



Report
Title:

Geo-Environmental Site Investigation

Project
Name:

Milksey Lane, Graveley



Report
Reference:

BRD3930-OR2-B

Date:

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REPORT CONTROL SHEET

REPORT TITLE	GEO-ENVIRONMENTAL SITE INVESTIGATION
PROJECT	MILKSEY LANE, GRAVELEY
CLIENT	GADE HOMES

REPORT REFERENCE	ISSUE DETAIL	DATE	PREPARED BY	CHECKED BY
BRD3930-OR2-A	First Issue - Draft. Gas monitoring on going.	26/07/2021	R Marina & A Leon	B Devonshire
BRD3930-OR2-B	Second Issue - Updated following additional Lead testing and completed gas monitoring.	06/09/2021	R Marina	J Brockwell

BRD Environmental Limited

Geotechnical and Environmental Services

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- Japanese Knotweed Removal
- Soil, Water and Gas Testing
- Contamination Assessment
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Geo-Environmental Site Investigation
Milksey Lane, Graveley
BRD3930-OR2-B SI

REPORT LAYOUT

This report is divided into the following four sections: Summary Report, Technical Report, Supporting Information and Appendices.

SUMMARY REPORT

This expanded executive summary provides the main findings of the work undertaken in brief non-technical language. This section provides an overview of the key outcomes for the benefit of non-specialists and concludes with the main recommendations. This section should only be relied upon in the context of the whole report and the Technical Report should be referred to with respect to any design decisions.

TECHNICAL REPORT

The main report section is intended to provide the technical detail of the investigation and is intended to provide the level of information required by current guidance documents and practice. The Technical Report is written in a language that, in part, assumes knowledge of subject matter so that it can be written in as concise a form as possible. Its intended audience is peers, regulators and other professionals in related disciplines.

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APPENDICES		
The final section of the report presents the factual data collected and employed as part of the investigation.		
APPENDIX 1	SITE PLANS	
	Site Location Plan	Ref. BRD3930-OP2-A
	Revised Conceptual Site Model	Ref. BRD3930-OP7-A
	Proposed Sketch Layout (Preliminary)	Woods Hardwick, ref. 18945/1000, & date July 2021
	Exploratory Hole Location Plan	Ref. BRD3930-OD1-B
APPENDIX 2	EXPLORATORY HOLE & MONITORING RECORDS	
	Logs of trial pits.	Ref. TP01-TP11
	Photographic records of trial pits.	Ref. BRD3930-OP6-A
	Logs of boreholes.	Ref. WS01-WS04
	BRE365 soakage test records.	6 x A4 pages
	Gas monitoring records.	6 x A4 pages
	Groundwater monitoring records.	1 x A4 page
APPENDIX 3	LABORATORY TEST RESULTS	
	DETS report 21-08346, 21-08347 & 21-09528	24 x A4 pages
	SPT report 39029_1	17 x A4 pages

SUMMARY REPORT - GENERAL INFORMATION

SUBJECT	COMMENTS
CURRENT SITE CONDITION	The site comprises a heavily overgrown field of irregular shape, which covers 1.77 hectares which consist of the former gardens and grounds of Graveley House. A variety of mature trees is found either on site or bordering the parcel. There are few soil stockpiles present on site which appear to contain demolition materials such as bricks, stones, timber and scrap metal.
PROPOSED DEVELOPMENT	It is proposed that the site will be developed as residential housing of around 29No. units with private gardens, driveways and access road.
HISTORICAL SUMMARY	The site has been the former gardens and grounds of Graveley House and later an open field throughout its mapped history. By 2017-2018, some soils stockpiles appear to have been brought to site following the redevelopment of the residential properties located at 37-41, High Street, immediately east of the site. The surrounding area has been predominately rural and agricultural, albeit with the A1 motorway 150m to the west of site from 1970s onwards. A gravel pit located some 40m east of the site appears to have been backfilled during the late 1960s and subsequently developed as residential properties and paddocks.
PUBLISHED GEOLOGY	The western half of the site is shown to be underlain by superficial deposits comprising Glaciofluvial Deposits (clayey sands, sands and gravels). The eastern half of the site is shown to be underlain by superficial deposits comprising Glacial Till (gravelly clays). These form part of a wider glacial channel beneath the site. The shallowest bedrock unit is shown to be the Holywell Nodular Chalk Formation and New Pit Chalk Formation (Undifferentiated) but is likely to be present at a reasonably depth beneath the site.
ACTUAL GROUND CONDITIONS	In general, the encountered ground conditions comprised a surface cover of Topsoil on to Glaciofluvial Deposits, generally thicker to the west and south of the site. Beneath, glacial till deposits of the Lowestoft Formation were recorded down to the full depth of the investigation.
HYDROGEOLOGY	The Glaciofluvial Deposits shown to be present across the western half of the site are classified as a Secondary A Aquifer. The glacial Till deposits shown to be present across the eastern half of the site are classified as a Secondary (Undifferentiated) aquifer. The chalk bedrock is classified as a Principal aquifer and the site is located within a groundwater Source Protection Zone 3 (Total Catchment).
HYDROLOGY	The closest surface water feature to the site is the Ash Brook, located some 100m southeast of the site. The nearest river is the River Beane (tributary of the River Lea) located some 6.5km east of the site, which flows in a south and southeast direction.
PREVIOUS GROUND REPORTS	BRD is not aware of any previous ground investigations having been conducted at the site. However, BRD has undertaken geo-environmental desk study research and this has been reported separately.



SUMMARY REPORT - GEOTECHNICAL

SUBJECT	COMMENTS
EXCAVATIONS	It should be possible to forward excavations employing normal equipment. Specific groundwater control unlikely to be required at this site. Limited groundwater control in the form of pumping from sumps is likely to be required. It is unlikely that requirements of the Party Wall Act will apply to the development.
SLOPE STABILITY	It is considered that slope stability is unlikely to be a concern at this site.
SUB-SURFACE CONCRETE	Design Sulphate Class of DS-1 and Aggressive Chemical Environment for Concrete class of AC-1 applies.
SOAKAWAYS	Site is not suitable for surface water disposal to soakaways or other forms of infiltration device.
PAVEMENT DESIGN	A preliminary design California Bearing Ratio (CBR) of 3% to 4% has been recommended.
FOUNDATIONS	
LIKELY FOUNDATION TYPE	Generally shallow strip or deeper trench fill footings bearing upon the Glaciofluvial Deposits and/or Glacial Till. Reinforcement of footings will be required where they straddle a change in ground conditions (sand/clay). Piled foundations required within influence of existing trees.
VOLUME CHANGE POTENTIAL	<u>Glaciofluvial Deposits</u>: Low i.e. minimal swelling or shrinking with moisture content changes. <u>Glacial Till</u>: Medium i.e. moderate swelling or shrinking with moisture content changes.
ESTIMATED FOUNDATION DEPTHS	<u>Plots 12, 14-26</u>: The minimum footing depth required is 0.90m, but foundations up to 2.0m will be expected due to the tree influence. <u>Plots 1-10 and 13</u>: Pile lengths to be determined by specialist piling contractor. <u>Plots 27-29</u>: The minimum footing depth required is 0.75m, but 1.00m where required to allow for restricted new tree planting
HEAVE PROTECTION	Will be required for the majority of plots.

SUMMARY REPORT - CONTAMINATION ISSUES

SUBJECT	COMMENTS
SOIL RISKS TO HUMAN HEALTH	Elevated concentrations of Lead have been found within the Made Ground Topsoil around WS01. These levels pose a risk to the health of the future residents. The full extent of this Lead contamination still needs to be established through some further testing. Testing shows one of the soil mounds to be contaminated with Lead and some hydrocarbons. Given the mounds were all of similar composition it is likely that other parts of the other three mounds could display similar concentrations.
LANDFILL GAS	The gas monitoring undertaken confirms a negligible gas regime and no requirement for landfill gas protection measures.
RADON GAS	Radon gas protection measures are not required.
RISKS TO THE WATER ENVIRONMENT	No unacceptable contamination risks to the water environment have been identified by this investigation.
RISKS TO BUILDING MATERIALS AND SERVICES	BRD do not believe a realistic risk to water service pipes exists from the natural sub-soils at the site, particularly if the soil and rubble mounds on site are removed as part of the development. However, if these mounds are not disposed of from site and are instead re-used as general fill then it would be prudent to assume the use of hydrocarbon resistant pipes, for example plastic 'barrier' pipes incorporating an aluminium foil layer or metal pipes.
REMEDIATION	It is likely that some targeted removal of the Lead contaminated Topsoil around WS01 will be required. However, the extent of remediation can only be determined once the recommended additional Lead testing and assessment has been undertaken. Once determined, a formal remediation strategy will need to be developed by an experienced Geo-Environmental Consultant. The remediation of the soil and rubble mounds would be best achieved by disposing of these materials from site.
ASBESTOS	No asbestos has been detected in the soil samples tested.
WASTE SOIL DISPOSAL	It is considered that the any natural sub-soils disposed of from the site would be classified as 'inert waste'. The contaminated Topsoil around WS01 and the mounds of mixed soils and rubble remains should be disposed of from site as 'non-hazardous' waste.

SUMMARY REPORT - KEY RECOMMENDATIONS

RECOMMENDATIONS

It is considered that further testing of the Made Ground Topsoil is required in the vicinity of borehole WS01 in order to delineate the extent of the identified elevated Lead concentrations.

In order to confirm the deeper ground conditions for pile design, further ground investigation comprising deep cable percussive boreholes is recommended. It is suggested that 2No. such boreholes are drilled to depths of 18m. Due to the limited access to the site a specific drilling machine may be required or access routes will need to be created.

1. INTRODUCTION TO TECHNICAL REPORT

1.1. CONTRACT DETAILS

CLIENT	Gade Property Developments Ltd trading as Gade Homes.
SITE	Land situated at Milksey Lane in the village of Graveley.
CLIENT'S ADVISORS	BRD Environmental Limited (BRD) has been commissioned directly by the Client.
REPORT CONTEXT	It is understood that the Client intends to purchase the site and develop it for residential housing.
REPORT TYPE	Geo-environmental site investigation (i.e. combined geotechnical ground investigation and Phase 2 contamination assessment).
REPORT OBJECTIVES	The site has been the subject of a desk study referenced as follows: • 'Phase 1 Environmental Desk Study - Milksey Lane, Graveley', BRD Environmental Ltd, report ref. BRD3930-OR1-A, dated July 2021. The purpose of the report is to present the findings of a ground investigation, and to present both geotechnical and contamination assessments of the ground conditions revealed.

