7.0	pH >7.0	
Zinc	200	200	300	No
Copper	100	135	200	No
Nickel	60	75	110	No

Table 6.1 Summary of Plant Phytotoxicity Assessment

The phytotoxicity assessment did not identify any exceedances above the relevant phytotoxicity criteria. As such it is considered that no specific measures are required in this respect.

6.7 Soil Contamination vs. Built Environment

Recommendations with respect to pH and sulphate in relation to buried concrete are made in Section 5.6.

Given the ground conditions encountered on site, it is considered likely that standard pipe would be suitable for potable water supply. However, the utility company should be consulted in order to confirm their specific requirements in this respect. As a matter of good practice and to maximise the protection to maintenance workers, it is recommended that clean, granular backfill is used in service runs and that marker tapes are used for all buried services.

6.8 Soil Contamination vs. Adjacent Land Users

As assessment of the geochemical analysis undertaken has not identified the presence of any contaminants of concern above the respective threshold for a proposed residential end use. As such in the absence of a plausible pollutant linkage it is considered that no specific remedial action is warranted in relation to adjacent land users.

However, short term risks to adjacent land users do arise in relation to the generation of soil derived dust from the site during the construction phase. Therefore, it is recommended that dust suppression techniques, e.g. damping down exposed soils, are employed during the ground works and construction phases on site in order to minimise the potential nuisance issues for adjacent land users.

6.9 Soil Contamination vs. Groundwater

The investigation did not identify any mobile contamination and thus in the absence of a pollutant linkage, no further action is warranted.

6.10 Groundwater Contamination vs. Human Health

End users would not come in to contact with groundwater and thus in the absence of a plausible pollutant linkage between groundwater and end-users, no specific protection measures are considered likely to be required in this respect.

6.11 Groundwater Contamination vs. Soft Landscaping

Groundwater was not encountered during the instructive investigation works or during the return gas and groundwater monitoring visits undertaken on the site. As such it is expected that groundwater will be present at depth beneath the site and beyond the likely root zones of vegetation as part of a proposed residential development. Notwithstanding this, the vegetation on and around the site showed no evidence of stress. As such, it is considered that no specific action is warranted with respect to soft landscaping.

6.12 Groundwater Contamination vs. Built Environment

Protection measures for the Built Environment as discussed in Section 6.7 are considered appropriate.

6.13 Groundwater Contamination vs. Controlled Waters

In the absence of any evidence of groundwater contamination and the presence of discontinuous groundwater beneath the site, no remedial action is considered to be warranted.

6.14 Waste Disposal

Initial Waste Acceptance Criteria (WAC) testing was undertaken on a representative sample of shallow natural soils on the site within WS5 at 0.5m bgl.

The test results for the Lambeth Group indicate that if required to be disposed of as a waste, these natural soils would be classified as inert waste. However it is recommended that once soils for disposal have been identified on the site that further WAC testing be undertaken to confirm the assessment in relation to those specific soils for disposal.

Other materials disposed of from site as part of the demolition or remediation process may require disposal separately. All materials containing dangerous substances e.g. tar or bitumen, asbestos, mercury, hydrocarbons and PCBs are likely to be classified as Hazardous Waste and therefore susceptible to the relevant legislative controls.

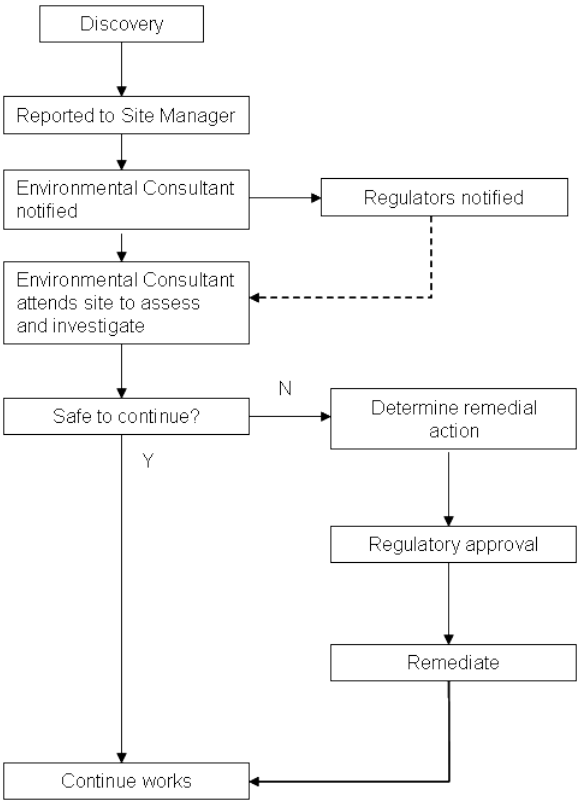
6.15 Discovery Strategy

Whilst an investigation has been undertaken on the site, it remains possible that unexpected soil conditions may be encountered during the process of site demolition, clearance and construction.

Examples may include oily pockets within the soil, pockets of cement boarding or fibrous materials within the soil, black ashy materials, soils exhibiting strong odours, brightly coloured materials and former structures or brickwork.

Should previously undiscovered contamination be encountered during construction by the ground workers, this should be reported to the Site Manager immediately in order that any necessary inspection may be made. Records should be kept and samples submitted for analysis where conditions encountered are not as anticipated. The results of any such testing should be sent to the authorities for consultation.

The process is shown below.



Discovery Strategy Process

A copy of the discovery strategy should be lodged on site and provisions made to ensure that all workers are made aware of their responsibility to observe, report and act on any potentially suspicious or contaminated materials they may encounter.

Geo-Environmental

FIGURES

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LOCATION PLAN (1:1250)

Project:	Lowfield Road, Caversham, Reading RG4 6NL			**Title**	Site Location Plan
Client:	Reading Borough Council			**Geo-Environmental Services Ltd** **Unit 7 Danworth Farm, Cuckfield Road** **Hurstpierpoint, West Sussex BN6 9GL** **+44(0)1273 832972 www.gesl.net**	Geo-Environmental
Ref No:	GE15373	**Revision:**	0		
Drawn:	LL	**Date:**	01/03/2016		
Figure:	1	**Scale:**	Not To Scale		

Project:	Lowfield Road			**Title:**	Site Walkover Plan		
Address:	Lowfield Road, Caversham, Reading RG4 6NL			**Date:**	04/03/2016	**Revision:**	v1
				Drawn:	AB	Geo-Environmental	
NGR:	473030, 175880	**Scale:**	Not to Scale	**Ref:**	GE15373		
Client:	Reading Borough Council			**Figure:**	2		

Project:	Lowfield Road			**Title:**	Site Investigation Locations		
Address:	Lowfield Road, Caversham, Reading RG4 6NL			**Date:**	19-09-16	**Revision:**	v1
				Drawn:	LL	Geo-Environmental	
NGR:	473030, 175880	**Scale:**	Not to Scale	**Ref:**	GE15373		
Client:	Reading Borough Council			**Figure:**	3		

Geo-Environmental

APPENDIX A

Site Photographs

Plate 1 – View of the site looking north from centre of site

Plate 2 – View of north western corner of site

Plate 3 – View of WS1 looking north

Plate 4 – View of site looking south from WS1 location

Plate 5 – View of site looking south

Plate 6 – Evidence of trees recently removed from site in the north western corner of the site

Plate 7 – Evidence of Made Ground and rubbish on the site in close within the north western corner

Plate 8 – Evidence of rubbish present on site

Plate 9 – View of concrete bases within the north eastern corner of the site looking east

Plate 10 – View of concrete bases and evidence of fires on central western portion of site

Plate 11 – View of the south western portion of the site

Plate 12 – View of the central portion of the site looking east, south-east

Plate 13 – Electricity box located on the south boundary of the access road into the site

Plate 14 – Evidence of disused gas canisters on the site

Plate 15 – View of the site entrance and materials previously utilised to block and secure the gate

Plate 16 – Site access looking east towards Cadogan Close and the main road

Plate 17 – View of Cadogan Close from the site boundary looking west

Plate 18 – View inside the electricity book on site

Geo-Environmental

APPENDIX B

Exploratory Hole Logs and In-Situ Test Results

Geo-Environmental	Unit 7, Danworth Farm Hurstpierpoint BN6 9GL www.gesl.net	Borehole Log	Borehole No. **WS1** Sheet 1 of 1

Project Name:	Lowfield Road, Caversham, Reading	Project No. GE15373	Co-ords:	472989E - 175933N	Hole Type WLS
Location:	Caversham, Reading		Level:	55.00	Scale 1:25
Client:	Reading Borough Council		Dates:	20/09/2016	Logged By LL

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.10	ES		0.10	54.90		Brown silty clay TOPSOIL with frequent fine to medium sub-rounded to sub-angular gravel of flint. TOPSOIL	
		0.50 0.50 0.60	D PP ES	4.5kg/cm2				Stiff to very stiff brown and light brown very silty, slightly sandy CLAY with occasional fine to medium sub-angular to sub-rounded gravel of flint. Occasional fine rootlets to 0.15m bgl (1-2mm diameter). LAMBETH GROUP	
		1.00 1.00	D PP	4.0kg/cm2					1
		1.20	PP	3.0kg/cm2	1.20	53.80		Light brown and orange very gravelly fine to coarse SAND. Gravel is angular to sub-angular of flint. Live rootlets to 0.9m (1-2mm), decaying roots to 1.2m. LAMBETH GROUP	
		1.50	D		1.40	53.60		Brown and light brown very silty sandy CLAY, becoming sandier with depth. Occasional medium to coarse sub-angular to angular gravel of flint with occasional black carbonaceous bands and decaying roots. LAMBETH GROUP	
		1.80	PP	3.0kg/cm2					
		2.00	D		1.90	53.10		Brown and light brown coarse SAND with occasional fine to medium sub-rounded to sub-angular gravel of flint. LAMBETH GROUP	2
		2.50	D						
		2.70	PP	1.0kg/cm2	2.60	52.40		Firm brown very sandy CLAY with occasional gravel of flint and flint gravel band present at 2.8-2.9m LAMBETH GROUP	
		3.00	D		2.90	52.10		Structureless grey and off white CHALK composed of fine low density very weak to weak gravel of chalk within an off-white silt matrix, matrix comprises approx. 85% with occasional fine to coarse gravel of flint. CIRIA Grade Dm CHALK	3
		3.50	D		3.40	51.60		Structureless grey and off white CHALK composed of medium density weak to moderately weak gravel of chalk, matrix comprises approx. 30% with frequent fine to coarse angular to sub-angular gravel of flint. CIRIA Grade Dm to Dc. CHALK	
		4.00	D		3.90 4.00	51.10 51.00		Structureless grey and off white CHALK composed of medium density weak to moderately weak gravel of chalk, matrix comprises approx. 30%. CIRIA Grade Dm to Dc. CHALK End of Borehole at 4.00m	4
									5

Casing		Water Strikes (mbgl)		Chiselling (mbgl)	
Diameter	Depth (m)	Depth Strike	Rose to	Depth from	Depth to
			0.00		

Remarks

AGS

Geo-Environmental	Unit 7, Danworth Farm Hurstpierpoint BN6 9GL www.gesl.net	Borehole Log	Borehole No. **WS2** Sheet 1 of 1

Project Name:	Lowfield Road, Caversham, Reading	Project No. GE15373	Co-ords: 473013E - 175884N	Hole Type WLS
Location:	Caversham, Reading		Level: 53.30	Scale 1:25
Client:	Reading Borough Council		Dates: 20/09/2016	Logged By LL

Well	Water Strikes	Sample and In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
		0.15	ES		0.15	53.15		Dark brown and brown silty clayey TOPSOIL with frequent fine to medium sub-rounded to sub-angular gravel of flint. Frequent fine rootlets. TOPSOIL
					0.30	53.00		Type 1 sub-base comprising brown medium to coarse sand and sub-angular to sub-rounded gravel of flint. MADE GROUND
		0.50 0.50	D PP	4.5kg/cm2				Very Stiff light brown friable silty CLAY with frequent gravel of flint. LAMBETH GROUP
		0.70	ES		0.70	52.60		Brown and orange sandy SILT with frequent medium to coarse sub-angular to sub-rounded gravel of flint. LAMBETH GROUP
		0.90	PP	4.2kg/cm2				
		1.00	D					1
		1.50	D					
					1.80	51.50		Very stiff brown silty very gravelly CLAY with frequent medium to coarse sub-rounded to sub-angular gravel and occasional cobble of flint. LAMBETH GROUP
		2.00	D					2
					2.20	51.10		Light brown and off white very gravelly SAND and GRAVEL, comprising medium to coarse sand and medium to coarse gravel of flint. LAMBETH GROUP
		2.50	D		2.50	50.80		Brown coarse SAND with occasaional fine to medium gravel of chalk. Gravels become frequent at the sand/ chalk boundary. LAMBETH GROUP
					2.60	50.70		Structureless off white CHALK composed of low to medium density fine to medium chalk clasts in an off white silt matrix, matrix is 65%, with gravel of chalk and flint. Flint gravel band from 2.8-2.9m. CHALK
		3.00	D					3
		3.50 3.50	D ES					
		3.70	D		3.70	49.60		
								End of Borehole at 4.00m
								4
								5

Casing		Water Strikes (mbgl)		Chiselling (mbgl)		Remarks
Diameter	Depth (m)	Depth Strike	Rose to	Depth from	Depth to	
			0.00			

AGS

Geo-Environmental	Unit 7, Danworth Farm Hurstpierpoint BN6 9GL www.gesl.net	# Borehole Log		Borehole No. **WS3** Sheet 1 of 1
Project Name:	Lowfield Road, Caversham, Reading	Project No. GE15373	Co-ords: 473036E - 175859N	Hole Type WLS
Location:	Caversham, Reading		Level: 52.08	Scale 1:25
Client:	Reading Borough Council		Dates: 20/09/2016	Logged By LL

Well	Water Strikes	Sample and In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
		0.10	ES		0.12	51.96		Brown clayey sandy silt TOPSOIL with frequent fine rootlets (1-2mm)and fine to coarse sub-angular to sub-rounded gravel of flint. TOPSOIL
					0.40	51.68		Brown fine to medium SAND and GRAVEL, comprisig fine to coarse sub-rounded to sub-angular of flint. LAMBETH GROUP
		0.50	D					
		0.60	ES		0.60	51.48		Orangey brown medium to coarse SAND with occasional sub-angular to sub-rounded gravel of flint. LAMBETH GROUP
								Light grey and brown SAND and GRAVEL. LAMBETH GROUP
		1.00	D					1
		1.10	PP	1.5kg/cm2	1.10	50.98		
					1.20	50.88		Firm to stiff light brown sandy CLAY with medium to coarse gravel and occasional cobble of flint. LAMBETH GROUP
		1.50	D					Orangey brown loose SAND and GRAVEL with frequent gravel of medium to coarse sub-rounded to angular of flint.with brown coarse sand bands. LAMBETH GROUP
		2.00	D					2
		2.50	D					
					2.55	49.53		Flint gravel band, comprising angular to sub-angular gravel of flint and chalk. LAMBETH GROUP
					2.65	49.43		Structureless off white and light grey CHALK, with low to medium density weak clasts within a silt matrix with occasional gravel of flint.Matrix comprises 60% CIRIA Grade Dm. CHALK
		3.00	D					3
		3.40	ES					
		3.50	D					
		4.00	D		4.00	48.08		End of Borehole at 4.00m 4
								5

Casing		Water Strikes (mbgl)		Chiselling (mbgl)		Remarks
Diameter	Depth (m)	Depth Strike	Rose to	Depth from	Depth to	
			0.00			

AGS

Geo-Environmental	Unit 7, Danworth Farm Hurstpierpoint BN6 9GL www.gesl.net	Borehole Log	Borehole No. **WS4** Sheet 1 of 1

Project Name:	Lowfield Road, Caversham, Reading	Project No. GE15373	Co-ords: 473067E - 175834N	Hole Type WLS
Location:	Caversham, Reading		Level: 51.17	Scale 1:25
Client:	Reading Borough Council		Dates: 20/09/2016	Logged By LL

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.05	51.12		Silty sandy clayey TOPSOIL with frequent rootlets (1-2mm) and medium to coarse gravel of flint. TOPSOIL	
		0.20	ES		0.10	51.07		Type 1 sub-base comprising brown medium to coarse sand and sub-angular to sub-rounded gravel of flint. MADE GROUND	
		0.50	D					Firm to stiff brown silty sandy CLAY with carbonaceous deposits and decaying roots and rare gravel of flints. Flint gravel band with frequent sub-rounded to sub-angular present at 0.3m. LAMBETH GROUP	
		0.60	ES						
		1.00	D		1.00	50.17		Stiff brown very sandy CLAY. LAMBETH GROUP	1
		1.10	PP	1.5kg/cm2					
					1.20	49.97		Orange ad brown medium to coarse SAND and GRAVEL comprising fine to medium of flint. LAMBETH GROUP	
		1.50	D						
					1.90	49.27		Structureless off white CHALK composed of low to medium density fine to medium chalk clasts in a brown silt matrix, matrix is 60% reducing with depth, with gravel of chalk and flint. Flint gravel band from 2.8-2.9m. CIRIA Grade Dm becoming Dc. CHALK	2
		2.00	D						
		2.10	ES						
		2.50	D						
		3.00	D						3
		3.50	D						
		4.00	D		4.00	47.17		End of Borehole at 4.00m	4
									5

Casing		Water Strikes (mbgl)		Chiselling (mbgl)		Remarks
Diameter	Depth (m)	Depth Strike	Rose to	Depth from	Depth to	
			0.00			

AGS

Geo-Environmental	Unit 7, Danworth Farm Hurstpierpoint BN6 9GL www.gesl.net	Borehole Log	Borehole No. **WS5** Sheet 1 of 1

Project Name:	Lowfield Road, Caversham, Reading	Project No. GE15373	Co-ords: 473011E - 175922N	Hole Type WLS
Location:	Caversham, Reading		Level: 54.50	Scale 1:25
Client:	Reading Borough Council		Dates: 20/09/2016	Logged By LL

Well	Water Strikes	Sample and In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
		0.20	ES		0.20	54.30		Dark brown and brown silty clay with fine rootlets and occasional decaying rootlets (3-4mm) with occasional fine sub-rounded to sub-angular gravel of flint with plastis sheet fragments. TOPSOIL
		0.50 0.50 0.60	D PP ES	0.8kg/cm2				Firm dark brown and orange silty very sandy CLAY, with roots up to 3-4mm and decaying roots up to 6mm with rare fine gravel of flint. Gravels become medium to coarse at 0.5m, with black carbonaceous bands and decaying roots at 1.0m. LAMBETH GROUP
		1.00 1.00	D PP	1.2kg/cm2	1.00	53.50		Stiff to very stiff brown and orangey sandy silty CLAY, with carbonaceous deposits and fine rootlets to 0.9m. LAMBETH GROUP
		1.40 1.50 1.60	PP D PP	2.8kg/cm2 3.8kg/cm2				
		2.00 2.00	D PP	3.5kg/cm2	2.10	52.40		Very stiff light grey and brown sandy CLAY and occasional/rare medium to coarse gravel of flint, comprising sub-angular to sub-rounded. LAMBETH GROUP
		2.50	D		2.30	52.20		Brown and orange fine to medium SAND and GRAVEL comprising fine to coarse sub-angular to sub-rounded. LAMBETH GROUP
		3.00	D		3.10	51.40		Structureless white and off white CHALK comprising low density (becoming medium density with depth) clasts within a off white and light brown silt matrix. Matrix comprises 75% reducing with depth. Occasional fine flint gravels at 3.4-3.5m. CIRIA Grade Dm becoming Dc. CHALK
		3.50	D					
		4.00	D		4.00	50.50		End of Borehole at 4.00m

1 2 3 4 5

Casing		Water Strikes (mbgl)		Chiselling (mbgl)	
Diameter	Depth (m)	Depth Strike	Rose to	Depth from	Depth to
			0.00		

Remarks

AGS

Geo-Environmental	Unit 7, Danworth Farm Hurstpierpoint BN6 9GL www.gesl.net	Borehole Log	Borehole No. **WS6** Sheet 1 of 1

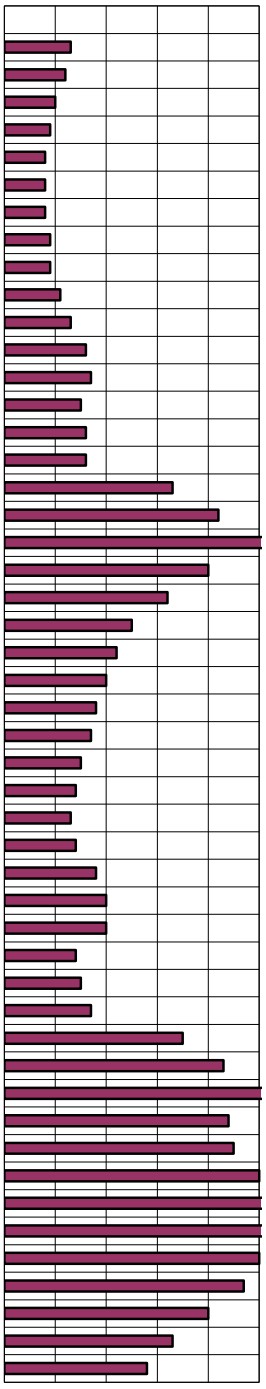
Project Name:	Lowfield Road, Caversham, Reading	Project No. GE15373	Co-ords: 473048E - 175877N	Hole Type WLS
Location:	Caversham, Reading		Level: 52.48	Scale 1:25
Client:	Reading Borough Council		Dates: 20/09/2016	Logged By LL

Well	Water Strikes	Sample and In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description	
					0.10	52.38		Brown sandy silty TOPSOIL with occasional sub-rounded to sub-angualr gravel of flint and fine rootlets. TOPSOIL	
		0.20	ES						
					0.30	52.18		Light brown very silty SAND with rounded to sub-rounded gravel of flint, becoming sandier with depth, with fine rootlets to 0.3m. LAMBETH GROUP	
		0.50	D						
		0.60	ES		0.60	51.88		Light brown loose SAND and GRAVEL with fine to coarse sub-angular to sub-rounded gravel of flint. LAMBETH GROUP	
		0.85	D					Brown and orange medium to coarse SAND with occasional medium to coarse gravel of flint. LAMBETH GROUP	
					0.90	51.58		Flint GRAVEL band. LAMBETH GROUP	
					1.00	51.48		Orange and grey loose medium to coarse SAND and GRAVEL comprising medium to coarse and occasional cobble fo flint. LAMBETH GROUP	1
		1.50	D						
					1.70	50.78		Structureless white and off white CHALK comprising low density (becoming medium density with depth) clasts within a off white silt matrix. Matrix comprises 50% reducing with depth. Occasional fine flint gravels at 2.9m. CIRIA Grade Dm becoming Dc. CHALK	
		2.00	D						2
		2.50	D						
		3.00	D						3
		3.50	D						
		4.00	D		4.00	48.48		End of Borehole at 4.00m	4
									5

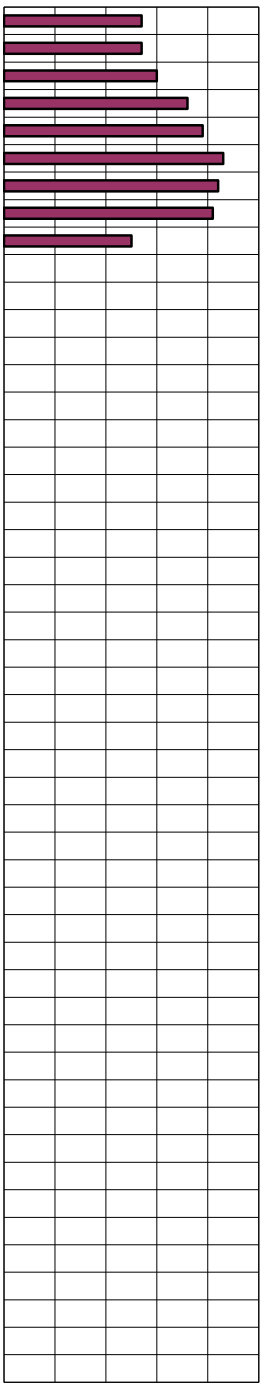
Casing		Water Strikes (mbgl)		Chiselling (mbgl)		Remarks
Diameter	Depth (m)	Depth Strike	Rose to	Depth from	Depth to	
			0.00			

AGS

Depth mbgl	DPSH N(100)	SPT N(300)
0.0	4	
0.1	5	13
0.2	4	12
0.3	3	10
0.4	3	9
0.5	3	8
0.6	2	8
0.7	3	8
0.8	3	9
0.9	3	9
1.0	3	11
1.1	5	13
1.2	5	16
1.3	6	17
1.4	6	15
1.5	3	16
1.6	7	16
1.7	6	33
1.8	20	42
1.9	16	51
2.0	15	40
2.1	9	32
2.2	8	25
2.3	8	22
2.4	6	20
2.5	6	18
2.6	6	17
2.7	5	15
2.8	4	14
2.9	5	13
3.0	4	14
3.1	5	18
3.2	9	20
3.3	6	20
3.4	5	14
3.5	3	15
3.6	7	17
3.7	7	35
3.8	21	43
3.9	15	52
4.0	16	44
4.1	13	45
4.2	16	50
4.3	21	54
4.4	17	55
4.5	17	50
4.6	16	47
4.7	14	40
4.8	10	33
4.9	9	28
	Continued	



Depth mbgl	DPSH N(100)	SPT N(300)
5.0	9	27
5.1	9	27
5.2	9	30
5.3	12	36
5.4	15	39
5.5	12	43
5.6	16	42
5.7	14	41
5.8	11	25
	End	

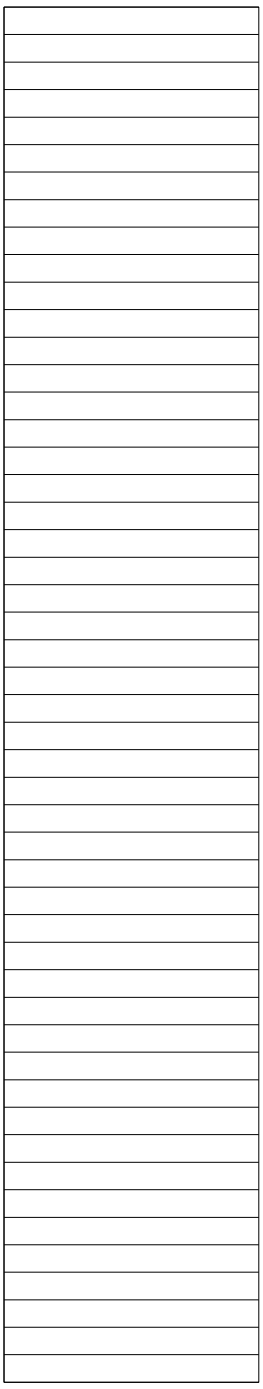


Note: DPSH'N' and SPT'N' directly correlate. SPT'N'(300) calculated as sum of DPSH'N' over 300mm