1.2. SCOPE OF WORKS

The agreed scope of works was:

- Mobilisation to site and production of health and safety documentation.
- Procure basic set of utility service records (electricity, gas, water, sewers, BT) cover the site and immediate surroundings, if not already held by the Client.
- Undertake a Cable Avoidance Tool (CAT) scan at each exploratory point location.
- One day of windowless sampling using a percussive drilling rig to provide approximately 5No. boreholes to a nominal depth of 3m-5m, ground conditions permitting. Undertake Standard Penetration Tests (SPT) at 1m intervals.
- Installation of a 5m depth combined gas and groundwater monitoring well (nominal 50mm diameter) into 4No. boreholes. Installations will be finished with a flush fitting metal stopcock cover.
- One day of trial pitting using a mechanical excavator to provide approximately 8-10No. trial pits to a nominal depth of 3m, ground conditions permitting.
- All exploratory points will be logged and sampled in general accordance with BS5930:2015 and CIRIA C574 "Engineering in Chalk" by supervising Geo-Environmental Consultant.
- In-situ geotechnical testing of fine soils using a Hand Shear Vane and/or Pocket Penetrometer.
- A photo-ionisation detector (PID) will be used during the site works to assist in identifying and delineating any volatile organic contamination.

- Determination of the location of exploratory points by tape measurements or the use of a handheld recreational GPS unit.
- Geo-Environmental Technician to undertake a total of 6No. combined gas, vapour and groundwater monitoring visits. For gas, the determination of oxygen, carbon dioxide, methane, hydrogen sulphide and carbon monoxide concentrations, together with atmospheric pressure and flow rates, using portable equipment. For vapours, determination of the concentration of volatile organic compounds by photo ionisation detector. For groundwater, the determination of groundwater levels.
- Chemical testing of soil samples with the budget based on the following testing schedule:
 - 10No. Metals Suite - As, Cd, Cr, CrVI, Hg, Pb, Se, Cu, Ni and Zn.
 - 10No. Inorganics Suite - water soluble sulphate, pH, organic matter.
 - 10No. Speciated Polycyclic Aromatic Hydrocarbons (PAH).
 - 5No. Banded aliphatic/aromatic Total Petroleum Hydrocarbons (TPH).
 - 5No. Benzene, Toluene, Ethylbenzene, Xylene (BTEX) and Methyl Tertiary Butyl Ether (MTBE) compounds.
 - 2No. Semi-Volatile Organic Compounds (SVOC) suite.
 - 5No. Asbestos quantification.
- Chemical testing of 2No. soil samples for Waste Acceptance Criteria (WAC) to assist in establishing the waste classification of the soil for disposal purposes.
- Geotechnical testing as appropriate to the nature of the ground conditions encountered, but the budget is based on the following testing schedule:
 - 10No. Moisture content.
 - 10No. Plasticity indices.
 - 2No. Particle size distribution by wet sieve and follow on hydrometer.
 - 8No. pH and water soluble sulphate analysis.
 - 8No. Total sulphate and sulphur analysis.
- Provision of a combined factual and interpretative investigation report. Factual findings to include all exploratory point records, monitoring and test results. Interpretative reporting to include a summary of information from desk study research, a Generic Quantitative Contamination Risk Assessment (GQRA), waste classification and a Geotechnical Assessment providing comments on pavement design, concrete classification, soakaway feasibility, foundation design recommendations.

As a consequence of recording an elevated lead concentration in the topsoil in borehole WS01, some additional lead testing of the surrounding soils was undertaken, with the samples obtained as part of the ongoing gas monitoring visits. The scope of works was therefore increased to include the following:

- Chemical testing of soil samples with budget based on the following testing schedule:
 - 5No. Total Lead.

1.3. REPORT LIMITATIONS

Any site boundary lines depicted on plans included within this report are approximate only and do not imply legal ownership of land. Any observations of tree species, asbestos containing materials within structures or invasive weeds, does not constitute a formal survey of such features. The identification of such features is therefore tentative only. In the case of Japanese Knotweed, BRD can undertake separate surveys for this plant undertaken by a Property Care Association qualified surveyor.

The report does not consider whether sensitive ecology or archaeology is present as these require consideration by professionals specialising in these matters. It should be recognised that the collection of desk study information may not be exhaustive and that other information pertinent to the site may be available.

The recommendations, interpretations and conclusions of this report are based solely on the ground conditions found at the exploratory holes. Due to the variability in the nature of ground, conditions between exploratory holes can only be interpreted and not defined. The description of the site and the ground conditions is accurate only for the dates of the field works. In particular, groundwater levels can vary due to seasonal and other effects.

The assessment and interpretation of contamination risks is based on the scope of works agreed with the Client together with the budgetary and programme constraints imposed. Further investigation, analysis and assessment of contamination may be required by regulators or other third parties with an interest in the site. An ecological risk assessment of contaminated soils is beyond the scope of this report. This report is concerned with assessing those contamination risks which apply to the future use of the site through the proposed development as part of the planning regime. The assessment does not consider the risk to current site users or continued future use of the site in its current state. If development of the site should occur that differs from that proposed, then the findings of the contamination assessment would need to be re-evaluated.

At the time of writing, detailed information on the proposed structure, such as detailed layout, loadings and serviceability limits, was not available. Accordingly, where geotechnical design advice is provided it is on the prescriptive basis allowed for by Eurocode 7: employing conventional and conservative design rules. The scope of this investigation excludes a formal slope stability study and any observations made regarding slopes are for information only.

2. SITE CHARACTERISTICS

2.1. SITE SETTING

SITE ADDRESS AND POST CODE	Land off Milksey Lane, Graveley, Hitchin, Hertfordshire, SG4 7LA.
NATIONAL GRID REFERENCE	Approximately centred at: 523010E, 228050N.

2.2. SITE DESCRIPTION

SUBJECT	COMMENTS
CURRENT SITE DESCRIPTION	The site comprises a heavily overgrown field of irregular shape, which covers 1.77 hectares, which consist of the former gardens and grounds of Graveley House. A variety of mature trees is found either on site or bordering the parcel. There are few soil stockpiles present on site which appear to contain demolition materials such as bricks, stones, timber and scrap metal.
SURROUNDING LAND USE	The site is set in a mixed residential and agricultural area.
PROPOSED DEVELOPMENT	It is proposed that the site will be developed as residential housing of around 29No. units with private gardens, driveways and access road.
HISTORICAL SUMMARY	The site has been the former gardens and grounds of Graveley House and later an open field throughout its mapped history. The surrounding area has been predominately rural and agricultural, albeit with the A1 motorway 150m to the west of site from 1970s onwards. A gravel pit located some 40m east of the site appears to have been backfilled during the late 1960s and subsequently developed as residential properties and paddocks. By 2017-2018, some soils stockpiles appear to have been brought to site following the redevelopment of the residential proprieties located at 37-41, High Street, immediately east of the site.
PUBLISHED GEOLOGY	The western half of the site is shown to be underlain by superficial deposits comprising Glaciofluvial Deposits (clayey sands, sands and gravels). The eastern half of the site is shown to be underlain by superficial deposits comprising Glacial Till (gravelly clays). These form part of a wider glacial channel beneath the site. The shallowest bedrock unit is shown to be the Holywell Nodular Chalk Formation and New Pit Chalk Formation (Undifferentiated) but is likely to be present at a reasonable depth beneath the site.
RADON	Radon protection measures are not required.

SUBJECT	COMMENTS
HYDROGEOLOGY	The Glaciofluvial Deposits shown to be present across the western half of the site are classified as a Secondary A Aquifer. The glacial Till deposits shown to be present across the eastern half of the site are classified as a Secondary (Undifferentiated) aquifer. The chalk bedrock is classified as a Principal aquifer and the site is located within a groundwater Source Protection Zone 3 (Total Catchment).
HYDROLOGY	The closest surface water feature to the site is the Ash Brook, located some 100m southeast of the site. The nearest river is the River Beane (tributary of the River Lea) located some 6.5km east of the site, which flows in a south and southeast direction.

2.3. PREVIOUS INVESTIGATIONS

BRD is unaware of any previous ground investigations having been conducted at the site. However, the site has been the subject of geo-environmental desk study research by BRD and this has been reported separately in “Phase 1 Geo-Environmental Desk Study - Milksey Lane, Graveley”, BRD Environmental Ltd, ref. BRD3930-OR1-A, dated July 2021. This current report should be read in conjunction with the previous desk study report.

3. GROUND INVESTIGATION

3.1. INVESTIGATION DESIGN

METHODOLOGY	The investigation was proposed to be a combination of trial pits and windowless sample boreholes to provide information on the general soils across the site. Trial pits were selected as they expose more soils, which enables a more reliable record of the ground conditions encountered, as well as facilitating BRD365 soakage tests. Windowless sample boreholes were selected as monitoring installations and in-situ density of the soils were required. Both the trial pits and windowless samples boreholes provided a sufficient number of soil samples to be tested for contamination and geotechnical assessment purposes.	
DATES OF SITE WORKS	The main field works were undertaken on 25th and 28th June 2021. Monitoring visits were undertaken on 30th June, 9th and 16th July 2021.	
CONSTRAINTS TO EXPLORATORY HOLE LAYOUT	No constraints were found.	
EXPLORATORY HOLE SPACING	Approximately 15-40m grid.	
LAYOUT RATIONALE	SOURCE / FEATURE	EXPLORATORY HOLE
CONTAMINATION SOURCES TARGETED	General site coverage.	TP01 to TP06 & WS01 to WS04.
	Soils and rubble mounds.	TP07 to TP11.
	Elevated Lead found in the Topsoil at WS01 during the main investigation.	TS01 to TS05 (Topsoil samples).
	General site coverage.	TP01 to TP06 & WS01 to WS04.
CONTAMINATION SAMPLING PLAN	Based on the proposed end use, the sampling and analysis plan is more positively biased towards near surface samples as these represent the soils most likely to be available to future site users. The analysis is more biased towards the Topsoil, Made Ground Topsoil and Made Ground samples as these strata represents the soils most likely to be contaminated.	

ANALYSIS PLAN	Given the site's history and based on the potential contaminants identified within the Phase 1 contamination assessment, BRD has scheduled a targeted suite of contaminants associated with such a former use. Samples from the soils and rubble mounds have been tested for a range of contaminants, including, metals, polycyclic aromatic hydrocarbons (PAHs), total petroleum hydrocarbons (TPH), benzene, toluene, ethylbenzene and xylene (BTEX). The analysis of the natural soils also aimed to confirm the water pipe specification and to assist with the waste classification for any soils (natural and mounds) to be removed from site. The additional Topsoil samples around WS01 were scheduled solely for Lead in order to determine the nature and extent of the apparent Lead contamination in this location.
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3.2. BRD FIELDWORK

HAND DUG INSPECTION PITS	
REFERENCES	TS01 to TS05
DEPTH RANGE	Up to 0.2m as purpose was solely to collect Topsoil samples.
BACKFILL	The inspection pits were backfilled with arisings upon completion.

TRIAL PITS	
REFERENCES	TP01 to TP11.
DEPTH RANGE	From 0.80m to 3.0m.
EXCAVATOR	JCB 3CX style wheeled backactor.
BACKFILL	Trial pits TP01, TP02 & TP06 were backfilled with coarse gravel and an observation well for the soakage tests. The surplus spoil was stockpiled neatly on site. The observation wells were removed at the end of the works. All the remaining trial pits were backfilled with arisings upon completion and compacted with rams of the excavator bucket.

WINDOWLESS SAMPLING BOREHOLES	
REFERENCES	WS01 to WS04.
DEPTH RANGE	From 3.45m to 5.45m.
RIG TYPE	Premier Drilling Rig.