Project:	Lowfield Road, Caversham, Reading RG4 6NL			**Title:**	DYNAMIC PROBE LOG DP1/WS1
Client:	Reading Borough Council			Geo-Environmental Services Ltd	
Ref No:	GE153273	**Rev:**	V1	Unit 7, Danworth Farm, Cuckfield Road,	
Drawn:	LL	**Date:**	21-09-16	Hurstpierpoint, West Sussex, BN6 9GL	
Figure:	WS1/DP1	**Scale:**	Not To Scale	E: mail@gesl.net T: 01273 832972	

Depth mbgl	DPSH N(100)	SPT N(300)
0.0	2	
0.1	4	14
0.2	8	19
0.3	7	19
0.4	4	14
0.5	3	9
0.6	2	8
0.7	3	7
0.8	2	8
0.9	3	8
1.0	3	10
1.1	4	16
1.2	9	27
1.3	14	37
1.4	14	43
1.5	15	46
1.6	17	52
1.7	20	54
1.8	17	53
1.9	16	49
2.0	16	44
2.1	12	40
2.2	12	34
2.3	10	30
2.4	8	27
2.5	9	25
2.6	8	26
2.7	9	26
2.8	9	22
2.9	4	20
3.0	7	22
3.1	11	30
3.2	12	36
3.3	13	36
3.4	11	34
3.5	10	29
3.6	8	24
3.7	6	20
3.8	6	22
3.9	10	25
4.0	9	31
4.1	12	33
4.2	12	36
4.3	12	40
4.4	16	37
4.5	9	33
4.6	8	27
4.7	10	29
4.8	11	33
4.9	12	23
	End	

Depth mbgl	DPSH N(100)	SPT N(300)



Note: DPSH'N' and SPT'N' directly correlate. SPT'N'(300) calculated as sum of DPSH'N' over 300mm

Project:	Lowfield Road, Caversham, Reading RG4 6NL			**Title:**	DYNAMIC PROBE LOG DP2/WS2
Client:	Reading Borough Council			**Geo-Environmental Services Ltd**	
Ref No:	GE153273	**Rev:**	V1	**Unit 7, Danworth Farm, Cuckfield Road,**	
Drawn:	LL	**Date:**	21-09-16	**Hurstpierpoint, West Sussex, BN6 9GL**	
Figure:	WS2/DP2	**Scale:**	Not To Scale	**E: mail@gesl.net T: 01273 832972**	

Depth mbgl	DPSH N(100)	SPT N(300)
0.0	3	
0.1	5	14
0.2	6	14
0.3	3	12
0.4	3	9
0.5	3	8
0.6	2	7
0.7	2	6
0.8	2	7
0.9	3	8
1.0	3	8
1.1	2	7
1.2	2	8
1.3	4	10
1.4	4	16
1.5	8	20
1.6	8	22
1.7	6	19
1.8	5	15
1.9	4	13
2.0	4	12
2.1	4	13
2.2	5	13
2.3	4	13
2.4	4	12
2.5	4	13
2.6	5	16
2.7	7	28
2.8	16	38
2.9	15	47
3.0	16	45
3.1	14	39
3.2	9	29
3.3	6	21
3.4	6	18
3.5	6	18
3.6	6	17
3.7	5	17
3.8	6	18
3.9	7	21
4.0	8	23
4.1	8	23
4.2	7	22
4.3	7	19
4.4	5	20
4.5	8	19
4.6	6	20
4.7	6	18
4.8	6	18
4.9	6	18

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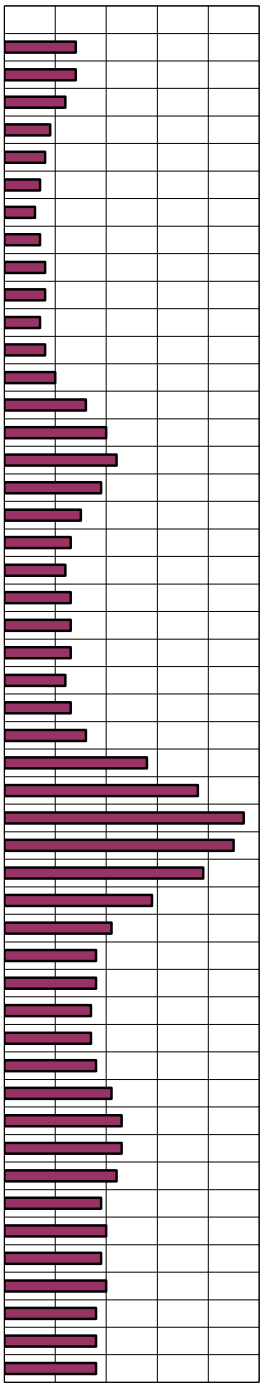
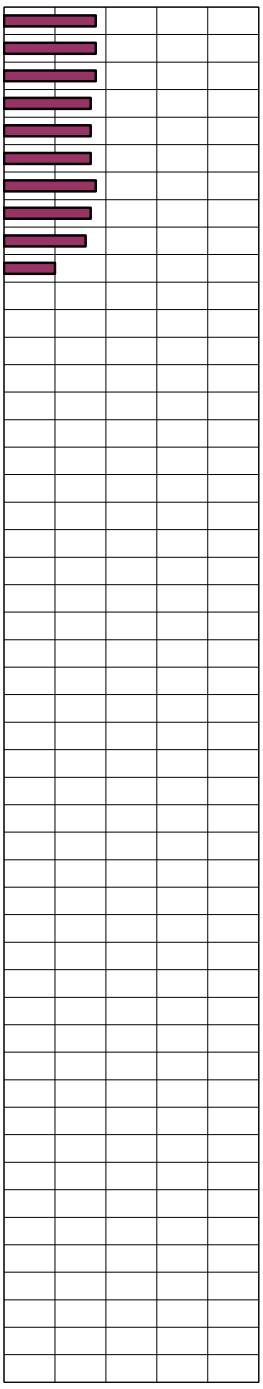


Depth mbgl	DPSH N(100)	SPT N(300)
5.0	6	18
5.1	6	18
5.2	6	18
5.3	6	17
5.4	5	17
5.5	6	17
5.6	6	18
5.7	6	17
5.8	5	16
5.9	5	10

End



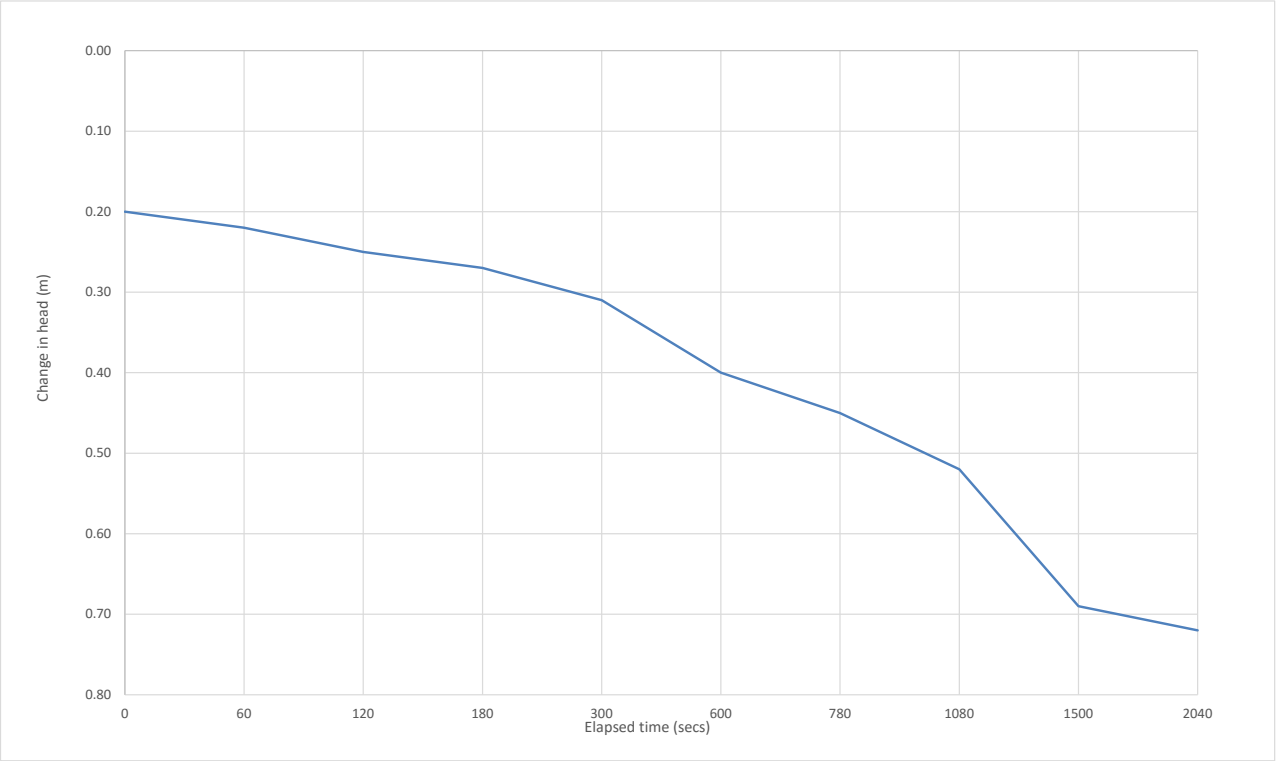
Note: DPSH'N' and SPT'N' directly correlate. SPT'N'(300) calculated as sum of DPSH'N' over 300mm

Project:	Lowfield Road, Caversham, Reading RG4 6NL			**Title:**	DYNAMIC PROBE LOG DP4/WS4
Client:	Reading Borough Council			Geo-Environmental Services Ltd	
Ref No:	GE153273	**Rev:**	V1	Unit 7, Danworth Farm, Cuckfield Road,	
Drawn:	LL	**Date:**	21-09-16	Hurstpierpoint, West Sussex, BN6 9GL	
Figure:	WS4/DP4	**Scale:**	Not To Scale	E: mail@gesl.net T: 01273 832972	

Variable Head Permeabillity Test (after BS5930:2015 and BS EN ISO 22282:2012)

Location	Lowfield Road, Caversham, RG4 6NL	**Position**	WS1	**Date:**	20-09-16
Borehole depth (m bgl)	4	**Standing water level (m bgl)**	-		
Casing height above ground level (m)	-	**Depth of casing below ground level (m bgl)**	-	**Casing diameter (m)**	0.05

Time elapsed				Depth (m)					
mins	**secs**	**total time (secs)**	**t-t0 (secs)**		**h_0**	**h_0/ht**	**ln (h_0/ht)**	**dh/dt (m/s)**	
0	10	0	0.00	0.20	0.20	1.00	0.00	0.00	
1	0	60	60.00	0.22	0.20	0.91	0.10	0.02	
2	0	120	120.00	0.25	0.20	0.80	0.22	0.03	
3	0	180	180.00	0.27	0.20	0.74	0.30	0.02	
5	0	300	300.00	0.31	0.20	0.65	0.44	0.04	
10	0	600	600.00	0.40	0.20	0.50	0.69	0.09	
13	0	780	780.00	0.45	0.20	0.44	0.81	0.05	
18	0	1080	1080.00	0.52	0.20	0.38	0.96	0.07	
25	0	1500	1500.00	0.69	0.20	0.29	1.24	0.17	
34	0	2040	2040.00	0.72	0.20	0.28	1.28	0.03	



Shape Factor F (from BS EN ISO 22282-1

L =	0.52
D =	0.05
L/D =	10.40
F=	**1.08**

Permeability (from BS EN ISO 22282-2)

t0	0.00		
t	2040.00		
h0	0.20		
h	0.72		
S =	0.0020		
k =	**-1.15E-06**	m/s	(negative value means falling head of water)

Project:	Lowfield Road, Caversham, Reading RG4 6NL			**Title**	WS1 Variable Head Permeability Test
Client:	Reading Borough Council			**Geo-Environmental Services Ltd**	
Ref No:	GE15373	**Rev:**	-	**Unit 7 Danworth Farm, Cuckfield Road**	
Drawn:	LL	**Date:**	21-11-16	**Hurstpierpoint, West Sussex BN6 9GL**	
Figure:	FHT WS1	**Scale:**	Not To Scale	**+44(0)1273 832972 www.gesl.net**	

Geo-Environmental

Geo-Environmental

APPENDIX C

Geotechnical Laboratory Test Results

Summary of Natural Moisture Content, Liquid Limit and Plastic Limit Results

Job No.	Project Name	Programme	
21644	Lowfield Road, Caversham, Reading	Samples received	26/09/2016
		Schedule received	26/09/2016
Project No.	Client	Project started	27/09/2016
GE15373	GESL	Testing Started	10/10/2016

Hole No.	Sample				Soil Description	NMC	Passing 425µm	LL	PL	PI	Remarks
	Ref	Top	Base	Type		%	%	%	%	%	
WS1	2	0.50	-	D	Orangish brown slightly gravelly slightly sandy silty CLAY (gravel is fm and sub-angular)	16	92	48	18	30	
WS1	5	1.50	-	D	Brownish grey slightly gravelly silty CLAY (gravel is fine and sub-angular)	23	98	57	21	36	
WS2	2	0.50	-	D	Brown sandy silty gravelly CLAY (gravel is fm and angular to rounded)	16	54	48	19	29	
WS2	6	2.00	-	D	Brown slightly clayey sandy GRAVEL (gravel is fmc and angular to rounded)	7.0	-	-	-	-	Unsuitable
WS4	2	0.50	-	D	Orangish brown slightly gravelly silty CLAY (gravel is fine and sub-angular)	20	98	58	22	36	
WS5	2	0.50	-	D	Orangish brown and brown slightly gravelly slightly sandy silty CLAY with occasional rootlets (gravel is fm and sub-angular)	21	94	43	21	22	
WS5	5	1.50	-	D	Brown and occasional orange and pale grey slightly gravelly silty CLAY (gravel is fine and sub-angular)	21	98	59	18	41	

Test Methods: BS1377: Part 2: 1990:
Natural Moisture Content : clause 3.2
Atterberg Limits: clause 4.3 and 5.0

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

Tel: 01923 711 288
Email: James@k4soils.com

Checked and Approved

Initials J.P

Date: 12/10/2016

UKAS TESTING 2519

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

MSF-5-R1(b)

Sulphate Content (Gravimetric Method) for 2:1 Soil: Water Extract and pH Value - Summary of Results

Tested in accordance with BS1377 : Part 3 : 1990, clause 5.3 and clause 9

Job No.	Project Name	Programme	
21644	Lowfield Road, Caversham, Reading	Samples received	26/09/2016
		Schedule received	26/09/2016
Project No.	Client	Project started	27/09/2016
GE15373	GESL	Testing Started	11/10/2016

Hole No.	Sample				Soil description	Dry Mass passing 2mm	SO3 Content	SO4 Content	pH	Remarks
	Ref	Top	Base	Type		%	g/l	g/l		
WS1	2	0.50	-	D	Orangish brown slightly gravelly slightly sandy silty CLAY (gravel is fm and sub-angular)	92	0.31	0.37	7.38	
WS3	2	0.50	-	D	Orangish brown gravelly clayey SAND (gravel is fm and sub-angular)	95	0.22	0.27	7.50	
WS4	2	0.50	-	D	Orangish brown slightly gravelly silty CLAY (gravel is fine and sub-angular)	99	0.22	0.27	7.18	
WS4	6	2.00	-	D	Off white CHALK with orange staining	100	0.09	0.10	7.53	
WS6	4	0.85	-	D	Orangish brown clayey gravelly SAND (gravel is fm and angular to sub-angular)	90	0.29	0.35	7.52	

Test Report by K4 SOILS LABORATORY
Unit 8 Olds Close Olds Approach
Watford Herts WD18 9RU
Tel: 01923 711 288
Email: James@k4soils.com

Checked and Approved
Initials **J.P**
Date: **12/10/2016**

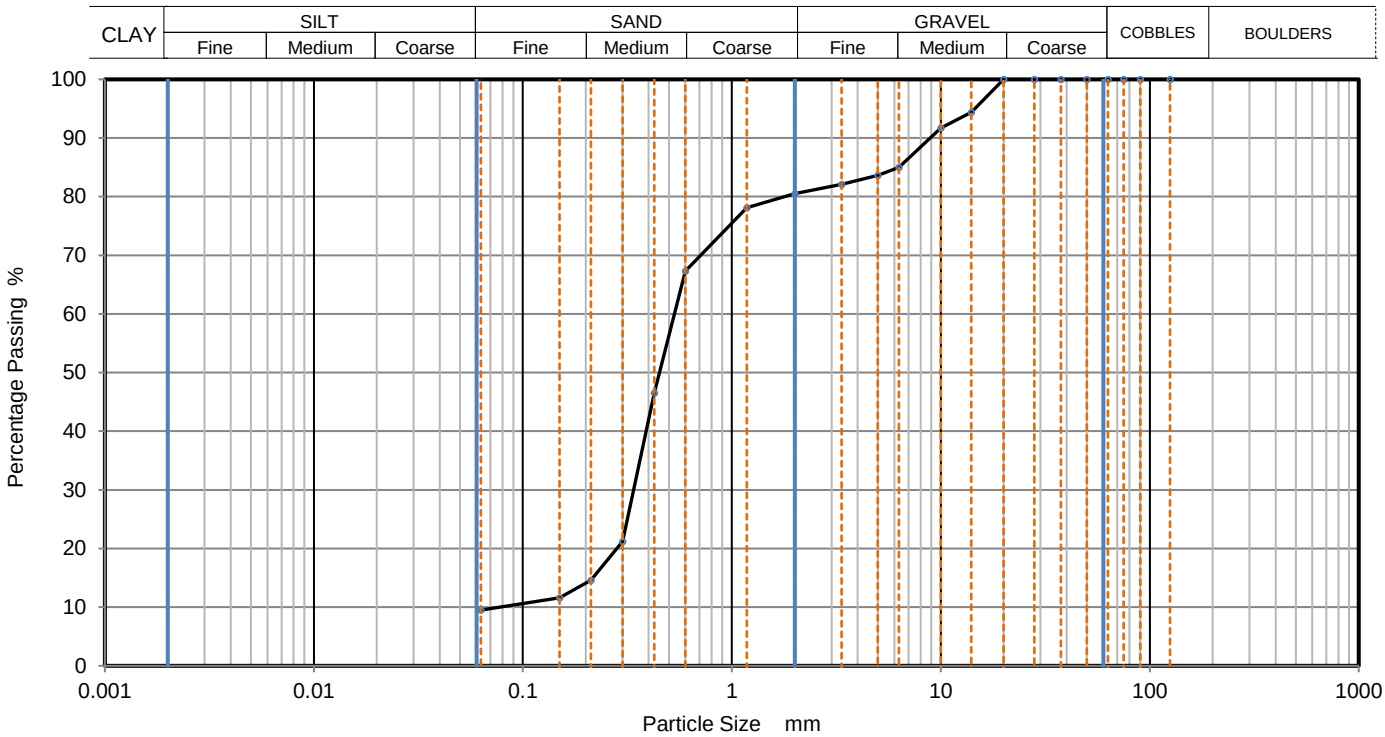
UKAS TESTING 2519

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

MSF-5-R29

PARTICLE SIZE DISTRIBUTION

				Job Ref	21644
				Borehole/Pit No.	WS1
Site Name	Lowfield Road, Caversham, Reading			Sample No.	6
Project No.	GE15373	Client	GESL	Depth	2.00 m
Soil Description	Orangish brown clayey gravelly SAND (gravel is fm and angular to sub-angular)			Sample Type	D
				Samples received	26/09/2016
				Schedules received	26/09/2016
Test Method	BS1377:Part 2: 1990, clause 9.0			Project started	27/09/2016
				Date tested	10/10/2016



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	94		
10	92		
6.3	85		
5	84		
3.35	82		
2	81		
1.18	78		
0.6	67		
0.425	47		
0.3	21		
0.212	15		
0.15	12		
0.063	10		

Dry Mass of sample, g: 224

Sample Proportions	% dry mass
Very coarse	0.0
Gravel	19.5
Sand	71.0
Fines <0.063mm	9.5

Grading Analysis		
D100	mm	
D60	mm	0.531
D30	mm	0.339
D10	mm	0.0775
Uniformity Coefficient		6.9
Curvature Coefficient		2.8

Remarks

Preparation and testing in accordance with BS1377 unless noted below

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Checked and Approved
Initials: J.P
Date: 12/10/2016

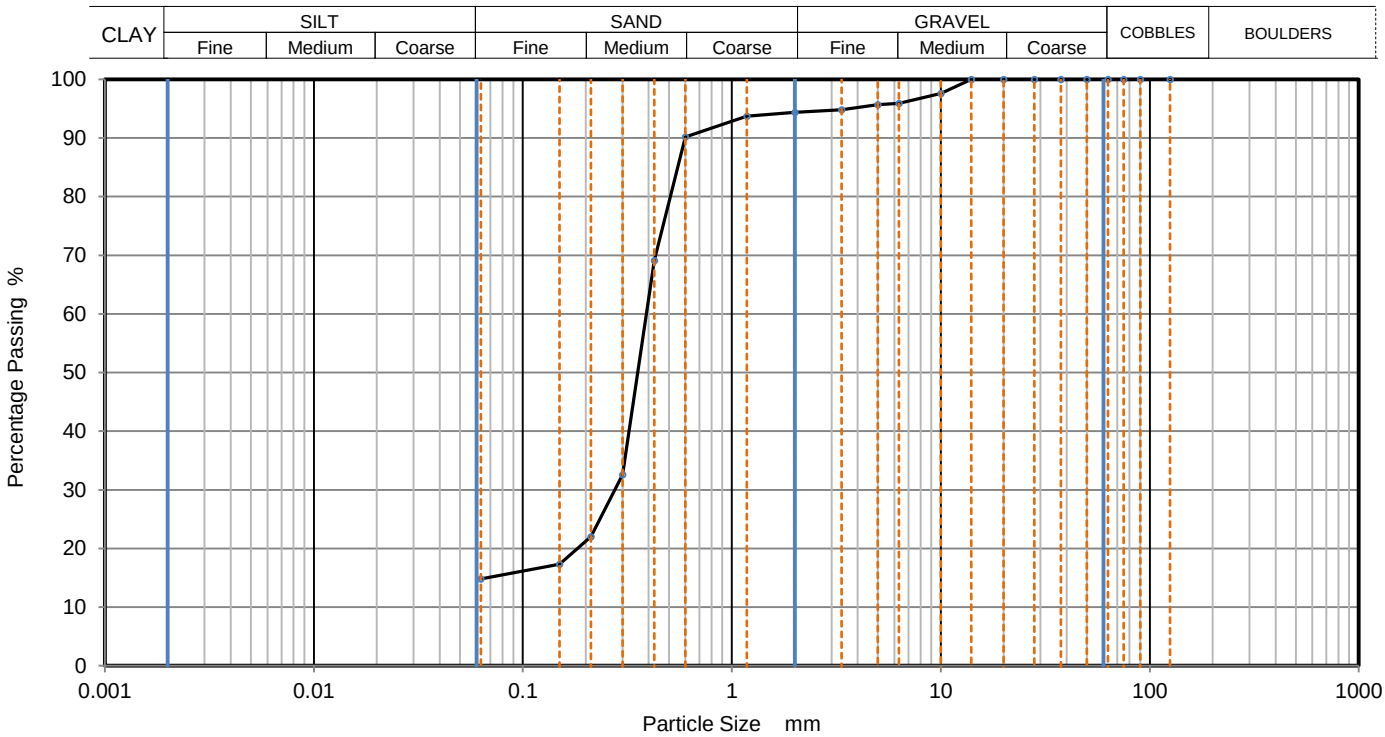
UKAS TESTING 2519

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

MSF-5-R3

PARTICLE SIZE DISTRIBUTION

				Job Ref	21644
				Borehole/Pit No.	WS3
Site Name	Lowfield Road, Caversham, Reading			Sample No.	2
Project No.	GE15373	Client	GESL	Depth	0.50 m
Soil Description	Orangish brown gravelly clayey SAND (gravel is fm and sub-angular)			Sample Type	D
				Samples received	26/09/2016
				Schedules received	26/09/2016
Test Method	BS1377:Part 2: 1990, clause 9.0			Project started	27/09/2016
				Date tested	10/10/2016



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	98		
6.3	96		
5	96		
3.35	95		
2	94		
1.18	94		
0.6	90		
0.425	69		
0.3	33		
0.212	22		
0.15	17		
0.063	15		

Dry Mass of sample, g: 207

Sample Proportions	% dry mass
Very coarse	0.0
Gravel	5.6
Sand	79.6
Fines <0.063mm	14.8

Grading Analysis		
D100	mm	
D60	mm	0.39
D30	mm	0.275
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

Preparation and testing in accordance with BS1377 unless noted below

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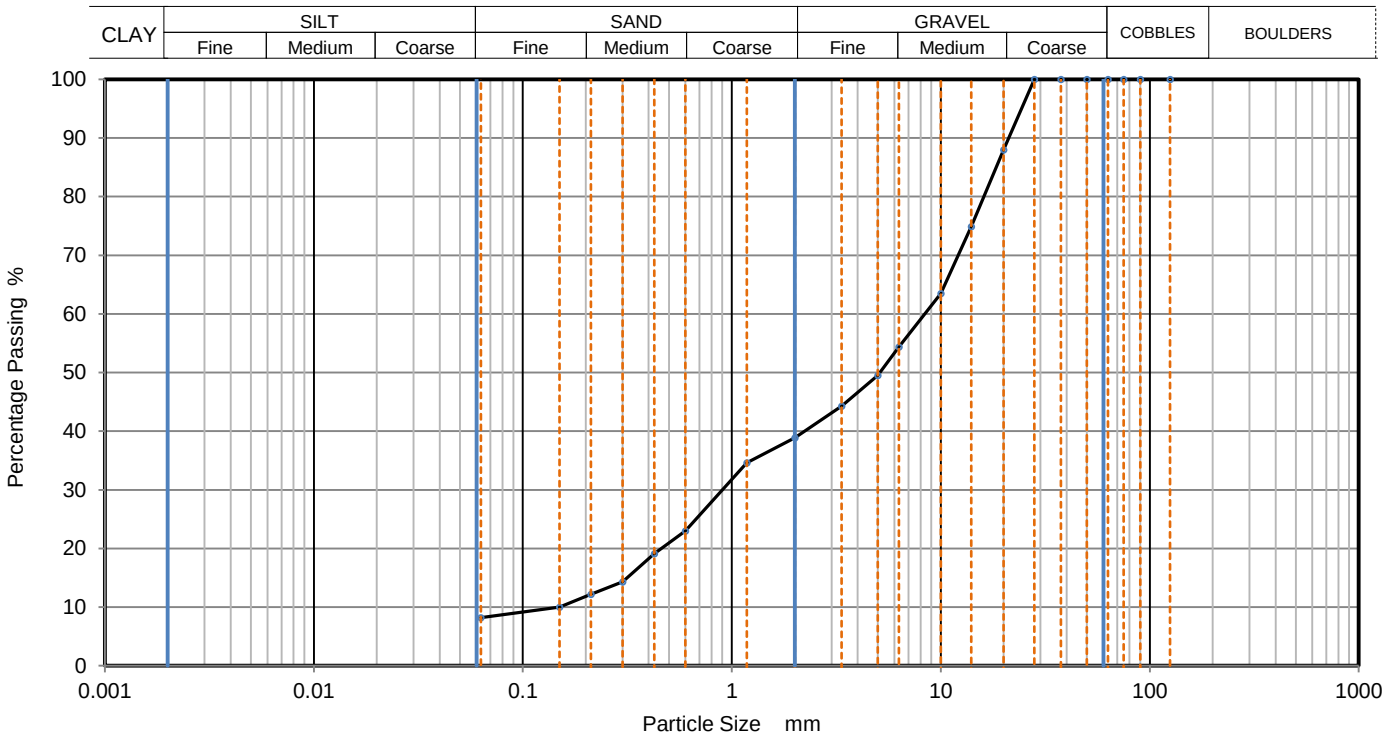
UKAS TESTING 2519