INSTALLATION / BACKFILL	Boreholes WS01 to WS04 had monitoring wells installed. These comprised 50mm nominal diameter standpipes fitted with a gas tap finished with a flush metal cover. The slotted response length of the well is shown on the individual logs. Bentonite seals are also indicated on the logs. The filter medium used was pea gravel.
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MONITORING	
TYPE	Ground gases. Vapour. Groundwater monitoring.
DATES	30 th June, 9 th , 16 th , 28 th July, 16 th and 28 th August 2021.
GROUNDWATER LEVELS	Groundwater levels were measured using a dipmeter.

3.3. LABORATORY TESTING

GEOTECHNICAL TESTING	
The soil samples for geotechnical testing were forwarded to the laboratory of Soil Property Testing Ltd with pH and sulphate analysis undertaken at the laboratory of DETS Ltd. The geotechnical testing suite is detailed below. The UKAS accreditation of the individual test methods is shown on the laboratory test report included in the Appendices.	
TEST	NUMBER OF SAMPLES TESTED
Moisture content	10
Liquid and plastic limits	10
Particle size distribution by wet sieve and hydrometer	2
pH and Water soluble Sulphate	8
Total Sulphur and Sulphate	8

SOIL CHEMICAL TESTING	
The soil samples for contamination and/or chemical geotechnical testing were forwarded to the laboratory of DETS Ltd and the testing suite is detailed below. The UKAS or MCERTS accreditation of the individual test methods is shown on the laboratory test report included in the Appendices.	
SOIL TESTS	NUMBER OF SAMPLES TESTED
Arsenic, Cadmium, Chromium, Chromium VI, Copper, Mercury, Nickel, Selenium, Zinc	10
Lead	15
Speciated Polycyclic Aromatic Hydrocarbons (PAH)	10

Total Petroleum Hydrocarbons (TPH) with full carbon banding and aliphatic/aromatic split	5
Benzene, Toluene, Ethylbenzene and Xylenes (BTEX) plus Methyl Tert Butyl Ether (MTBE)	5
Organic Matter	10
Asbestos Quantification	5
Semi-Volatile Organic Compounds (SVOCs)	2
Waste Acceptance Criteria (WAC) testing	2

4. GROUND CONDITIONS

4.1. OVERVIEW

The ground conditions encountered were generally as expected from the anticipated geology shown on the available BGS geology maps.

In general, the encountered ground conditions comprised a surface cover of Topsoil on to Glaciofluvial Deposits, generally thicker to the west and south of the site. Beneath, glacial till deposits of the Lowestoft Formation-Diamicton were recorded down to the full depth of the investigation.

Groundwater was encountered in the form of seepages in some of the exploratory points.

Details of the various stratigraphic units are given in the following sections.

4.2. ARTIFICIAL GROUND

TP07 to TP11 (inclusive) targeted the soil and rubble mounds located on site. In several of the trial pits two differentiated layers of Made Ground were recorded, the shallower comprising up to 0.50m of 'brown to dark brown, slightly clayey, sandy, gravel/gravelly sand. Gravel is fine to coarse, subangular to subrounded flint and quartzite. Frequent brick fragments, whole bricks, concrete blocks, timber and scrap metal'. The vast majority of the mound comprised up to 0.95m of 'brown and grey, very gravelly, silty clay. Gravel is fine to coarse, subangular to subrounded flint and chalk.'

4.3. TOPSOIL AND MADE GROUND TOPSOIL

Topsoil and Made Ground Topsoil were found across the whole site and described as 'dark brown, sandy, silty clay with occasional gravel of fine to coarse, subangular to subrounded flint'. The surface soils where occasional brick and charcoal fragments were found have been described as Made Ground Topsoil.

4.4. SUPERFICIAL DEPOSITS

4.4.1. Glaciofluvial Deposits

The Glaciofluvial Deposits were recorded across the whole site with thickness ranging 0.3-0.5m in the northeast of the site up to more than 3.0m in the south of the site.

These deposits were found predominately as clay rich sediments described as 'firm, brown, slightly gravelly, sandy clay. Gravel is fine to coarse, subangular to subrounded flint'.

Occasional beds of granular deposits were found across the site although were recorded to be of significant thickness in the southeast of the site (TP01 and WS01) recorded below 1.35m depth and to 3.45m bgl in borehole WS01. Typically, these deposits were described as 'medium dense, moist becoming wet, light brown, slightly clayey, sandy gravel and gravelly silty sand. Gravel is fine to coarse, subangular to subrounded flint and chalk'.

4.4.2. Lowestoft Formation-Diamicton (Glacial Till)

Sediments of the Lowestoft Formation Diamicton, herein after referred to as Glacial Till, were found across the site underlying the Glaciofluvial Deposits and up to the maximum depth of investigation (5.45m bgl).

These deposits were described as ‘firm to stiff, grey and brown, gravelly, silty clay. Gravel is fine to coarse, subangular to subrounded, flint, chalk and quartzite’, becoming with depth ‘stiff, some fissured, brown, grey and dark grey with occasional greenish grey, very gravelly, silty clay. Gravel is fine to coarse, subangular to subrounded, flint, chalk, slate and limestone’.

Rare sandy pockets were recorded associated with these deposits like in WS02 at 3.0m depth or trial pit TP03 below 1.5m depth.

4.5. **BEDROCK**

The bedrock geology was not encountered in any of the exploratory holes.

4.6. **GEOTECHNICAL COMMENTS**

Occasional running sands due to groundwater seepages were found in TP06 on encountering groundwater within the granular soils of the Glaciofluvial Deposits.

4.7. **CONTAMINATION OBSERVATIONS**

No visual or olfactory evidence of contamination was noted during the forwarding of exploratory holes.

4.8. **GROUNDWATER BEHAVIOUR**

Groundwater was encountered as seepages or slow ingress in TP01 at 1.70m bgl and WS01 at 2.0m bgl, both located in the southeast corner of the site. In both, holes the seepage water was related to granular soils associated with the Glaciofluvial Deposits.

Slight seepages were recorded across the site in borehole WS02 and trial pits TP04 and TP06 at depths between 0.70m and 3.0m bgl.

4.9. **GROUNDWATER MONITORING**

DATE	RESTING GROUNDWATER RANGE	COMMENTS
30/06/2021	1.65m bgl.	Standing groundwater was only found in WS01 at 1.65m bgl. The remaining boreholes were dry.
09/07/2021	From 1.40m to 3.07m bgl.	Standing groundwater rose in WS01, recorded to 1.40m bgl. Groundwater was found in WS02 at 3.07m bgl. The remaining boreholes were dry.
16/07/2021	From 1.70m to 3.15m bgl.	Falling groundwater levels were recorded in WS01 and WS02 at 1.70m and 3.15m bgl, respectively. The remaining boreholes were dry.

DATE	RESTING GROUNDWATER RANGE	COMMENTS
27/07/2021	From 1.92m to 3.22m bgl.	Falling groundwater levels were recorded in WS01 and WS02 at 1.92m and 3.22m bgl, respectively. The remaining boreholes were dry.
16/08/2021	From 2.12m to 3.24m bgl.	Falling groundwater level recorded in WS01 at 2.12m bgl. The groundwater level in WS02 had barely changed since the previous monitoring visit. The remaining boreholes were dry.
28/08/2021	From 2.29m to 3.31m bgl.	Falling groundwater levels were recorded in WS01 and WS02 at 2.29m and 3.31m bgl, respectively. The remaining boreholes were dry.

5. GEOTECHNICAL PROPERTIES

5.1. COARSE SOIL PARAMETERS

5.1.1. Standard Penetration Tests

As mentioned before, occasionally, the Glaciofluvial Deposits have been recorded as coarse soils comprising sand and gravel. In borehole WS01, these deposits were proved below 1.75m depth and were recorded with N-values ranging from 25 to 30 indicating medium dense soils.

A pocket of wet sandy soils was recorded in the Glacial Till deposits in borehole WS02 with an N-value of 8 indicative loose soils, however, it is considered that the soil strength of these deposits have been reduced due to the presence of the groundwater.

5.1.2. Particle Size Distribution (PSD)

Two samples, one from coarse Glaciofluvial Deposits and one from Glacial Till soils, were subject to PSD determination.

The grading curve of the Glaciofluvial Deposits recorded in trial pit TP01 (1.6m bgl) revealed the soil to be a slightly clayey, slightly silty, gravelly sand. A gravel and sand content of 29% and 46% was recorded, respectively, and a fines content of 25%, of which 12% was of silt and 13% of clay fraction.

The grading curve of the Glacial Till recorded in trial pit TP02 (1.2m bgl) revealed the soil to be a slightly gravelly, slightly sandy, silty clay. A gravel and sand content of 13% and 21% was recorded, respectively and a fines content of 66%, of which 29% was of silt and 37% of clay fraction.

5.2. FINE SOIL PARAMETERS

5.2.1. Index Property Testing

SOIL TYPE	Glaciofluvial Deposits.
PLASTICITY INDEX (PI)	Oversize particles present.
MODIFIED PI	9% (Two samples: Non shrinkable soil type). 12% - 17% (Four samples: Low volume change potential).
NHBC CLASS	Non shrinkable soil type (granular deposits). Low volume change potential.

SOIL TYPE	Glacial Till.
PLASTICITY INDEX (PI)	17% (One sample: Low volume change potential).
MODIFIED PI	14% - 16% (Two samples: Low volume change potential). 22% - 24% (Two samples: Medium volume change potential).
NHBC CLASS	Medium volume change potential.

5.2.2. Undrained Shear Strength

This section discusses all of the laboratory and in-situ tests that produce either direct or indirect measures of undrained shear strength.

5.2.2.1. Hand Shear Vane

SOIL TYPE	Glaciofluvial Deposits.
CORRECTION FACTOR μ	$\mu=1.0$
JUSTIFICATION	Soil considered normally consolidated and correction as per BS EN 1997-2:2007, National Annex I, based on Liquid Limit. $W_L < 40$ so $\mu=1.0$.
DISCUSSION OF CORRECTED RESULTS	The recorded undrained shear strength was in the range of 54kPa and 64kPa which is indicative of medium strength soil type.

SOIL TYPE	Glacial Till.
CORRECTION FACTOR μ	$\mu=1.0$
JUSTIFICATION	After Bjerrum 1972, employing Plasticity Index, $PI \sim 20$ so $\mu=1.0$
DISCUSSION OF CORRECTED RESULTS	The recorded undrained shear strength was in the range of 80kPa and >140kPa which is indicative of high to very high strength soils.

5.2.2.2. Hand Penetrometer

SOIL TYPE	Glaciofluvial Deposits.
DISCUSSION OF CORRECTED RESULTS	The recorded undrained shear strength was of 33kPa which is indicative of low strength soil type.

SOIL TYPE	Glacial Till.
DISCUSSION OF CORRECTED RESULTS	The recorded undrained shear strength was in the range of 50kPa and 116kPa which is indicative of medium to high strength soils type. Typically, strength increase with depth.

5.2.2.3. Standard Penetration Test Correlations

Standard Penetration tests (SPTs) were undertaken in all the windowless sampling boreholes at 1.00m intervals.

Tests undertaken in the clayey soils of the Glaciofluvial Deposits have recorded N-values between 8 and 10 which is indicative of firm to stiff soils. The lowest value was recorded in borehole WS02 at 3.0m depth, likely related to the presence of groundwater.

For the Glacial Till, N-values between 5 and 37 which is indicative of firm to hard soils have been recorded. The lowest value was recorded in borehole WS03 at 1.0m depth.

The SPT N-values of both the Glaciofluvial Deposits and the Glacial Till soils have been converted using industry standard correlations, such as Stroud's method, to equivalent undrained shear strengths of a 100mm-diameter triaxial compression test. For fissured, over consolidated fine-grained soils, i.e. the Glacial Till, SPT N-values can be converted. This conversion has been conducted on the N_{60} -values using values for Stroud's conversion factor, f_1 , selected on the basis of plasticity index recorded in the samples tested for both strata. An energy ratio value for the windowless sampling borehole of $Er=0.88$ has been considered based on the annual calibration certificate provided by the sub-contractor.

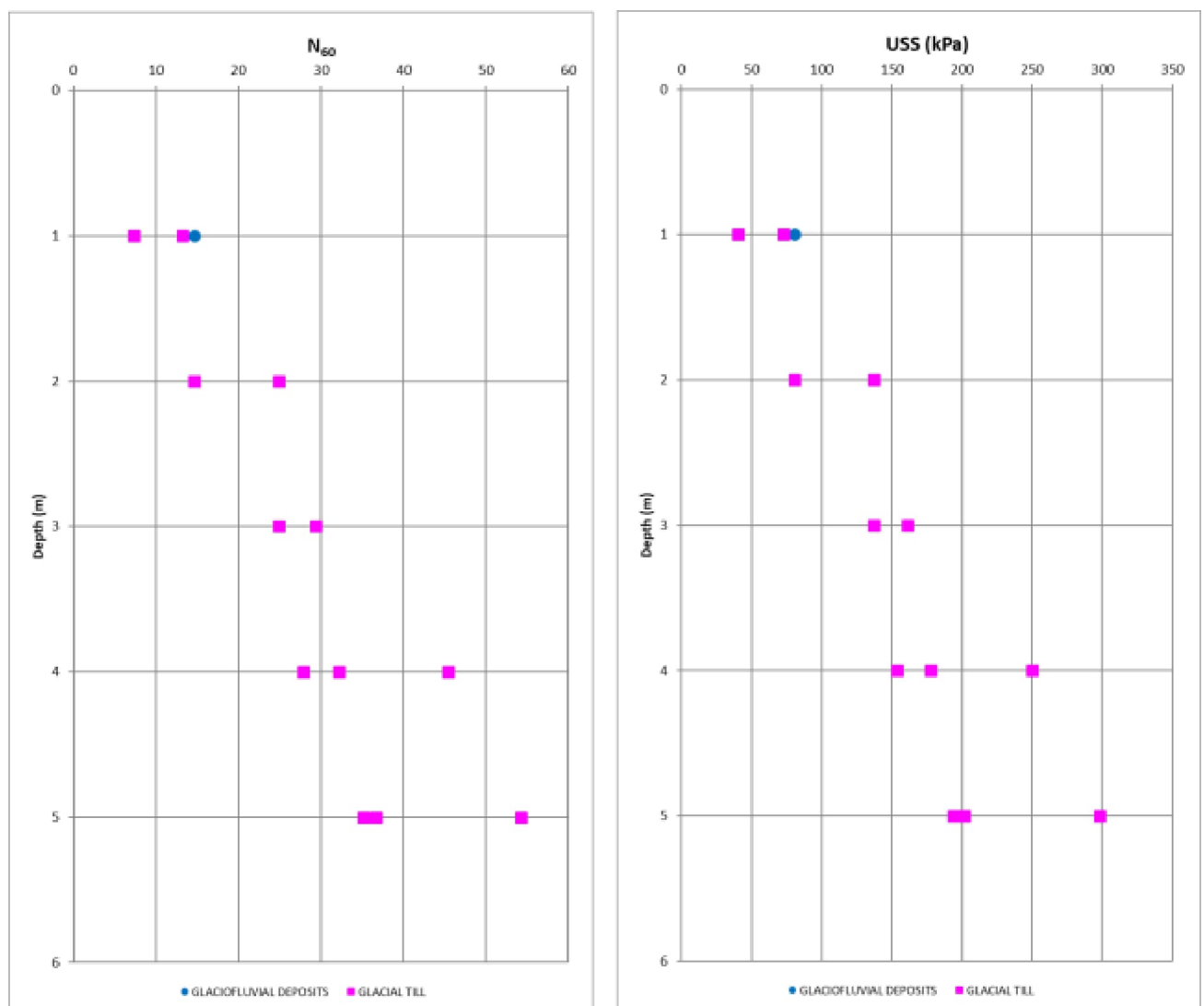
The equivalent undrained shear strengths for the Glaciofluvial Deposits at a depth of 1.0m range between 73kPa and 81kPa which is indicative of medium to high strength soil type.

For the Glacial Till, equivalent undrained shear strengths at a depth of 1.0m range between 40kPa and 73kPa which is indicative of medium strength soil type.

At a depth of 2.0m, equivalent undrained shear strengths ranging between 81Pa and 137kPa which is indicative of high strength soil type.

Between 3.0m and 5.0m depth, equivalent undrained shear strength values between 137kPa and 298kPa have been recorded indicating high to very high strength soil type.

The following charts show the distribution with depth of the N_{60} values considered in every borehole together with the derived equivalent undrained shear strength values for each strata.



5.3. SULPHATE AND pH

	ALL ON-SITE SOILS			
	Sulphate		pH	
Characteristic Value	100 mg/l		6.3 units	
Justification	Mean of highest 20% results rounded to nearest 100mg/l.		Mean of lowest 20% results.	
	No. of tests	Results Range	No. of tests	Results Range
Soil	18	<10 - 40 mg/l	18	6.0 - 8.2 units
Groundwater	-	Not tested	-	Not tested
Total Potential Sulphate	8	Not applicable as pyrite unlikely in the samples tested.		

6. GEOTECHNICAL ASSESSMENT

6.1. INTRODUCTION

The following advice and recommendations are based on the construction of about 29 No. low rise, two to three storey residential properties across the site. The proposed development layout plan is included in Appendix 1. From assessment of the nature of the ground conditions and the type of proposed structures, it is considered that the situation falls within EC7 Geotechnical Category 1.

Should the nature of the development be changed then the results of this investigation would need to be reviewed and reassessed.

6.2. EXCAVATIONS

STABILITY	Any excavation requiring man entry should be battered back to a safe angle, supported by an appropriate proprietary trench support system or adequately shored to provide safe working conditions. Shoring to any excavation requiring man entry must be designed by a suitably qualified and experienced engineer. Any support system will require regular inspection as detailed in published guidelines to ensure the excavation support is adequate and appropriate for the ground conditions present. For most of the site, it is anticipated that narrow trench excavations will remain relatively stable and open for short periods, but minor spalling of side walls could still occur. In the south eastern corner of the site, where granular soils of the Glaciofluvial Deposits are recorded to a reasonable depth, groundwater is more likely to be encountered. Trench excavations encountering the groundwater are likely to suffer side wall collapse. Likewise, excavations below the water table at the southern part of the site are likely to result in excavation difficulties due to 'running sands' and appropriate groundwater control will therefore be required.
EQUIPMENT	It should be possible to progress excavations with conventional equipment.
GROUNDWATER CONTROL	Specific groundwater control is unlikely to be required across the majority of the site. Limited pumping from sumps or bailing out may be required to deal with slight seepages or surface water ingress during periods of inclement weather. More specialist groundwater control may be required where excavations are in areas where granular soils extend to significant depth.
PARTY WALL ISSUES	As there are no nearby third party structures, the Party Wall Act is unlikely to apply to the development.

6.3. SLOPE STABILITY

The site is relatively flat and no significant changes in level as part of the development are anticipated. It is therefore considered that slope stability is unlikely to be a significant concern at this site.

6.4. SUB-SURFACE CONCRETE

ALL ON-SITE SOILS	
SITE / SOIL CATEGORY	Natural ground.
DESIGN SULPHATE CLASS	DS-1
GROUNDWATER REGIME	Mobile.
AGGRESSIVE CHEMICAL ENVIRONMENT FOR CONCRETE (ACEC) CLASS	AC-1

6.5. SOAKAWAYS

6.5.1. Soil Infiltration Rate

The records of the soakage tests are presented in the Appendices that includes the calculation of the soil infiltration rate. A summary of results are presented in the table below:

TRIAL PIT	SOIL INFILTRATION RATE		STRATUM TESTED
TP01	Test 1	$2.36 \times 10^{-5} \text{ m/s}$	0.20m - 0.90m: Firm, brown, slightly sandy, silty CLAY with occasional gravel. 0.90m - 1.35m: Firm, brown, occasional light grey, gravelly, silty CLAY. 1.35m - 1.90m: Moist, brown, orangish brown, gravelly, silty SAND.
	Test 2	$1.73 \times 10^{-5} \text{ m/s}$	
	Test 3	$1.78 \times 10^{-5} \text{ m/s}$	
TP02	Test 1	Permeability too low to calculate soil infiltration rate.	0.20m - 0.60m: Firm, brown and occasional orangish brown, slightly sandy, silty CLAY. 0.60m - 1.90m: Firm to stiff, light brown mottled light grey and orangish brown, very gravelly, silty CLAY.
TP06	Test 1	$2.62 \times 10^{-7} \text{ m/s}$ Result extrapolated and so guide only.	0.20m - 0.45m: Firm, brown, slightly gravelly, sandy CLAY. 0.45m - 0.80m: Firm, brown mottled orangish brown, gravelly, sandy CLAY. 0.80m - 1.30m: Firm, brown and orangish brown, slightly gravelly, sandy CLAY. 1.30m - 1.50m: Firm to stiff, brown and grey, gravelly, silty CLAY.
	Test 2	$1.60 \times 10^{-7} \text{ m/s}$ Result extrapolated and so guide only.	

6.5.2. Soakaway Design Advice

Trial pit soakage tests TP02 and TP06 in clayey rich soils of both the Glaciofluvial Deposits and Glacial Till recorded either low infiltration rates of the order of 10^{-7} m/s or a rate could not be calculated due to the cohesive nature of the soils.

Most of the site covered with clay rich soils of both the Glaciofluvial Deposits and Glacial Till and therefore it is considered that the disposal of collected surface water to soakaways will not be feasible due to the cohesive nature and proved low permeability of the underlying soils

Soakage tests undertaken in trial pit TP01 recorded infiltration rates of the order of 10^{-5} m/s, which are indicative of good infiltration media. The Glaciofluvial Deposits recorded below 1.35m depth in this trial pit was of sand nature which permitted good infiltration. However, relatively shallow standing groundwater levels in the area of trial pit TP01 have been recorded ranging from 1.40m and 1.70m depth. It is worth noting that the levels have been recorded in the middle of the dry season (summer time). Therefore, it is apparent that the shallow groundwater will have a significant impact on the ability to adopt soakaway drainage in this part of the site. It should be noted that the Environment Agency (EA) will object to the use of infiltration devices that lead to the direct input to groundwater and seek that in excess of a 1m thick unsaturated zone is present between the base of the infiltration device and the seasonal high maximum groundwater level. Clearly such an unsaturated zone is not achievable on this site. There is also the possibility that the granular soils are isolated in large pockets and so once full of water, will not provide further infiltration.