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

MSF-5-R3

PARTICLE SIZE DISTRIBUTION

				Job Ref	21644
				Borehole/Pit No.	WS4
Site Name	Lowfield Road, Caversham, Reading			Sample No.	5
Project No.	GE15373	Client	GESL	Depth	1.50 m
Soil Description	Brown clayey very sandy GRAVEL (gravel is fmc and angular to sub-angular)			Sample Type	D
				Samples received	26/09/2016
				Schedules received	26/09/2016
Test Method	BS1377:Part 2: 1990, clause 9.0			Project started	27/09/2016
				Date tested	10/10/2016



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	88		
14	75		
10	64		
6.3	54		
5	50		
3.35	44		
2	39		
1.18	35		
0.6	23		
0.425	19		
0.3	14		
0.212	12		
0.15	10		
0.063	8		

Dry Mass of sample, g: 310

Sample Proportions	% dry mass
Very coarse	0.0
Gravel	61.1
Sand	30.7
Fines <0.063mm	8.2

Grading Analysis		
D100	mm	
D60	mm	8.38
D30	mm	0.905
D10	mm	0.148
Uniformity Coefficient		57
Curvature Coefficient		0.66

Remarks

Preparation and testing in accordance with BS1377 unless noted below

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Checked and Approved
Initials: J.P
Date: 12/10/2016

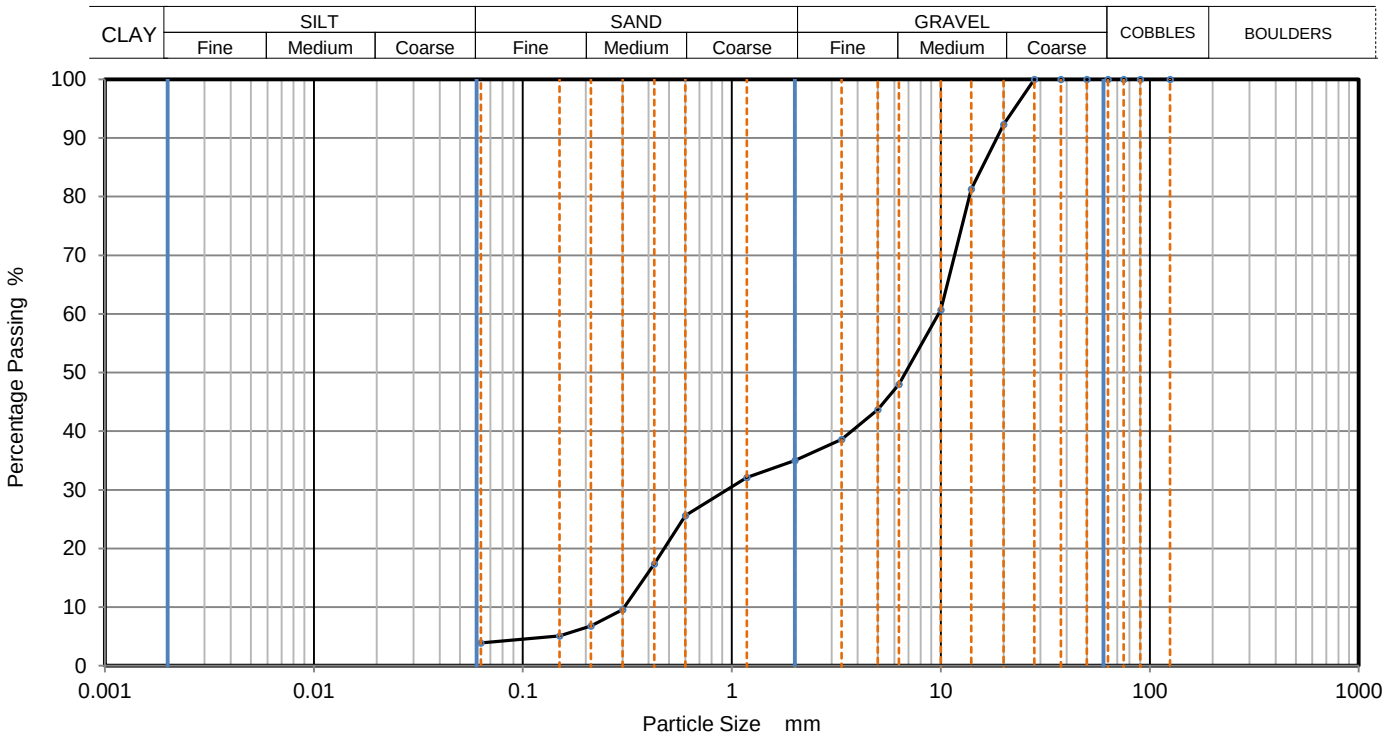
UKAS TESTING 2519

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

MSF-5-R3

PARTICLE SIZE DISTRIBUTION

				Job Ref	21644
				Borehole/Pit No.	WS6
Site Name	Lowfield Road, Caversham, Reading			Sample No.	2
Project No.	GE15373	Client	GESL	Depth	0.50 m
Soil Description	Orangish brown slightly clayey very sandy GRAVEL (gravel is fmc and angular to sub-rounded)			Sample Type	D
				Samples received	26/09/2016
				Schedules received	26/09/2016
Test Method	BS1377:Part 2: 1990, clause 9.0			Project started	27/09/2016
				Date tested	10/10/2016



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	92		
14	81		
10	61		
6.3	48		
5	44		
3.35	39		
2	35		
1.18	32		
0.6	26		
0.425	17		
0.3	10		
0.212	7		
0.15	5		
0.063	4		

Dry Mass of sample, g	422

Sample Proportions	% dry mass
Very coarse	0.0
Gravel	65.0
Sand	31.1
Fines <0.063mm	3.9

Grading Analysis		
D100	mm	
D60	mm	9.74
D30	mm	0.944
D10	mm	0.305
Uniformity Coefficient		32
Curvature Coefficient		0.3

Remarks

Preparation and testing in accordance with BS1377 unless noted below

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Date: 12/10/2016

UKAS TESTING 2519

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MSF-5-R3

Geo-Environmental

APPENDIX D

Geochemical Laboratory Test Results

Unit A2
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2683

THE ENVIRONMENTAL LABORATORY LTD

Analytical Report Number:	16-08702
Issue:	1
Date of Issue:	04/10/2016
Contact:	Laura Legate
Customer Details:	GESL Unit 7 Danworth Farm Hurstpierpoint West SussexBN6 9GL
Quotation No:	Q14-00021
Order No:	1127
Customer Reference:	GE15373
Date Received:	22/09/2016
Date Approved:	04/10/2016
Details:	Lowfield Road, Caversham
Approved by:	

John Wilson, Operations Manager

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

Sample Summary

Report No.: 16-08702

Elab No.	Client's Ref.	Date Sampled	Date Scheduled	Description	Deviations
74249	WS1 0.10	20/09/2016	23/09/2016	Silty loam	c
74250	WS1 0.60	20/09/2016	23/09/2016	Silty loam	c
74251	WS2 0.15	20/09/2016	23/09/2016	Silty loam	c
74252	WS2 0.70	20/09/2016	23/09/2016	Silty loam	
74253	WS2 3.50	20/09/2016	23/09/2016	Chalk	
74254	WS3 0.10	20/09/2016	23/09/2016	Silty loam	c
74255	WS3 0.60	20/09/2016	23/09/2016	Sandy loam	
74256	WS3 3.40	20/09/2016	23/09/2016	Chalk	
74257	WS4 0.20	20/09/2016	23/09/2016	Silty loam	c
74258	WS4 0.60	20/09/2016	23/09/2016	Silty clayey loam	c
74259	WS4 2.10	20/09/2016	23/09/2016	Chalk	
74260	WS5 0.20	20/09/2016	23/09/2016	Silty loam	c
74261	WS5 0.60	20/09/2016	23/09/2016	Silty clayey loam	c
74262	WS5 WAC 0.50	20/09/2016	23/09/2016	Silty loam	
74263	WS6 0.20	20/09/2016	23/09/2016	Silty loam	c
74264	WS6 0.60	20/09/2016	23/09/2016	Sandy loam	c

Results Summary

Report No.: 16-08702

			ELAB Reference	74249	74250	74251	74252	74253	74254
			Customer Reference						
			Sample ID						
			Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
			Sample Location	WS1	WS1	WS2	WS2	WS2	WS3
			Sample Depth (m)	0.10	0.60	0.15	0.70	3.50	0.10
			Sampling Date	20/09/2016	20/09/2016	20/09/2016	20/09/2016	20/09/2016	20/09/2016
Determinand	**Codes**	**Units**	**LOD**						
Metals									
Arsenic	M	mg/kg	1	10.7	17.3	10.9	n/t	n/t	12.2
Barium	U	mg/kg	10	73.2	83.6	235	n/t	n/t	33.6
Beryllium	U	mg/kg	1	< 1.0	1.3	< 1.0	n/t	n/t	< 1.0
Cadmium	M	mg/kg	0.5	< 0.5	< 0.5	< 0.5	n/t	n/t	< 0.5
Chromium	M	mg/kg	5	17.9	34.6	12.3	n/t	n/t	13.5
Copper	M	mg/kg	5	9.6	14.1	6.7	n/t	n/t	8.1
Lead	M	mg/kg	5	17.7	29.0	17.8	n/t	n/t	20.8
Magnesium	U	mg/kg	25	n/t	n/t	n/t	2820	1680	n/t
Mercury	M	mg/kg	0.5	< 0.5	< 0.5	< 0.5	n/t	n/t	< 0.5
Nickel	M	mg/kg	5	13.5	25.0	9.9	n/t	n/t	11.7
Potassium	U	mg/kg	35	n/t	n/t	n/t	2040	178	n/t
Selenium	M	mg/kg	1	< 1.0	< 1.0	< 1.0	n/t	n/t	< 1.0
Sodium	N	mg/kg	70	n/t	n/t	n/t	478	753	n/t
Vanadium	M	mg/kg	5	24.5	48.1	17.7	n/t	n/t	23.7
Zinc	M	mg/kg	5	44.4	53.8	64.7	n/t	n/t	38.7
Anions									
Water Soluble Chloride	M	mg/kg	40	< 40	< 40	< 40	n/t	n/t	< 40
Water Soluble Sulphate	M	g/l	0.02	0.06	0.07	0.03	n/t	n/t	0.03
Inorganics									
Elemental Sulphur	N	mg/kg	20	< 20	< 20	< 20	n/t	n/t	< 20
Ammoniacal Nitrogen as N	N	mg/kg	0.1	n/t	n/t	n/t	< 0.1	< 0.1	n/t
Hexavalent Chromium	N	mg/kg	0.8	< 0.8	< 0.8	< 0.8	n/t	n/t	< 0.8
Total Sulphide	N	mg/kg	2	< 2	< 2	< 2	n/t	n/t	< 2
Total Cyanide	M	mg/kg	1	< 1.0	< 1.0	< 1.0	n/t	n/t	< 1.0
Acid Soluble Sulphate (SO4)	U	%	0.02	0.02	< 0.02	0.03	n/t	n/t	< 0.02
Water Soluble Boron	N	mg/kg	0.5	c < 0.5	c < 0.5	c < 0.5	n/t	n/t	c < 0.5
Miscellaneous									
Acid Neutralisation Capacity	N	mol/kg	0.1	n/t	n/t	n/t	n/t	n/t	n/t
Loss On Ignition (450°C)	M	%	0.01	n/t	n/t	n/t	n/t	n/t	n/t
pH	M	pH units	0.1	7.8	6.8	7.9	n/t	n/t	7.6
Total Organic Carbon	N	%	0.01	0.45	0.29	0.59	n/t	n/t	0.64
E. Coli (Soil)	NS	MPN/g	0	n/t	n/t	n/t	0	0	n/t
Coliforms (Soil)	NS	MPN/g	0	n/t	n/t	n/t	0	0	n/t
Phenols									
Total Phenols	N	mg/kg	6	< 6	< 6	< 6	n/t	n/t	< 6

Tests marked N are not UKAS accredited.
The Environmental Laboratory Ltd. Reg. No. 3882193