Therefore, it is considered that the site is unsuitable for conventional soakaways and a positive drainage solution should be pursued.

6.6. **PAVEMENT CONSTRUCTION**

From consideration of the observed ground conditions and the plasticity of the clay, it is recommended that a preliminary design California Bearing Ratio (CBR) of 3% to 4% is assumed. The cohesive deposits will be prone to rapid degradation during wet weather working and this should be avoided where possible.

All unsuitable soils, such as topsoil or desiccated soils, should be removed from beneath proposed paved areas. The exposed sub-grade formation should then be proof rolled to reveal any excessively soft or compressible zones and any such features identified also removed by excavation. Where unsuitable materials are removed, the resultant voids should be filled in layers with appropriately compacted suitable granular fill. To reduce the loss of granular construction materials into the sub-grade, consideration should be given to utilising a geotextile starter layer across the formation level.

6.7. PRELIMINARY FOUNDATION RECOMMENDATIONS

6.7.1. Introduction

It is proposed to develop the site with about 29No. new residential properties.

Outside of the zones of influence of the trees and hedges it is considered that shallow spread foundations may be adopted for the proposed residential properties emplaced within the underlying Glaciofluvial Deposits and/or Glacial Till.

The Glaciofluvial Deposits have been recorded with a low volume change potential under the NHBC Standards whereas the Glacial Till has been recorded with a medium volume change potential. For most of the site the Glaciofluvial Deposits have been recorded to relatively shallow depths and then plasticity of the Glacial Till will be required to use for foundation depths purposes. However, for Plots 27 to 29, located in the south where the Glaciofluvial Deposits have been proved deeper than 3.0m depth, foundation depths based on the low volume change potential of the Glaciofluvial Deposits will be considered.

Nominal steel mesh reinforcement should be included within the footings when sandy soils are recorded as part of the Glaciofluvial Deposits, to reduce the effects of differential settlement across the varying strata and distribute stresses more evenly.

Within the zones of influence of the trees deepened trench fill foundations are considered appropriate. However, where plots are located adjacent to the trees and hedges piled foundations may need to be considered if trench fill foundations are too deep to be economic or practical to construct. A preliminary foundation analysis considering the trees and the proposed plots has been undertaken. This revealed at least 35% of the plots will require deep foundation in the form of piling due to the tree influence.

6.7.2. Floor Slabs

In consideration of the near surface clay soils, fully suspended floor slabs designed and constructed in accordance with NHBC Standards are recommended at this development.

With reference to Section 2.2, the floor construction will not have to incorporate radon gas protection measures.

6.7.3. Traditional Footings

The site is suitable for the adoption of shallow strip/trench fill footings. Foundations should be taken through made ground/topsoil to bear upon the Glaciofluvial Deposits and/or the Glacial Till.

The soils recorded across the site are mainly clay rich, however, occasionally, the Glaciofluvial Deposits have been recorded comprising granular soil beds. Where both soil types, granular or clayey soils, are found at formation level, it is recommended that nominal steel mesh reinforcement is included within the footing to reduce the effects of differential settlement across the varying strata and distribute stresses more evenly. Alternatively, the footings could be over deepened so that they bear entirely within clayey soils and thereby eliminating the potential for differential settlement.

A presumed bearing value of 100kN/m² is considered appropriate for foundations up to 1m wide bearing upon the clay soils of the Glaciofluvial Deposits or the Glacial Till. For foundations bearing solely within the Glacial Till an increased bearing capacity of 125kN/m² could be employed, but it is likely that inspection by a geotechnical consultant would be necessary to confirm the identification of the soil type if this higher bearing capacity is to be safely employed.. Immediate and long term settlement should be within tolerable limits and take place over several years.

The Glacial Till have been shown to have a variably low to medium volume change potential when assessed against NHBC standards. As it will not be possible to visually differentiate between low and medium volume change potential soils it will be necessary to assume medium volume change potential deposits to be present beneath the whole site. Therefore, the minimum foundation depth required is 0.90m, but 1.25m where required to allow for restricted new tree planting.

For Plots 27 to 29, the Glacial Till is at depths greater than 3.0m and then foundation depths should be considered based on the low volume change potential recorded in the Glaciofluvial Deposits, and then, the minimum foundation depth required for those plots is 0.75m, but 1.00m where required to allow for restricted new tree planting.

Under the NHBC Standards, foundation depths have to be increased if they are within the influence zone of felled trees, existing trees or proposed tree planting. Several trees have been recorded across the site and along its boundaries such that Plots 1-6, 7, 8 and 9-10 will require deep piled foundations. Plot 13 is located in an area with several tree stumps of unknown trees and so piled foundation should be considered.

For the rest of the plots trench fill footings between 1.0m and 2.0m have been estimated.

It should be noted that where trees are in groups the resulting competition for resources can lead to deeper root systems than allowed for in the NHBC Standards. In any event, foundations should be taken below any roots encountered in foundation trench excavation. Where the required foundation depth varies around a structure, this can be accommodated by forming steps in the foundation as per NHBC Standards.

Where foundation depths exceed 1.50m in clay soils and are within the zone of influence of existing or felled trees or where foundations cut through tree roots, a compressible void former will be required against the internal faces of new foundations in order to accommodate potential long term soil heave. Such precautions against heave should be designed and constructed in accordance with NHBC Standards.

The excavator must be set up with care and operated correctly to ensure trench walls are vertical and base horizontal as any slight inclination will result in eccentric loading on such deep trench fill footings.

A number of trees and tree stumps are located across the site. It will be necessary to remove all unwanted trees, stumps and root structures prior to commencing with the development. Any resultant void should be backfilled accordingly with respect to the preferred foundation design.

During construction, any soft spots found at foundation formation level should be excavated and replaced with lean mix concrete. Foundation excavations should be kept dry and left open for the minimum amount of time possible. Where foundations cannot be completed immediately, a blinding layer of concrete should be placed.

6.7.4. Piling

Due to the tree influence several plots will require deep foundation in the form of piling.

For piling design, deeper ground investigation will be required to confirm the ground conditions, consistency and thickness of the superficial deposits recorded at the base of the existing windowless sampling boreholes and the depth of the bedrock.

6.8. RECOMMENDATIONS FOR FURTHER GEOTECHNICAL WORK

In order to confirm deeper ground conditions for pile design, further ground investigation comprising deep cable percussive boreholes is recommended. It is suggested that 2No. such boreholes are drilled to depths of 18m. Monitoring wells should be included in the boreholes and at least one post work monitoring visit should be undertaken to record groundwater levels. In-situ Standard Penetration Tests should be conducted during forwarding of the boreholes and collected soil samples submitted for appropriate geotechnical laboratory testing.

Due to the limited access to the site a specific drilling machine may be required or access routes will need to be created, either of which will increase the price of the proposed investigation.

7. RISK ESTIMATION - SOILS

7.1. HUMAN HEALTH

The Generic Assessment Criteria (GAC) employed below are for residential land use as this is appropriate to the proposed form of development.

CONTAMINANT	UNITS	NUMBER OF TESTS	MAXIMUM CONCENTRATION	GAC	NUMBER EXCEEDING GAC
Arsenic	mg/kg	10	30	37	0
Cadmium	mg/kg	10	0.6	22	0
Chromium (total)	mg/kg	10	25	910	0
Chromium (hexavalent)	mg/kg	10	<2	21	0
Copper	mg/kg	10	27	2,400	0
Lead	mg/kg	15	1,080	200	7
Mercury	mg/kg	10	<1	11	0
Nickel	mg/kg	10	24	180	0
Selenium	mg/kg	10	<3	250	0
Zinc	mg/kg	10	272	3,700	0
pH	Units	18	6.0-8.2	<5-10>	0
Naphthalene	mg/kg	10	0.30	2.3	0
Acenaphthylene	mg/kg	10	0.40	170	0
Acenaphthene	mg/kg	10	<0.1	210	0
Fluorene	mg/kg	10	0.53	170	0
Phenanthrene	mg/kg	10	8.36	95	0
Anthracene	mg/kg	10	3.23	2,400	0
Fluoranthene	mg/kg	10	23.90	280	0
Pyrene	mg/kg	10	20.70	620	0
Benzo(a)anthracene	mg/kg	10	11.60	7.2	1
Chrysene	mg/kg	10	9.09	15	0
Benzo(b)fluoranthene	mg/kg	10	9.52	2.6	1
Benzo(k)fluoranthene	mg/kg	10	4.24	77	0
Benzo(a)pyrene	mg/kg	10	10.70	2.2	1
Indeno(1,2,3-cd)pyrene	mg/kg	10	4.44	27	0
Dibenzo(a,h)anthracene	mg/kg	10	1.06	0.24	1
Benzo(ghi)perylene	mg/kg	10	3.19	320	0
TPH Aliphatic C5-C6	mg/kg	5	<0.01	42	0
TPH Aliphatic C6-C8	mg/kg	5	<0.05	100	0
TPH Aliphatic C8-C10	mg/kg	5	<2	27	0
TPH Aliphatic C10-C12	mg/kg	5	<2	130	0
TPH Aliphatic C12-C16	mg/kg	5	<3	1,100	0
TPH Aliphatic C16-C35	mg/kg	5	<10	65,000	0
TPH Aliphatic C35-C44	mg/kg	5	<10	65,000	0

CONTAMINANT	UNITS	NUMBER OF TESTS	MAXIMUM CONCENTRATION	GAC	NUMBER EXCEEDING GAC
TPH Aromatic C5-C7	mg/kg	5	<0.01	70	0
TPH Aromatic C7-C8	mg/kg	5	<0.05	130	0
TPH Aromatic C8-C10	mg/kg	5	<2	34	0
TPH Aromatic C10-C12	mg/kg	5	<2	74	0
TPH Aromatic C12-C16	mg/kg	5	4	140	0
TPH Aromatic C16-C21	mg/kg	5	<3	260	0
TPH Aromatic C21-C35	mg/kg	5	69	1,100	0
TPH Aromatic C35-C44	mg/kg	5	142	1,100	0
Benzene	mg/kg	5	<2	0.87	0
Toluene	mg/kg	5	<5	130	0
Ethylbenzene	mg/kg	5	<2	47	0
Xylene (total of all types)	mg/kg	5	<2	56	0
Methyl Tert Butyl Ether (MTBE)	mg/kg	5	<5	49	0
Semi-Volatile Organic Compounds (SVOCs)	mg/kg	5	None above limit of detection	LOD*	0
Asbestos	Presence	5	None above limit of detection	Fibres Present	0

Notes: *Limit of detection: Given the large amount of compounds in this group, coupled with the lack of GAC for certain compounds, any concentrations above the limit of detection will be highlighted in the first instance.

RESULTS EXCEEDING HUMAN HEALTH ASSESSMENT CRITERIA

LEAD

The main investigation recorded one elevated concentration of Lead in the Made Ground Topsoil at WS01 recording 316mg/kg at 0.10m bgl, in comparison to the GAC of 200mg/kg. Further sampling around this location was undertaken during one of the ongoing monitoring visits in order to confirm if the elevated Lead was an anomaly or indicative of contamination in this area. A further five samples of the Made Ground Topsoil in this location were taken (ref. TS01 to TS05) and submitted for Lead analysis. Four of these five additional samples also recorded lead in excess of the GAC.

The six samples from this area were grouped together for statistical analysis as the material was fairly consistent across the area. A normality plot was undertaken which demonstrated that the Lead concentrations in the vicinity of WS01 approximated to a normal distribution. The maximum value test demonstrated that there are unlikely to be any statistical outliers. The mean Lead concentration from the six samples of Topsoil in the vicinity of WS01 was 304mg/kg and the upper 95th percentile was 376mg/kg, both elevated in relation to the GAC of 200mg/kg. This confirms that the Made Ground Topsoil in this part of the site is contaminated with Lead.

Elevated concentrations of Lead above the GAC were also recorded in two samples from the soil and rubble mounds present on site at concentrations of 1,080mg/kg at 0.45m bgl in TP07 and of 411mg/kg at 0.20m bgl in TP08.

RESULTS EXCEEDING HUMAN HEALTH ASSESSMENT CRITERIA

PAH	Elevated concentrations of PAH above the GAC for residential land use were recorded in the Made Ground mound in TP08 at 0.20m bgl. The sample recorded elevated concentrations of Benzo(a)anthracene, Benzo(b)fluoranthene, Benzo(a)pyrene and Dibenzo(a,h)anthracene up to 11.60mg/kg, 9.52mg/kg, 10.70mg/kg and 1.06mg/kg respectively.
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7.2. WATER ENVIRONMENT

It is not appropriate to consider human health assessment criteria for human health in relation to the risk to the water environment, but currently there are no generic soil assessment criteria in respect of the water environment. In the absence of any groundwater sampling data, the soil results are assessed on the basis of professional judgement.

The contaminant concentrations recorded in the soils at the site are not considered to be at such levels that they would present any significant risk to the underlying water environment.

7.3. BUILDING MATERIALS

CONTAMINANT	UNITS	NUMBER OF TESTS	MAXIMUM CONCENTRATION	GAC	NUMBER EXCEEDING GAC
pH	units	18	6.0-8.2	<5.5	0
Sulphate (w/s)	mg/l	18	500	500	0
Sum of SVOC + Aliphatic TPH >C5-C10 + Aromatic TPH >C5-C10 above detection limits	mg/kg	5	None above limit of detection	2	0
Sum of Aliphatic TPH >C10-C21 + Aromatic TPH >C10-C21 above detection limits	mg/kg	5	73	10	1
Sum of Aliphatic TPH >C21-C34 + Aromatic TPH >C10-C35 above detection limits	mg/kg	5	211	500	0
Sum of BTEX + MTBE above detection limits	mg/kg	5	None above limit of detection	0.1	0
Phenols	mg/kg	2	None above limit of detection	2	0
Cresols and chlorinated phenols	mg/kg	2	None above limit of detection	2	0
Naphthalene	mg/kg	10	0.30	0.5	0
Benzo(a)pyrene	mg/kg	10	10.70	0.5	1

RESULTS EXCEEDING BUILDING MATERIALS ASSESSMENT CRITERIA

BENZO(A)PYRENE	The concentrations of the Polycyclic Aromatic Hydrocarbon (PAH) benzo(a)pyrene recorded in one sample of the soils and rubble mounds are above the limits for the use of conventional polyethylene (PE) water supply pipes.
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RESULTS EXCEEDING BUILDING MATERIALS ASSESSMENT CRITERIA

TOTAL PETROLEUM HYDROCARBONS (TPH)

The concentrations of TPH in one sample of the soils and rubble mounds exceed the threshold for conventional plastic water supply pipes. This TPH result is all within the aromatic range and so relates to the elevated PAH recorded within this sample.

8. RISK ESTIMATION - GAS

8.1. RESULTS SUMMARY

PARAMETER	MINIMUM	MAXIMUM	COMMENTS
Methane	0.0%	0.2%	No significant concentrations recorded.
Carbon Dioxide	0.0%	3.2%	No significant concentrations recorded.
Oxygen	16.6%	20.6%	The oxygen levels were typically depleted as carbon dioxide concentrations increased.
Hydrogen Sulphide	0ppm	1ppm	No significant concentrations recorded.
Carbon Monoxide	0ppm	1ppm	No significant concentrations recorded.
Atmospheric pressure	996mB	1017mB	Two monitoring visits were undertaken during falling atmosphere pressure trends when the gas generation potential is increased.
Groundwater levels	1.40m	Dry	Groundwater level in WS01 fell from the second visit onwards from 1.40m to 2.29m bgl. Borehole WS02 started off dry but then recorded water at just over 3.00m bgl coincident with a sand layer at that depth. The remaining boreholes were recorded as dry or nearly dry.
Flow rate	-0.5 l/hr	0.1 l/hr	Negative flows are indicative of 'draw down' in the boreholes. These can be a factor of the effect of drilling on the immediate ground conditions, the creation of a partial vacuum as a result of monitoring, groundwater behaviour or due to certain geologic conditions. In terms of the contamination risk assessment, this does not present a cause for concern as the net effect is to reduce the emission of gas at surface.

SENSITIVITY OF DEVELOPMENT	High (Residential with gardens)	
	IDEALISED	ACTUAL
MONITORING PERIOD	Up to 3 months	2-3 months
TOTAL NUMBER OF VISITS	6	6
NUMBER OF VISITS DURING FALLING PRESSURE TRENDS	At least two visits	2
COMMENT	It is considered that the number of gas monitoring visits completed complies with the guidance within CIRIA C665.	

8.2. GAS REGIME CHARACTERISATION

8.2.1. Gas Source

GAS SOURCE	GENERATION POTENTIAL	COMMENTS
Backfilled gravel pit.	Low/moderate	A historical gravel pit which appears to have been infilled in the 1960s and redeveloped with a house and paddocks is located some 40m east of the site. Historically it was common to backfill old mineral workings with waste materials. Organic rich wastes degrade to form hazardous gases under anaerobic conditions and the landfill gases could be migrating from the pit to the site. However, soils are generally cohesive that will inhibit the migration of gases and so general potential risk to the site is reduced from high to low/moderate.

8.2.2. Building Type

In accordance with BS8485:2015+A1:2019, the development comprises Type A buildings. These buildings are in private ownership with no controls over the use of and alterations to the building. This building type typically comprises private dwellings.

	CHARACTERISTIC GAS CONCENTRATION (fraction)	CHARACTERISTIC GAS FLOW RATE (l/hr)	GAS SCREENING VALUE (l/hr)
Methane	0.02	0.1	0.002
Carbon Dioxide	0.032	0.1	0.0032
Methodology	BS8485:2015+A1:2019.		
Gas Regime	Characteristic situation 1 - Very low risk.		

8.3. GAS PROTECTION MEASURES

8.3.1. Radon Gas

The site is not situated within an area where radon gas protection measures are required in new buildings.

8.3.2. Volatile Organic Compounds

The site is not affected by Volatile Organic Compounds (VOC) contamination.

8.3.3. Methane and Carbon Dioxide

A negligible gas regime has been identified and gas protection measures are not considered necessary.

9. RISK EVALUATION

9.1. REVISED CONCEPTUAL MODEL

The revised conceptual site model plan is presented in the Appendices.

ADDITIONAL POLLUTANT LINKAGES	During the ground investigation, no additional sources of contamination were identified. Some contaminants were confirmed within both the reworked Made Ground Topsoil and within the soil and rubble mounds on site.
INVALID POLLUTANT LINKAGES	The testing did not reveal any contamination that would be a concern to water environment. The waste soil mounds were confirmed as being above the existing ground level and so present no risk to buried services unless this soil is reused within the development. The gas monitoring confirms that the potential gas risk from the nearby infilled gravel pit is invalid.
LIMITATIONS AND UNCERTAINTIES	All the potential contamination sources have been targeted by the exploratory holes and therefore it is considered that a sufficient number of exploratory points have been completed for preliminary contamination assessment purposes. Testing shows one of the soil mounds to be contaminated. Given the mounds were all of similar composition it is likely that other parts of the other three mounds could display similar concentrations.

9.2. UPDATED CONTAMINATION RISK ASSESSMENT

The pollutant linkages identified in the revised conceptual site model will now be evaluated as to their severity:

SOURCES AND CONTAMINANTS	PATHWAYS (REFERENCE FROM MODEL)	RECEPTORS	POTENTIAL RISK
Lead contaminants from Made Ground Topsoil in the location of WS101. -Lead	Ingestion Inhalation Consumption of home grown produce (1)	Future residents	Moderate
Contaminants within the soil and rubble stockpiles: -Lead -PAH -TPH	Ingestion Inhalation Consumption of home grown produce (2)	Future residents	Moderate

The contamination risks that are presented to the various receptor groups are discussed further in the following sections:

RISK TO HUMAN HEALTH

The soil and rubble mounds were found to be contaminated with lead and PAH that present a potential risk to human health if the material was to remain on site and be re-used at shallow depth in gardens or landscaping. Alternatively, if the surplus material is to be removed from site then the risks will be mitigated.

Moderate risks to future residents have been identified from elevated concentrations of Lead present within the Made Ground Topsoil around borehole WS01. Further testing of the more widespread Topsoil around this area and across the site is recommended to confirm the full extent of the Lead contamination.

RISK TO WATER ENVIRONMENT

The investigation has not revealed any contamination risks to the water environment.

RISK TO BUILDING MATERIALS AND SERVICES

The natural soils at the site do not present any cause for concern in respect of conventional plastic water supply pipes.

The PAH and TPH concentrations in some of the soil mounds do exceed the strict thresholds set by the water supply companies. This would dictate the use of protective barrier pipe for water supply connections if the soil was re-used on site. However, it is likely that the soil and rubble mounds will be disposed of from site before any development. This should be confirmed with the local water supply company as they may still stipulate on protective water supply pipes being installed at the development regardless.

9.3. RISK MANAGEMENT

9.3.1. Introduction

A risk to future residents has been identified from elevated lead detected within the Made Ground Topsoil around borehole WS01. Some additional testing has confirmed that it is more widespread around this part of the site and therefore some further testing is recommended to confirm the extent of the contamination. The mounds of soil and rubble on site will also present a potential contamination risk if re-used within the development.

It is recommended that this report is submitted to the planning department of the Local Authority, the organisation undertaking the Building Control function, warranty providers to confirm that the investigation completed to date is satisfactory.

9.3.2. Further Contamination Assessment

In order to provide further confidence in the risk assessment and to address the limitations and uncertainties identified within the existing conceptual model it is recommended that the following additional investigation elements are completed for contamination assessment purposes:

- As discussed above, it is considered that further testing of the Made Ground Topsoil is required in the vicinity of borehole WS01 to delineate the extent of the identified elevated lead concentrations.

9.3.3. Outline Remediation Strategy

The aim of any remediation undertaken as part of site development will be to remove or break all of the viable pollutant linkages identified in the previous section.