Results Summary

Report No.: 16-08702

			ELAB Reference	74249	74250	74251	74252	74253	74254
			Customer Reference						
			Sample ID						
			Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
			Sample Location	WS1	WS1	WS2	WS2	WS2	WS3
			Sample Depth (m)	0.10	0.60	0.15	0.70	3.50	0.10
			Sampling Date	20/09/2016	20/09/2016	20/09/2016	20/09/2016	20/09/2016	20/09/2016
Determinand	**Codes**	**Units**	**LOD**						
Polyaromatic hydrocarbons									
Naphthalene	M	mg/kg	0.1	< 0.1	< 0.1	< 0.1	n/t	n/t	< 0.1
Acenaphthylene	M	mg/kg	0.1	< 0.1	< 0.1	< 0.1	n/t	n/t	< 0.1
Acenaphthene	M	mg/kg	0.1	< 0.1	< 0.1	< 0.1	n/t	n/t	< 0.1
Fluorene	M	mg/kg	0.1	< 0.1	< 0.1	< 0.1	n/t	n/t	< 0.1
Phenanthrene	M	mg/kg	0.1	< 0.1	< 0.1	< 0.1	n/t	n/t	< 0.1
Anthracene	M	mg/kg	0.1	< 0.1	< 0.1	< 0.1	n/t	n/t	< 0.1
Fluoranthene	M	mg/kg	0.1	< 0.1	< 0.1	< 0.1	n/t	n/t	< 0.1
Pyrene	M	mg/kg	0.1	< 0.1	< 0.1	< 0.1	n/t	n/t	< 0.1
Benzo(a)anthracene	M	mg/kg	0.1	< 0.1	< 0.1	< 0.1	n/t	n/t	< 0.1
Chrysene	M	mg/kg	0.1	< 0.1	< 0.1	< 0.1	n/t	n/t	< 0.1
Benzo (b) fluoranthene	M	mg/kg	0.1	< 0.1	< 0.1	< 0.1	n/t	n/t	< 0.1
Benzo(k)fluoranthene	M	mg/kg	0.1	< 0.1	< 0.1	< 0.1	n/t	n/t	< 0.1
Benzo (a) pyrene	M	mg/kg	0.1	< 0.1	< 0.1	< 0.1	n/t	n/t	< 0.1
Indeno (1,2,3-cd) pyrene	M	mg/kg	0.1	< 0.1	< 0.1	< 0.1	n/t	n/t	< 0.1
Dibenzo(a,h)anthracene	M	mg/kg	0.1	< 0.1	< 0.1	< 0.1	n/t	n/t	< 0.1
Benzo[g,h,i]perylene	M	mg/kg	0.1	< 0.1	< 0.1	< 0.1	n/t	n/t	< 0.1
Total PAH(16)	M	mg/kg	0.4	< 0.4	< 0.4	< 0.4	n/t	n/t	< 0.4
Total PAH (Including Coronene)	N	mg/kg	2	n/t	n/t	n/t	n/t	n/t	n/t
BTEX									
Benzene	M	ug/kg	10	< 10.0	< 10.0	< 10.0	n/t	n/t	< 10.0
Toluene	M	ug/kg	10	< 10.0	< 10.0	< 10.0	n/t	n/t	< 10.0
Ethylbenzene	M	ug/kg	10	< 10.0	< 10.0	< 10.0	n/t	n/t	< 10.0
Xylenes	M	ug/kg	10	< 10.0	< 10.0	< 10.0	n/t	n/t	< 10.0
Total BTEX	M	mg/kg	0.01	n/t	n/t	n/t	n/t	n/t	n/t
TPH CWG									
>C5-C6 Aliphatic	N	mg/kg	0.01	< 0.01	< 0.01	< 0.01	n/t	n/t	< 0.01
>C6-C8 Aliphatic	N	mg/kg	0.01	< 0.01	< 0.01	< 0.01	n/t	n/t	< 0.01
>C8-C10 Aliphatic	N	mg/kg	1	< 1.0	< 1.0	< 1.0	n/t	n/t	< 1.0
>C10-C12 Aliphatic	N	mg/kg	1	< 1.0	< 1.0	< 1.0	n/t	n/t	< 1.0
>C12-C16 Aliphatic	N	mg/kg	1	< 1.0	< 1.0	< 1.0	n/t	n/t	< 1.0
>C16-C21 Aliphatic	N	mg/kg	1	< 1.0	< 1.0	< 1.0	n/t	n/t	< 1.0
>C21-C35 Aliphatic	N	mg/kg	1	4.1	< 1.0	< 1.0	n/t	n/t	< 1.0
>C35-C40 Aliphatic	N	mg/kg	1	1.3	< 1.0	< 1.0	n/t	n/t	< 1.0
>C5-C7 Aromatic	N	mg/kg	0.01	< 0.01	< 0.01	< 0.01	n/t	n/t	< 0.01
>C7-C8 Aromatic	N	mg/kg	0.01	< 0.01	< 0.01	< 0.01	n/t	n/t	< 0.01
>C8-C10 Aromatic	N	mg/kg	1	< 1.0	< 1.0	< 1.0	n/t	n/t	< 1.0
>C10-C12 Aromatic	N	mg/kg	1	< 1.0	< 1.0	< 1.0	n/t	n/t	< 1.0
>C12-C16 Aromatic	N	mg/kg	1	< 1.0	< 1.0	< 1.0	n/t	n/t	< 1.0
>C16-C21 Aromatic	N	mg/kg	1	< 1.0	< 1.0	< 1.0	n/t	n/t	< 1.0
>C21-C35 Aromatic	N	mg/kg	1	< 1.0	< 1.0	1.7	n/t	n/t	< 1.0
>C35-C40 Aromatic	N	mg/kg	1	< 1.0	< 1.0	4.1	n/t	n/t	< 1.0
Total (>C5-C40) Ali/Aro	N	mg/kg	1	5.3	< 1.0	5.8	n/t	n/t	< 1.0
Total Petroleum Hydrocarbons									
Mineral Oil	U	mg/kg	5	n/t	n/t	n/t	n/t	n/t	n/t
PCB (ICES 7 congeners)									
PCB (Total of 7 Congeners)	M	mg/kg	0.03	n/t	n/t	n/t	n/t	n/t	n/t

Tests marked N are not UKAS accredited.

Results Summary

Report No.: 16-08702

			ELAB Reference	74255	74256	74257	74258	74259	74260
			Customer Reference						
			Sample ID						
			Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
			Sample Location	WS3	WS3	WS4	WS4	WS4	WS5
			Sample Depth (m)	0.60	3.40	0.20	0.60	2.10	0.20
			Sampling Date	20/09/2016	20/09/2016	20/09/2016	20/09/2016	20/09/2016	20/09/2016
Determinand	**Codes**	**Units**	**LOD**						
Metals									
Arsenic	M	mg/kg	1	n/t	n/t	13.1	15.9	n/t	9.7
Barium	U	mg/kg	10	n/t	n/t	68.7	76.6	n/t	46.2
Beryllium	U	mg/kg	1	n/t	n/t	< 1.0	1.2	n/t	< 1.0
Cadmium	M	mg/kg	0.5	n/t	n/t	< 0.5	< 0.5	n/t	< 0.5
Chromium	M	mg/kg	5	n/t	n/t	21.9	25.0	n/t	17.9
Copper	M	mg/kg	5	n/t	n/t	12.7	18.3	n/t	9.9
Lead	M	mg/kg	5	n/t	n/t	18.6	17.0	n/t	27.1
Magnesium	U	mg/kg	25	2120	1560	n/t	n/t	1430	n/t
Mercury	M	mg/kg	0.5	n/t	n/t	< 0.5	< 0.5	n/t	< 0.5
Nickel	M	mg/kg	5	n/t	n/t	17.2	23.2	n/t	12.1
Potassium	U	mg/kg	35	2190	191	n/t	n/t	411	n/t
Selenium	M	mg/kg	1	n/t	n/t	< 1.0	< 1.0	n/t	< 1.0
Sodium	N	mg/kg	70	340	780	n/t	n/t	527	n/t
Vanadium	M	mg/kg	5	n/t	n/t	33.8	41.6	n/t	28.1
Zinc	M	mg/kg	5	n/t	n/t	53.3	46.4	n/t	53.4
Anions									
Water Soluble Chloride	M	mg/kg	40	n/t	n/t	52	< 40	n/t	< 40
Water Soluble Sulphate	M	g/l	0.02	n/t	n/t	0.02	0.05	n/t	0.06
Inorganics									
Elemental Sulphur	N	mg/kg	20	n/t	n/t	< 20	< 20	n/t	< 20
Ammoniacal Nitrogen as N	N	mg/kg	0.1	< 0.1	< 0.1	n/t	n/t	< 0.1	n/t
Hexavalent Chromium	N	mg/kg	0.8	n/t	n/t	< 0.8	< 0.8	n/t	< 0.8
Total Sulphide	N	mg/kg	2	n/t	n/t	< 2	< 2	n/t	< 2
Total Cyanide	M	mg/kg	1	n/t	n/t	< 1.0	< 1.0	n/t	< 1.0
Acid Soluble Sulphate (SO4)	U	%	0.02	n/t	n/t	0.04	0.04	n/t	0.06
Water Soluble Boron	N	mg/kg	0.5	n/t	n/t	c < 0.5	c < 0.5	n/t	c < 0.5
Miscellaneous									
Acid Neutralisation Capacity	N	mol/kg	0.1	n/t	n/t	n/t	n/t	n/t	n/t
Loss On Ignition (450°C)	M	%	0.01	n/t	n/t	n/t	n/t	n/t	n/t
pH	M	pH units	0.1	n/t	n/t	7.2	7.6	n/t	7.1
Total Organic Carbon	N	%	0.01	n/t	n/t	0.16	0.35	n/t	1.0
E. Coli (Soil)	NS	MPN/g	0	0	0	n/t	n/t	0	n/t
Coliforms (Soil)	NS	MPN/g	0	0	0	n/t	n/t	0	n/t
Phenols									
Total Phenols	N	mg/kg	6	n/t	n/t	< 6	< 6	n/t	< 6

Tests marked N are not UKAS accredited.

Results Summary

Report No.: 16-08702

			ELAB Reference	74255	74256	74257	74258	74259	74260
			Customer Reference						
			Sample ID						
			Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
			Sample Location	WS3	WS3	WS4	WS4	WS4	WS5
			Sample Depth (m)	0.60	3.40	0.20	0.60	2.10	0.20
			Sampling Date	20/09/2016	20/09/2016	20/09/2016	20/09/2016	20/09/2016	20/09/2016
Determinand	**Codes**	**Units**	**LOD**						
Polyaromatic hydrocarbons									
Naphthalene	M	mg/kg	0.1	n/t	n/t	< 0.1	< 0.1	n/t	< 0.1
Acenaphthylene	M	mg/kg	0.1	n/t	n/t	< 0.1	< 0.1	n/t	< 0.1
Acenaphthene	M	mg/kg	0.1	n/t	n/t	< 0.1	< 0.1	n/t	< 0.1
Fluorene	M	mg/kg	0.1	n/t	n/t	< 0.1	< 0.1	n/t	< 0.1
Phenanthrene	M	mg/kg	0.1	n/t	n/t	< 0.1	< 0.1	n/t	< 0.1
Anthracene	M	mg/kg	0.1	n/t	n/t	< 0.1	< 0.1	n/t	< 0.1
Fluoranthene	M	mg/kg	0.1	n/t	n/t	< 0.1	< 0.1	n/t	< 0.1
Pyrene	M	mg/kg	0.1	n/t	n/t	< 0.1	< 0.1	n/t	< 0.1
Benzo(a)anthracene	M	mg/kg	0.1	n/t	n/t	< 0.1	< 0.1	n/t	< 0.1
Chrysene	M	mg/kg	0.1	n/t	n/t	< 0.1	< 0.1	n/t	< 0.1
Benzo (b) fluoranthene	M	mg/kg	0.1	n/t	n/t	< 0.1	< 0.1	n/t	< 0.1
Benzo(k)fluoranthene	M	mg/kg	0.1	n/t	n/t	< 0.1	< 0.1	n/t	< 0.1
Benzo (a) pyrene	M	mg/kg	0.1	n/t	n/t	< 0.1	< 0.1	n/t	< 0.1
Indeno (1,2,3-cd) pyrene	M	mg/kg	0.1	n/t	n/t	< 0.1	< 0.1	n/t	< 0.1
Dibenzo(a,h)anthracene	M	mg/kg	0.1	n/t	n/t	< 0.1	< 0.1	n/t	< 0.1
Benzo[g,h,i]perylene	M	mg/kg	0.1	n/t	n/t	< 0.1	< 0.1	n/t	< 0.1
Total PAH(16)	M	mg/kg	0.4	n/t	n/t	< 0.4	< 0.4	n/t	< 0.4
Total PAH (Including Coronene)	N	mg/kg	2	n/t	n/t	n/t	n/t	n/t	n/t
BTEX									
Benzene	M	ug/kg	10	n/t	n/t	< 10.0	< 10.0	n/t	< 10.0
Toluene	M	ug/kg	10	n/t	n/t	< 10.0	< 10.0	n/t	< 10.0
Ethylbenzene	M	ug/kg	10	n/t	n/t	< 10.0	< 10.0	n/t	< 10.0
Xylenes	M	ug/kg	10	n/t	n/t	< 10.0	< 10.0	n/t	< 10.0
Total BTEX	M	mg/kg	0.01	n/t	n/t	n/t	n/t	n/t	n/t
TPH CWG									
>C5-C6 Aliphatic	N	mg/kg	0.01	n/t	n/t	< 0.01	< 0.01	n/t	< 0.01
>C6-C8 Aliphatic	N	mg/kg	0.01	n/t	n/t	< 0.01	< 0.01	n/t	< 0.01
>C8-C10 Aliphatic	N	mg/kg	1	n/t	n/t	< 1.0	< 1.0	n/t	< 1.0
>C10-C12 Aliphatic	N	mg/kg	1	n/t	n/t	< 1.0	< 1.0	n/t	< 1.0
>C12-C16 Aliphatic	N	mg/kg	1	n/t	n/t	< 1.0	< 1.0	n/t	< 1.0
>C16-C21 Aliphatic	N	mg/kg	1	n/t	n/t	< 1.0	< 1.0	n/t	< 1.0
>C21-C35 Aliphatic	N	mg/kg	1	n/t	n/t	< 1.0	< 1.0	n/t	< 1.0
>C35-C40 Aliphatic	N	mg/kg	1	n/t	n/t	< 1.0	< 1.0	n/t	< 1.0
>C5-C7 Aromatic	N	mg/kg	0.01	n/t	n/t	< 0.01	< 0.01	n/t	< 0.01
>C7-C8 Aromatic	N	mg/kg	0.01	n/t	n/t	< 0.01	< 0.01	n/t	< 0.01
>C8-C10 Aromatic	N	mg/kg	1	n/t	n/t	< 1.0	< 1.0	n/t	< 1.0
>C10-C12 Aromatic	N	mg/kg	1	n/t	n/t	< 1.0	< 1.0	n/t	< 1.0
>C12-C16 Aromatic	N	mg/kg	1	n/t	n/t	< 1.0	< 1.0	n/t	< 1.0
>C16-C21 Aromatic	N	mg/kg	1	n/t	n/t	< 1.0	< 1.0	n/t	< 1.0
>C21-C35 Aromatic	N	mg/kg	1	n/t	n/t	< 1.0	< 1.0	n/t	< 1.0
>C35-C40 Aromatic	N	mg/kg	1	n/t	n/t	< 1.0	< 1.0	n/t	< 1.0
Total (>C5-C40) Ali/Aro	N	mg/kg	1	n/t	n/t	< 1.0	< 1.0	n/t	< 1.0
Total Petroleum Hydrocarbons									
Mineral Oil	U	mg/kg	5	n/t	n/t	n/t	n/t	n/t	n/t
PCB (ICES 7 congeners)									
PCB (Total of 7 Congeners)	M	mg/kg	0.03	n/t	n/t	n/t	n/t	n/t	n/t