It is likely that some targeted removal of the Lead contaminated Topsoil will be required. However, the extent of remediation can only be determined once the recommended additional Lead testing and assessment has been undertaken. Once determined, a formal remediation strategy will need to be developed by an experienced Geo-Environmental Consultant.

The remediation of the soil and rubble mounds would be best achieved by disposing of these materials from site.

9.4. **WASTE SOIL DISPOSAL**

Topsoil should be viewed as a resource rather than a waste. With the exception of some of the Made Ground Topsoil around borehole WS01 (full extents still to be confirmed), the topsoil is suitable for residential garden use in terms of contamination. Once the additional testing has delineated the contamination, the clean topsoil at the site should be stripped and the surplus reused on other developments. It should be noted that topsoil, even if uncontaminated, is unlikely to constitute 'inert waste' due to its high organic matter content.

It is considered that the soil and rubble mounds or any natural sub-soils disposed of from the site would be classified as 'non-hazardous waste' and would be characterised for disposal to landfill as 'inert waste'. However, the chemical results should be forwarded to the proposed landfill site and the waste classification confirmed prior to disposing of any surplus soils. Waste Acceptance Criteria (WAC) testing of the soils has been completed and the results are in the Appendices which confirm the soil tested complies with the inert waste limits. The waste code from the European Waste Catalogue (EWC) 2002 for the soils would be 17 05 04 'Soil and Stones, not containing dangerous substances'.

10. HEALTH AND SAFETY FILE INFORMATION

10.1. INTRODUCTION

The aim of the following sections is to present pertinent Health and Safety information that has arisen from the current investigation/survey works discussed in this report. The aim is to identify health and safety controls that may be necessary during any subsequent maintenance, refurbishment, demolition or construction works. The information is not exhaustive and stems only from the aspects identified within the scope of the works undertaken by BRD.

Where BRD has been appointed as a Principal Contractor, then this information shall form the Health and Safety Files as required by the Construction Design and Management (CDM) Regulations 2015.

Reports are always forwarded to the Client and they shall be responsible for ensuring this safety information is disseminated to those who need it.

The works undertaken by BRD are detailed in the previous sections of this report.

10.2. HAZARDS

During the course of the BRD works the following noteworthy safety hazards have been identified:

10.2.1. Contamination

Contaminated soils are present at the site. Construction workers will be at risk where they are exposed to these soils and groundwater, for example during demolition, utility services work and foundation construction. During the redevelopment of the site, the presence of contaminated soils should be considered within health and safety plans. Measures to protect the health and safety of site workers should be implemented including use of appropriate personal protective equipment, education and good hygiene procedures.

10.3. EXISTING STRUCTURES

BRD recommend that advice on existing structures is gained from a qualified and experienced Building Surveyor or Structural Engineer.

10.4. HAZARDOUS MATERIALS

BRD did not construct anything with hazardous materials.

Any soils to be imported to the site, in particular topsoil, should be tested to confirm their suitability in the development.

10.5. UTILITY SERVICES

No previously unidentified utility services were encountered during the BRD works.

The utility services plans held by the Client should be referred to.

REPORT SPECIFIC REFERENCES

- British Geological Survey sheet 221 “Hitchin” Solid and Drift edition (1:50,000) published 1995.
- British Geological Survey sheet 14 “Cambridge and Maidenhead” Hydrogeological Map of the area between Cambridge and Maidenhead edition (1:100,000) published 1984.
- ‘Phase 1 Environmental Desk Study - Milksey Lane, Graveley’, BRD Environmental Ltd, report ref. BRD3930-OR1-A, dated July 2021.

SUPPORTING INFORMATION

GROUND INVESTIGATION

Exploratory holes are logged by an experienced Geo-Environmental Consultant in general accordance with 'Code of practice for site investigations' BS5930:2015, British Standards Institution, 2015. Soil samples for chemical and geotechnical analysis are taken from the exploratory holes at intervals dictated by the nature of the soils and the objectives of the investigation.

Where stated on the logs of inspection pits, trial pits or boreholes (where insitu testing has not been undertaken), the relative density of coarse (sand and gravel) soils is tentative only. Such assessments of density are on the basis of visual inspection only taking into consideration such factors as drilling rates, stability of pit side walls, appearance and behaviour under excavation.

Where Chalk strata is encountered it is logged and graded in general accordance with CIRIA guidance 'C574 - Engineering in Chalk'. It should be recognised that where percussive drilling methods are employed, the structure of the Chalk is destroyed and therefore the grading stated on such logs is either tentative or absent where it is not possible to assess the grade.

Hand Dug Inspection Pits

Hand tools are used to forward shallow inspection pits as a cost effective method of describing and sampling near surface soils. The technique is also used where exposure of existing footings is required. The depth reached by such techniques is a function of the nature of the ground and generally does not exceed 1.5m

Trial Pits

Mechanically excavated trial pits allow detailed inspection of near surface ground due to the large volume of soil exposed. A wheeled backhoe loader is the usual machine for digging trial pits that are typically 3 to 4.5m deep, 0.5m wide and 3m long.

Windowless Sampling Boreholes

This type of borehole is formed by a small tracked dynamic percussion drilling rig with samples retrieved in thin plastic liners within the narrow diameter steel sampling tubes. Borehole depths of up to 5m are typical, but in exceptional circumstances up to 15m depth can be achieved. This is the smallest type of rig that is capable of undertaking Standard Penetration Tests (SPTs).

Hand Held Window Sampling

Hand held window sampling is a useful method of drilling narrow diameter boreholes particularly where access is difficult. Hand held mechanical percussive hammers are used to drive the sampling tube into the ground. The soil samples are collected within the hollow metal sampling tubes and inspected via the open window along one side. Window sampling boreholes can be forwarded to depths of 3m to 6m depending upon ground conditions.

Cable Percussive Boreholes

This form of drilling involves repetitive dropping of a tube into the soil under its own weight from a tripod support. The sample is obtained from the clay cutter head in fine soils or a bailer for wet granular soils. As the borehole progresses SPTs can be undertaken and relatively undisturbed samples can be obtained. Typically these boreholes are 15 to 25m deep, but depths of double that can be achieved in soils, but only thin weak rock layers can be penetrated.



Rotary Boreholes

Where competent rock is required to be drilled then rotary drilling techniques are required. The drilling rigs can vary in size from small tracked units to larger units mounted on four wheel drive trucks. Rotary open hole drilling techniques break the rock into small fragments and so recovery of any samples is limited. In contrast, rotary coring retrieves excellent samples. Some rigs also allow windowless sampling to be undertaken through soil layers. There are no practical limits to the depths that this drilling method can achieve.

Dynamic Probing

Dynamic probing comprises a sectional rod with a sacrificial cone at the base of slightly larger diameter than the rod. The rod is driven into the ground by a constant mass falling through a set distance. The number of blows required to forward the rod per 100mm is then recorded and presented in a graph of N_{10} values. The standard applicable to dynamic probing is "BS EN ISO 22476-2:2005 Incorporating corrigendum no. 1, Geotechnical investigation and testing – Field testing – Part 2: Dynamic probing" BSi, February 2007.

Static Cone Penetration Tests

Cone Penetration Tests (CPT) consist of pushing a conical 60° cone into the ground at a constant rate and recording the force required to do this. Sensors in the cone record other information and this data can be correlated to a number of different geotechnical parameters.

Dynamic Penetrometer

The Transport Research Laboratory Dynamic Cone Penetrometer (TRL DCP) uses an 8 kg hammer dropping through a height of 575mm to drive a 60° cone of 20mm maximum diameter into the ground. The depth driven either per blow or per several blows is recorded. The strength of each of the soil layer encountered is then calculated by converting the penetration rate (mm per blow) into an approximate California Bearing Ratio (CBR) value employing the correlation proposed by TRL.

Gas Monitoring

Gas monitoring is undertaken with a portable gas monitor for oxygen, Methane, Carbon Dioxide, Hydrogen Sulphide and Carbon Monoxide together with recording of atmospheric pressure and any flow rate.

Vapour Monitoring

Headspace tests and monitoring for Volatile Organic Compounds (VOC) or Semi Volatile Organic Compounds (SVOC) is undertaken using a Photo Ionisation Detector (PID). The MiniRAE models used have a 10.6 eV lamp calibrated for isobutylene. The PID is useful tool to indicate the presence of a wide range of volatile compounds, but only provides semi-quantitative data as different compounds provide a different response and thus the reading is not a true reflection of the actual concentration present.

Low PID readings can be recorded in natural uncontaminated organic soils or even as a result of atmospheric pollution. It is generally accepted by consultants and regulators that recorded values in excess 50 parts per million (ppm) represents the presence of organic compound pollutants and in excess of 100 ppm such contamination may be significant.

The headspace test procedure involves the collection of a sample of suspected contaminated soils and placing within a sample bag. A tight seal to the bag is formed with a similar volume of air trapped to that of the soil and the sample is left for fifteen minutes to allow volatilisation of any contaminants. The bag is then pierced by, and sealed around, the sample probe of the PID and a reading taken.

Borehole well monitoring is undertaken by connecting the PID directly to the gas tap on the monitoring well installation.

Groundwater Level Monitoring

Groundwater levels are recorded with an electronic dip meter that has a detector end that is lowered into the borehole well. An audible signal is made when water is reached and the depth recorded from the graduated tape used to lower the detector. Where there is potential for a separate Light Non Aqueous Phase Liquid (LNAPL) to be present floating on the groundwater an oil/water interface meter is used in preference to a conventional dip meter so that any such floating product can be detected.

Geotechnical Sampling

BRD schedule a range of geotechnical testing as appropriate to the identified ground conditions, available budget and the proposed development. Different types of soil samples are obtained as appropriate to the ground conditions and planned testing.

SAMPLE TYPE	SYMBOL USED ON LOGS	DESCRIPTION
<i>Disturbed</i>	<i>D</i>	<i>Small disturbed soil samples of about 1 to 2 kg are collected in plastic bags.</i>
<i>Bulk</i>	<i>B</i>	<i>Large disturbed bulk samples up to about 20 to 30 kg are collected in plastic bags</i>
<i>Undisturbed</i>	<i>U</i>	<i>‘Undisturbed’ samples generally collected in plastic or metal tubes within cable percussive boreholes of 100mm diameter for samples of fine soils of firm to stiff consistency. Can also be representative of samples taken by cutting plastic sample liners from windowless sampling drilling methods. It is recognised that such samples do not generally meet Eurocode sample quality requirements for the tests commonly employed. However, given the wealth of experience with these sampling methods this continues to be common in United Kingdom practice particularly for less sensitive developments where more expensive sampling techniques are not economically justifiable.</i>
<i>Undisturbed</i>	<i>UT</i>	<i>A thin walled steel sampler developed by Archway Engineering called a UT100 in an attempt to gain better quality samples of soft to firm fine soils when using cable percussive drilling methods.</i>

Contamination Sampling

BRD schedule contamination testing as appropriate to the ground conditions, available budget, potential contaminants and the proposed development. Samples are collected in single use laboratory supplied containers.

Soil samples are retrieved in plastic containers and/or amber glass jars with a lined plastic cap. Contamination samples are indicated by a 'J' on exploratory hole logs.