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Results Summary

Report No.: 16-08702

			ELAB Reference	74261	74262	74263	74264
			Customer Reference		WAC		
			Sample ID				
			Sample Type	SOIL	SOIL	SOIL	SOIL
			Sample Location	WS5	WS5	WS6	WS6
			Sample Depth (m)	0.60	0.50	0.20	0.60
			Sampling Date	20/09/2016	20/09/2016	20/09/2016	20/09/2016
Determinand	**Codes**	**Units**	**LOD**				
Metals							
Arsenic	M	mg/kg	1	13.6	n/t	12.9	13.4
Barium	U	mg/kg	10	63.1	n/t	47.1	28.6
Beryllium	U	mg/kg	1	< 1.0	n/t	< 1.0	< 1.0
Cadmium	M	mg/kg	0.5	< 0.5	n/t	< 0.5	< 0.5
Chromium	M	mg/kg	5	28.0	n/t	23.9	13.1
Copper	M	mg/kg	5	10.9	n/t	9.2	7.7
Lead	M	mg/kg	5	13.6	n/t	13.5	7.0
Magnesium	U	mg/kg	25	n/t	n/t	n/t	n/t
Mercury	M	mg/kg	0.5	< 0.5	n/t	< 0.5	< 0.5
Nickel	M	mg/kg	5	22.5	n/t	17.9	16.7
Potassium	U	mg/kg	35	n/t	n/t	n/t	n/t
Selenium	M	mg/kg	1	< 1.0	n/t	< 1.0	< 1.0
Sodium	N	mg/kg	70	n/t	n/t	n/t	n/t
Vanadium	M	mg/kg	5	38.5	n/t	42.7	23.9
Zinc	M	mg/kg	5	43.0	n/t	44.2	27.7
Anions							
Water Soluble Chloride	M	mg/kg	40	< 40	n/t	< 40	< 40
Water Soluble Sulphate	M	g/l	0.02	0.10	n/t	< 0.02	< 0.02
Inorganics							
Elemental Sulphur	N	mg/kg	20	< 20	n/t	< 20	< 20
Ammoniacal Nitrogen as N	N	mg/kg	0.1	n/t	n/t	n/t	n/t
Hexavalent Chromium	N	mg/kg	0.8	< 0.8	n/t	< 0.8	< 0.8
Total Sulphide	N	mg/kg	2	< 2	n/t	< 2	< 2
Total Cyanide	M	mg/kg	1	< 1.0	n/t	< 1.0	< 1.0
Acid Soluble Sulphate (SO4)	U	%	0.02	0.07	n/t	0.04	0.02
Water Soluble Boron	N	mg/kg	0.5	c < 0.5	n/t	c < 0.5	c < 0.5
Miscellaneous							
Acid Neutralisation Capacity	N	mol/kg	0.1	n/t	< 0.1	n/t	n/t
Loss On Ignition (450°C)	M	%	0.01	n/t	1.99	n/t	n/t
pH	M	pH units	0.1	6.9	6.6	7.4	8.0
Total Organic Carbon	N	%	0.01	0.41	0.49	0.36	0.11
E. Coli (Soil)	NS	MPN/g	0	n/t	n/t	n/t	n/t
Coliforms (Soil)	NS	MPN/g	0	n/t	n/t	n/t	n/t
Phenols							
Total Phenols	N	mg/kg	6	< 6	n/t	< 6	< 6

Results Summary

Report No.: 16-08702

			ELAB Reference	74261	74262	74263	74264
			Customer Reference		WAC		
			Sample ID				
			Sample Type	SOIL	SOIL	SOIL	SOIL
			Sample Location	WS5	WS5	WS6	WS6
			Sample Depth (m)	0.60	0.50	0.20	0.60
			Sampling Date	20/09/2016	20/09/2016	20/09/2016	20/09/2016
Determinand	**Codes**	**Units**	**LOD**				
Polyaromatic hydrocarbons							
Naphthalene	M	mg/kg	0.1	< 0.1	n/t	< 0.1	< 0.1
Acenaphthylene	M	mg/kg	0.1	< 0.1	n/t	< 0.1	< 0.1
Acenaphthene	M	mg/kg	0.1	< 0.1	n/t	< 0.1	< 0.1
Fluorene	M	mg/kg	0.1	< 0.1	n/t	< 0.1	< 0.1
Phenanthrene	M	mg/kg	0.1	< 0.1	n/t	< 0.1	< 0.1
Anthracene	M	mg/kg	0.1	< 0.1	n/t	< 0.1	< 0.1
Fluoranthene	M	mg/kg	0.1	< 0.1	n/t	< 0.1	< 0.1
Pyrene	M	mg/kg	0.1	< 0.1	n/t	< 0.1	< 0.1
Benzo(a)anthracene	M	mg/kg	0.1	< 0.1	n/t	< 0.1	< 0.1
Chrysene	M	mg/kg	0.1	< 0.1	n/t	< 0.1	< 0.1
Benzo (b) fluoranthene	M	mg/kg	0.1	< 0.1	n/t	< 0.1	< 0.1
Benzo(k)fluoranthene	M	mg/kg	0.1	< 0.1	n/t	< 0.1	< 0.1
Benzo (a) pyrene	M	mg/kg	0.1	< 0.1	n/t	< 0.1	< 0.1
Indeno (1,2,3-cd) pyrene	M	mg/kg	0.1	< 0.1	n/t	< 0.1	< 0.1
Dibenzo(a,h)anthracene	M	mg/kg	0.1	< 0.1	n/t	< 0.1	< 0.1
Benzo[g,h,i]perylene	M	mg/kg	0.1	< 0.1	n/t	< 0.1	< 0.1
Total PAH(16)	M	mg/kg	0.4	< 0.4	n/t	< 0.4	< 0.4
Total PAH (Including Coronene)	N	mg/kg	2	n/t	< 2	n/t	n/t
BTEX							
Benzene	M	ug/kg	10	< 10.0	n/t	< 10.0	< 10.0
Toluene	M	ug/kg	10	< 10.0	n/t	< 10.0	< 10.0
Ethylbenzene	M	ug/kg	10	< 10.0	n/t	< 10.0	< 10.0
Xylenes	M	ug/kg	10	< 10.0	n/t	< 10.0	< 10.0
Total BTEX	M	mg/kg	0.01	n/t	< 0.01	n/t	n/t
TPH CWG							
>C5-C6 Aliphatic	N	mg/kg	0.01	< 0.01	n/t	< 0.01	< 0.01
>C6-C8 Aliphatic	N	mg/kg	0.01	< 0.01	n/t	< 0.01	< 0.01
>C8-C10 Aliphatic	N	mg/kg	1	< 1.0	n/t	< 1.0	< 1.0
>C10-C12 Aliphatic	N	mg/kg	1	< 1.0	n/t	< 1.0	< 1.0
>C12-C16 Aliphatic	N	mg/kg	1	< 1.0	n/t	< 1.0	< 1.0
>C16-C21 Aliphatic	N	mg/kg	1	< 1.0	n/t	< 1.0	< 1.0
>C21-C35 Aliphatic	N	mg/kg	1	< 1.0	n/t	< 1.0	< 1.0
>C35-C40 Aliphatic	N	mg/kg	1	< 1.0	n/t	< 1.0	< 1.0
>C5-C7 Aromatic	N	mg/kg	0.01	< 0.01	n/t	< 0.01	< 0.01
>C7-C8 Aromatic	N	mg/kg	0.01	< 0.01	n/t	< 0.01	< 0.01
>C8-C10 Aromatic	N	mg/kg	1	< 1.0	n/t	< 1.0	< 1.0
>C10-C12 Aromatic	N	mg/kg	1	< 1.0	n/t	< 1.0	< 1.0
>C12-C16 Aromatic	N	mg/kg	1	< 1.0	n/t	< 1.0	< 1.0
>C16-C21 Aromatic	N	mg/kg	1	< 1.0	n/t	< 1.0	< 1.0
>C21-C35 Aromatic	N	mg/kg	1	< 1.0	n/t	< 1.0	< 1.0
>C35-C40 Aromatic	N	mg/kg	1	< 1.0	n/t	< 1.0	< 1.0
Total (>C5-C40) Ali/Aro	N	mg/kg	1	< 1.0	n/t	< 1.0	< 1.0
Total Petroleum Hydrocarbons							
Mineral Oil	U	mg/kg	5	n/t	< 5	n/t	n/t
PCB (ICES 7 congeners)							
PCB (Total of 7 Congeners)	M	mg/kg	0.03	n/t	< 0.03	n/t	n/t

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The Environmental Laboratory Ltd. Reg. No. 3882193

Results Summary

Report No.: 16-08702

WAC Analysis								
Elab Ref:	74262					**Landfill Waste Acceptance Criteria Limits**		
Sample Date:	20/09/2016					**Inert Waste Landfill**	**Stable Non-reactive Hazardous waste in non-hazardous Landfill**	**Hazardous Waste Landfill**
Sample ID:	WS5 WAC							
Depth (m)	0.5							
Site:	Lowfield Road, Caversham							
Determinand		**Code**	**Units**					
Total Organic Carbon		N	%		0.49	3	5	6
Loss on Ignition		M	%		2.0	--	--	10
Total BTEX		M	mg/kg		< 0.01	6	--	--
Total PCBs (7 congeners)		M	mg/kg		< 0.03	1	--	--
TPH Total WAC		M	mg/kg		< 5	500	--	--
Total (of 17) PAHs		N	mg/kg		< 2	100	--	--
pH		M			6.6	--	>6	--
Acid Neutralisation Capacity		N	mol/kg		< 0.1	--	To evaluate	To evaluate
Eluate Analysis			**10:1**		**10:1**	**Limit values for compliance leaching test using BS EN 12457-2 at L/S 10 l/kg**		
			mg/l		**mg/kg**			
Arsenic		N	< 0.005		< 0.05	0.5	2	25
Barium		N	0.006		0.06	20	100	300
Cadmium		N	< 0.001		< 0.01	0.04	1	5
Chromium		N	< 0.005		< 0.05	0.5	10	70
Copper		N	< 0.005		< 0.05	2	50	100
Mercury		N	< 0.005		< 0.01	0.01	0.2	2
Molybdenum		N	< 0.005		< 0.05	0.5	10	30
Nickel		N	0.002		< 0.05	0.4	10	40
Lead		N	0.001		< 0.05	0.5	10	50
Antimony		N	< 0.005		< 0.05	0.06	0.7	5
Selenium		N	< 0.005		< 0.05	0.1	0.5	7
Zinc		N	0.009		0.09	4	50	200
Chloride		N	< 5		< 50	800	15000	25000
Fluoride		N	< 5		< 10	10	150	500
Sulphate		N	11		115.00	1000	20000	50000
Total Dissolved Solids		N	40		400.00	4000	60000	100000
Phenol Index		N	< 0.01		< 0.10	1	-	-
Dissolved Organic Carbon		N	27.000		270.00	500	800	1000
Leach Test Information								
pH		N	7.6					
Conductivity (uS/cm)		N	68					
Dry mass of test portion (g)			100.000					
Dry Matter (%)			83					
Moisture (%)			21					
Eluent Volume (ml)			952					

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

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Results Summary

Report No.: 16-08702

Asbestos Qualitative Results

Analytical result only applies to the sample as submitted by the client. Any comments, opinions or interpretations (marked #) in this report are outside UKAS accreditation (Accreditation No2683). They are subjective comments only which must be verified by the client.

Elab No	Depth (m)	Clients Reference	Description of Sample Matrix #	Result
74249	0.10	WS1	Silty loam	No asbestos detected
74250	0.60	WS1	Silty loam	No asbestos detected
74251	0.15	WS2	Silty loam	No asbestos detected
74252	0.70	WS2	Silty loam	No asbestos detected
74254	0.10	WS3	Silty loam	No asbestos detected
74255	0.60	WS3	Sandy loam	No asbestos detected
74257	0.20	WS4	Silty loam	No asbestos detected
74258	0.60	WS4	Silty clayey loam	No asbestos detected
74259	2.10	WS4	Chalk	No asbestos detected
74260	0.20	WS5	Silty loam	No asbestos detected
74261	0.60	WS5	Silty clayey loam	No asbestos detected
74263	0.20	WS6	Silty loam	No asbestos detected
74264	0.60	WS6	Sandy loam	No asbestos detected

Method Summary

Report No.: 16-08702

Parameter	Codes	Analysis Undertaken On	Date Tested	Method Number	Technique
Soil					
Ammonia in soil	N	As submitted sample	27/09/2016		
Sulphide	N	As submitted sample	27/09/2016	109	Colorimetry
Hexavalent chromium	N	As submitted sample	28/09/2016	110	Colorimetry
Acid Soluble Sulphate	U	Air dried sample	28/09/2016	115	Ion Chromatography
Aqua regia extractable metals	M	Air dried sample	27/09/2016	118	ICPMS
Phenols in solids	N	As submitted sample	27/09/2016	121	HPLC
Elemental Sulphur	N	Air dried sample	27/09/2016	122	HPLC
PAH (GC-FID)	M	As submitted sample	26/09/2016	133	GC-FID
Water soluble anions	M	Air dried sample	27/09/2016	172	Ion Chromatography
Water soluble boron	N	Air dried sample	27/09/2016	202	Colorimetry
Total cyanide	M	As submitted sample	28/09/2016	204	Colorimetry
Aliphatic hydrocarbons in soil	N	As submitted sample	26/09/2016	214	GC-FID
Aliphatic/Aromatic hydrocarbons in soil	N	As submitted sample	27/09/2016	214	GC-FID
Aromatic hydrocarbons in soil	N	As submitted sample	26/09/2016	214	GC-FID
Low range Aliphatic hydrocarbons soil	N	As submitted sample	27/09/2016	214	GC-MS
Low range Aromatic hydrocarbons soil	N	As submitted sample	27/09/2016	214	GC-MS
Asbestos identification	U	As submitted sample	26/09/2016	PMAN	Microscopy
Leachate					
Arsenic*	N		28/09/2016	101	ICPMS
Cadmium*	N		28/09/2016	101	ICPMS
Chromium*	N		28/09/2016	101	ICPMS
Lead*	N		28/09/2016	101	ICPMS
Nickel*	N		28/09/2016	101	ICPMS
Copper*	N		28/09/2016	101	ICPMS
Zinc*	N		28/09/2016	101	ICPMS
Mercury*	N		28/09/2016	101	ICPMS
Selenium*	N		28/09/2016	101	ICPMS
Antimony	N		28/09/2016	101	ICPMS
Barium*	N		28/09/2016	101	ICPMS
Molybdenum*	N		28/09/2016	101	ICPMS
pH Value*	N		28/09/2016	113	Electrometric
Electrical Conductivity*	N		28/09/2016	136	Probe
Dissolved Organic Carbon	N		28/09/2016	102	TOC analyser
Chloride*	N		28/09/2016	131	Ion Chromatography
Fluoride*	N		28/09/2016	131	Ion Chromatography
Sulphate*	N		28/09/2016	131	Ion Chromatography
Total Dissolved Solids	N		28/09/2016	144	Gravimetric
Phenol index	N		28/09/2016	121	HPLC
WAC Solids analysis	N				
pH Value**	M	Air dried sample	28/09/2016	113	Electrometric
Total Organic Carbon	N	Air dried sample	27/09/2016	210	IR
Loss on Ignition**	M	Air dried sample	28/09/2016	129	Gravimetric
Acid Neutralization Capacity to pH 7	N	Air dried sample	28/09/2016	NEN 737	Electrometric
Total BTEX**	M	As submitted sample	27/09/2016	181	GCMS
Mineral Oil**	U	As submitted sample	26/09/2016	117	GCFID
Total PCBs (7 congeners)	M	Air dried sample	26/09/2016	120	GCMS
Total PAH (17)**	N	As submitted sample	27/09/2016	133	GCFID

Tests marked N are not UKAS accredited

Report Information

Report No.: 16-08702

Key

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

Soil sample results are expressed on an air dried basis
Comments or interpretations are beyond the scope of UKAS accreditation
The results relate only to the items tested
PCB congener results may include any coeluting PCBs
Uncertainty of measurement for the determinands tested are available upon request

Deviation Codes

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

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

Sample Retention and Disposal

All soil samples will be retained for a period of one month
All water samples will be retained for 7 days following the date of the test report
Charges may apply to extended sample storage

Geo-Environmental

APPENDIX E

Ground Gas Monitoring and Assessment

Project: Lowfield Road, Reading
Ref: GE15373
Client: Reading Borough Council

Geo-Environmental

Location	Date	Time (sec)	CH_4 (%)	CO_2 (%)	O_2 (%)	Flow (l/hr)	VOC (ppm)	Pressure (mb)	GWL (m bgl)	GSV/Qhgs		Characteristic Situation		CS1 Limiting Value Check			NHBC			
										CH_4	CO_2	BS8485 & C665		Flow	CH_4	CO_2	CH_4		CO_2	
												CH_4	CO_2				GSV	Conc.	GSV	Conc.
WS1	28-09-16	10	0.0	3.8	17.0	0.0	0.0	1020	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS1	28-09-16	20	0.0	3.8	16.9	0.0	0.00	1020	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS1	28-09-16	30	0.0	3.9	16.9	0.0	0.00	1020	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS1	28-09-16	60	0.0	3.9	16.8	0.0	0.00	1020	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS1	28-09-16	120	0.0	3.9	16.8	0.0	0.00	1020	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS4	28-09-16	10	0.0	2.9	17.3	0.0	0.0	1020	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS4	28-09-16	20	0.0	2.9	17.1	0.0	0.00	1020	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS4	28-09-16	30	0.0	3.0	17.1	0.0	0.00	1020	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS4	28-09-16	60	0.0	3.0	17.0	0.0	0.00	1020	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS4	28-09-16	120	0.0	3.1	16.9	0.0	0.00	1020	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS1	19-10-16	10	0.0	0.8	21.0	0.0	0.0	1017	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS1	19-10-16	20	0.0	0.7	20.4	0.0	0.00	1017	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS1	19-10-16	30	0.0	0.5	20.5	0.0	0.00	1017	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS1	19-10-16	60	0.0	0.3	20.7	0.0	0.00	1017	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS1	19-10-16	120	0.0	0.0	20.8	0.0	0.00	1017	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS4	19-10-16	10	0.0	0.0	21.1	0.0	0.0	1017	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS4	19-10-16	20	0.0	0.0	21.1	0.0	0.00	1017	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS4	19-10-16	30	0.0	0.0	21.1	0.0	0.00	1017	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS4	19-10-16	60	0.0	0.0	21.1	0.0	0.00	1017	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS4	19-10-16	120	0.0	0.0	21.1	0.0	0.00	1017	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS6	19-10-16	10	0.0	0.0	21.1	0.0	0.0	1017	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS6	19-10-16	20	0.0	0.0	21.1	0.0	0.00	1017	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS6	19-10-16	30	0.0	0.0	21.1	0.0	0.00	1017	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS6	19-10-16	60	0.0	0.0	21.1	0.0	0.00	1017	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS6	19-10-16	120	0.0	0.0	21.1	0.0	0.00	1017	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS1	26-10-16	10	0.0	0.4	20.2	0.0	0.0	1020	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS1	26-10-16	20	0.0	0.5	20.0	0.0	0.00	1020	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS1	26-10-16	30	0.0	0.6	19.8	0.0	0.00	1020	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS1	26-10-16	60	0.0	0.8	19.8	0.0	0.00	1020	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS1	26-10-16	120	0.0	0.8	19.4	0.0	0.00	1020	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS4	26-10-16	10	0.0	0.3	20.1	0.0	0.0	1020	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS4	26-10-16	20	0.0	0.3	20.0	0.0	0.00	1020	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS4	26-10-16	30	0.0	0.3	19.9	0.0	0.00	1020	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS4	26-10-16	60	0.0	0.4	19.9	0.0	0.00	1020	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS4	26-10-16	120	0.0	0.4	19.8	0.0	0.00	1020	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS6	26-10-16	10	0.0	0.9	19.2	0.0	0.0	1020	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS6	26-10-16	20	0.0	1.2	19.0	0.0	0.00	1020	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS6	26-10-16	30	0.0	1.4	18.7	0.0	0.00	1020	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS6	26-10-16	60	0.0	1.5	18.5	0.0	0.00	1020	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS6	26-10-16	120	0.0	1.8	18.7	0.0	0.00	1020	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS1	11-11-16	10	0.0	0.3	21.3	0.0	0.0	1007	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS1	11-11-16	20	0.0	0.3	21.3	0.0	0.00	1007	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS1	11-11-16	30	0.0	0.2	21.2	0.0	0.00	1007	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS1	11-11-16	60	0.0	0.1	21.3	0.0	0.00	1007	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS1	11-11-16	120	0.0	0.0	21.5	0.0	0.00	1007	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS4	11-11-16	10	0.0	0.4	21.3	0.1	0.0	1008	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS4	11-11-16	20	0.0	0.3	21.0	0.1	0.00	1008	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS4	11-11-16	30	0.0	0.3	21.1	0.1	0.00	1008	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS4	11-11-16	60	0.0	0.3	21.1	0.1	0.00	1008	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS4	11-11-16	120	0.0	0.3	21.1	0.1	0.00	1008	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS6	11-11-16	10	0.0	1.0	21.2	0.0	0.0	1008	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS6	11-11-16	20	0.0	1.4	20.7	0.0	0.00	1008	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS6	11-11-16	30	0.0	1.4	20.2	0.0	0.00	1008	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS6	11-11-16	60	0.0	1.8	19.8	0.0	0.00	1008	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN

Project: Lowfield Road, Reading
Ref: GE15373
Client: Reading Borough Council

Geo-Environmental

Location	Date	Time (sec)	CH_4 (%)	CO_2 (%)	O_2 (%)	Flow (l/hr)	VOC (ppm)	Pressure (mb)	GWL (m bgl)	GSV/Qhgs		Characteristic Situation		CS1 Limiting Value Check			NHBC			
										CH_4	CO_2	BS8485 & C665		Flow	CH_4	CO_2	CH_4		CO_2	
												CH_4	CO_2				GSV	Conc.	GSV	Conc.
WS6	11-11-16	120	0.0	2.4	19.2	0.0	0.00	1008	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS1	22-11-16	10	0.0	0.3	21.2	0.0		989	DRY	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS1	22-11-16	20	0.0	0.2	21.9	0.0	-	989	DRY	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS1	22-11-16	30	0.0	0.2	21.9	0.0	-	989	DRY	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS1	22-11-16	60	0.0	0.2	21.8	0.0	-	989	DRY	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS1	22-11-16	120	0.0	0.1	21.9	0.0	-	989	DRY	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS4	22-11-16	10	0.0	0.5	21.2	0.1		989	Dry	0.000	0.001	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS4	22-11-16	20	0.0	0.4	21.1	0.1	-	989	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS4	22-11-16	30	0.0	0.4	21.0	0.1	-	989	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS4	22-11-16	60	0.0	0.4	21.0	0.1	-	989	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS4	22-11-16	120	0.0	0.3	20.9	0.1	-	989	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS6	22-11-16	10	0.0	1.3	20.7	0.0		989	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS6	22-11-16	20	0.0	1.6	20.4	0.0	-	989	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS6	22-11-16	30	0.0	1.7	20.1	0.0	-	989	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS6	22-11-16	60	0.0	2.0	19.9	0.0	-	989	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS6	22-11-16	120	0.0	2.1	19.7	0.0	-	989	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS1	22-11-16	10	0.0	0.1	20.7	0.0		1020	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS1	22-11-16	20	0.0	0.1	20.7	0.0	-	1020	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS1	22-11-16	30	0.0	0.0	20.6	0.0	-	1020	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS1	22-11-16	60	0.0	0.0	20.0	0.0	-	1020	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS1	22-11-16	120	0.0	0.0	20.6	0.0	-	1020	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS4	07-12-16	10	0.0	0.1	20.4	0.0		1020	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS4	07-12-16	20	0.0	0.1	20.5	0.0	-	1020	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS4	07-12-16	30	0.0	0.1	20.5	0.0	-	1020	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS4	07-12-16	60	0.0	0.1	20.5	0.0	-	1020	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS4	07-12-16	120	0.0	0.0	0.5	0.0	-	1020	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS6	07-12-16	10	0.0	0.8	20.1	0.0		1020	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS6	07-12-16	20	0.0	1.1	19.2	0.0	-	1020	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS6	07-12-16	30	0.0	1.3	18.9	0.0	-	1020	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS6	07-12-16	60	0.0	1.5	18.6	0.0	-	1020	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
WS6	07-12-16	120	0.0	1.6	18.4	0.0	-	1020	Dry	0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
Max values			0.0	3.9	21.9	0.1	0.0	1020.0		0.000	0.004	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
Min Vaules			0.0	0.0	0.5	0.0	0.0	989.0		0.000	0.000	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN
BH Flow LoD check			0.0	3.9	21.9	0.1	0.0	1020.0		0.000	0.004	CS1	CS1	NO	NO	NO	GREEN	GREEN	GREEN	GREEN