Water samples are collected in plastic bottles and/or amber glass jars with a lined plastic cap then placed in cool boxes together with freezer packs. Water samples are indicated by a 'W' on exploratory hole records, but generally such samples are not tested as testing from dedicated monitoring wells is preferred for sample quality reasons.

Samples retrieved from the exploratory holes are dispatched to the laboratory by overnight courier. Where samples cannot be transported directly from site they are temporarily stored in the BRD dedicated sample storage facility which includes refrigeration where necessary. The individual accreditation of the test methods is detailed in the laboratory test report.

GEOTECHNICAL ASSESSMENT

Under Eurocode 7 (EC7) the following risk ranking is applied to geotechnical projects:

GEOTECHNICAL CATEGORY	DESCRIPTION
1	<i>Small and relatively simple structures for which it is possible to ensure that the fundamental requirements will be satisfied on the basis of experience and qualitative geotechnical investigations with negligible risk. For example, straightforward ground conditions, local experience, no excavation below the water table unless this will be straight forward.</i>
2	<i>Conventional types of structures and foundations. No difficult soil or loading conditions. Quantitative geotechnical data and laboratory testing. Routine procedures for field and laboratory testing. Conventional structures and no exceptional geotechnical risk. For example, spread, raft and piled foundations, retaining walls, bridge piers and abutments, embankments, ground anchors, tunnels and excavations.</i>
3	<i>Those structures not in Categories 1 and 2 such as very large or unusual structures, structures involving abnormal risks, or unusual or exceptionally difficult ground or loading conditions. Structures in highly seismic areas. Structures in areas of probable site instability or persistent ground movements that require separate investigation or special measures.</i>

GEOTECHNICAL PARAMETERS

Soakage Tests

Soakage tests comprise the filling of a test pit with water and recording the time taken for the water to drain away. The tests are undertaken in general accordance with 'Digest DG 365: Soakaway design' BRE, Revised 2016. The test pits are usually gravel filled for safety with a slotted vertical pipe through which water observations are made. Water is generally supplied by a tanker to allow fast filling of the pits with water. Compliant tests are filled and allowed to drain near empty three times.

Standard Penetration Tests

The standard penetration test (SPT) determines the resistance of soils at the base of a borehole to the dynamic penetration of a split barrel sampler and the recovering of disturbed samples for identification purposes. In gravelly soils and some soft rocks a solid cone is used in preference to the sampler.

The basis of the test consists in driving a sampler by dropping a hammer of 63.5 kg mass on from a height of 760 mm. The number of blows (N value) necessary to achieve a penetration of the sampler of 300 mm is recorded. The test is described in 'Geotechnical investigation and testing – Field testing – Part 3: Standard penetration test - BS EN ISO 22476-3:2005 Incorporating corrigendum no. 1', BSi, 2007.

The uncorrected N values of the SPT tests are recorded upon the borehole logs together with a record of blows for each 75mm test portion including the seating blows. Where the full test depth cannot be achieved due to refusal on hard stratum, the number of blows and the distance achieved is recorded and the N value given as >50. The abbreviation SPT(c) is used upon the logs indicates that the test was performed with a solid cone rather than a split spoon sampler.

It is necessary to apply a correction to the N values to account for the effects of energy delivery using the equation: $N_{60} = \frac{E_r}{60} N$ where E_r is the energy ratio of the specific test equipment.

In the case of tests in sand, for the effects of overburden and rod length the equation is modified to $N_{60} = \frac{E_r}{60} \times \lambda \times C_N \times N$ where λ is the correction factor for energy losses due to the rod length and C_N is the correction factor for vertical stress due to overburden of the soil.

Sulphate

In order to compare the laboratory soil test results with 'Concrete in aggressive ground. BRE Special Digest 1: 2005' (BRE, 2005) laboratory results are converted to SO_4 mg/l. Laboratory results expressed as SO_3 g/l and are multiplied by a factor of 1200 to express the results as SO_4 mg/l.

Index Property Tests

In accordance with National House Building Council (NHBC) Standards Chapter 4.2 - Building near trees, the laboratory plasticity indexes are assessed against their volume change potential. The Modified Plasticity Index is defined as the Plasticity Index of the soil multiplied by the percentage of particles with a nominal diameter of less than $425\mu m$. Whilst the NHBC Standards were developed for residential buildings, the advice is equally applicable to a large number of other types of low rise structures.



Hand Shear Vane

The undrained shear strength of the fine (i.e. clay) soils at the site can be established using hand shear vane apparatus. Usually three readings are taken at every depth tested and the uncorrected results recorded on the exploratory point log. Shear vane readings from depths below 1.2m depth in trial pits are from tests performed on excavated soil. In accordance with Eurocode 7 – Geotechnical design – Part 2: Ground investigation and testing EN 1997-2:2007 the results should be corrected. BRD employ only simple correction methods as the more complex correction methodologies imply undue accuracy to a test that has distinct disadvantages and limitations.

Pocket Penetrometers

The Pocket Penetrometer is a lightweight instrument for use by field personnel to check visual classification of soils. It is a simple test and there is inherent uncertainty related to the small volume of soil being tested and so the results should be used with appropriate caution. Pocket penetrometers are calibrated in terms of unconfined compressive strength and once converted to undrained shear strength (divide by two) the results are further reduced by a factor of 1.5 - 2.0 as the device tends to overestimate strengths.

<i>Instrument Reading (uncompressive strength in kg/cm²)</i>	<i>Indicative Undrained Shear Strength (kN/m²)</i>	<i>Indicative Consistency</i>	<i>Indicative strength</i>
1.0	25 - 33	Soft	Low
1.5	38 - 50	Soft to firm	Low to medium
2.0	50 - 67	Firm	Medium
2.5	63 - 83	Firm to stiff	Medium to high
3.5	88 - 116	Stiff	High
4.5	113 - 150	Stiff to very stiff	High to very high

CONTAMINATION ASSESSMENT METHODOLOGY

UK Policy

The UK Government's policy in relation to land affected by historic contamination is based on a 'suitable for use' approach. The approach recognises that the risks presented by any given level of contamination will vary greatly according to the use of the land and a wide range of other factors, such as the underlying geology of the site. Contamination risks therefore need to be assessed on a site-by-site basis. The 'suitable for use' approach limits requirements for remediation to the work necessary to prevent unacceptable risks to human health or the environment in relation to either the current use or future use of the land.

The three main drivers for contamination assessment and remediation are:

- Voluntary action.*
- Development as part of the planning regime.*
- Regulatory action to mitigate unacceptable risks e.g. Part 2A of the Environmental Protection Act 1990.*

Pollutant Linkages

For a contamination risk to exist there must be a 'pollutant linkage' from the contaminant (source) via a pathway (the route from contaminant to receptor) to a receptor (the entity that could be harmed). The absence of a contaminant, pathway or receptor breaks the pollutant linkage and therefore no contamination risk exists.

Contamination is typically present at a site (in the ground and/or in the underlying groundwater) as a result of a historic or current industrial use, usually as a result of leaks, spills or disposal of residues, wastes and excess raw materials from the industrial processes. Contamination may also be present due to:

- The deliberate application of chemicals e.g. the spraying of herbicide/pesticide.*
- Migration of pollutants from adjacent land.*
- Naturally occurring processes e.g. elevated concentrations of particular heavy metals associated with specific geological strata.*

Conceptual Site Model

The conceptual site model can be defined as a textual or graphical representation of the identified pollutant linkages for a given site. The model forms the basis for designing the investigation as the aim will be to target all of the potential pollutant linkages to determine, through the subsequent phases of risk assessment, whether or not they pose an actual risk.

It is important that the conceptual site model is updated with new information as the various investigation, risk assessment and remediation works are completed.

Technical Guidance

The technical and legal framework for contamination assessment is complex. The process adopted through this report for assessing contamination risks is in general accordance with the following guidance, as listed below:

- 'Investigation of Potentially Contaminated Sites - Code of Practice - BS 10175:2011+A2:2017', The British Standards Institution 2017.
- 'Model Procedures for the management of Land Contamination - CLR Document No. 11', Environment Agency, 2004.
- 'Guidance for the safe development of housing on land affected by contamination - R&D66: 2008', NHBC/Environment Agency, 2008.

Risk Assessment Methodology

In line with the technical guidance, the contamination risk assessment follows a series of phased stages for each particular site:

PHASE	DESCRIPTION	RISK ASSESSMENT STAGE
PHASE 1	Generally limited to desk based research and a site walkover survey to develop an initial conceptual site model and identify what risks, if any, are likely to be presented by the site.	Hazard Identification and Assessment A preliminary stage of risk assessment concerned with identifying and characterising the hazards that may be associated with a particular site and identifying potential pollutant linkages.
PHASE 2	This phase is concerned with establishing whether contamination is present, usually through intrusive ground investigation, and then evaluating the degree and magnitude of the associated risks.	Risk Estimation A stage concerned with estimating the likelihood that receptors will suffer adverse effects if they come into contact with, or are otherwise affected by, a hazardous substance or agent under defined conditions. Risk Evaluation A stage of risk assessment concerned with evaluating the acceptability of estimated risks, taking into account the nature and scale of the risk estimates, any uncertainties associated with the assessment and the broad costs and benefits of taking action to mitigate risks.
PHASE 3	The appraisal and selection of remediation techniques, their implementation and verification.	Risk Management The process whereby decisions are made to accept a known or assessed risk and/or the implementation of action to reduce the consequences or probabilities of occurrence.

Risk Classification

The objective of risk assessment is to identify the nature and magnitude of the potential risks and should be based on a consideration of both:

- The likelihood/probability of an event [taking into account both the presence of the hazard and receptor and the integrity of the pathway].
- The severity of the potential consequence [taking into account both the potential severity of the hazard and the sensitivity of the receptor].

There is a need for a logical, transparent and repeatable system in defining the categories of severity of consequence and likelihood as well as for the risk itself and therefore the following risk rating matrix is employed:

		SEVERITY OF 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	Negligible Risk
	UNLIKELY	Moderate/Low Risk	Low Risk	Negligible Risk	Negligible Risk

These risk classifications are defined as follows:

- **Very High Risk** - There is a high probability that severe harm could arise to a designated receptor from an identified hazard at the site without appropriate remediation action.
- **High Risk** - Harm is likely to arise to a designated receptor from an identified hazard at the site without appropriate remediation action.
- **Moderate Risk** - It is possible that without appropriate remediation action harm could arise to a designated receptor. It is relatively unlikely that any such harm would be severe, and if any harm were to occur it is more likely that such harm would be relatively mild.
- **Low Risk** - It is possible that harm could arise to a designated receptor from an identified hazard. It is likely that, at worst if any harm was realised any effects would be mild.
- **Negligible Risk** - The presence of an identified hazard does not give rise to the potential to cause harm to a designated receptor.

This risk assessment matrix and classification system is based on guidance produced by Department for Environment, Food and Rural Affairs (Defra) and the Environment Agency in connection with contaminated land assessment.

RISK ESTIMATION - SOILS

Introduction to Soil Human Health Generic Assessment Criteria (GAC)

The Environment Agency (EA) and Department of Environment Food and Rural Affairs (DEFRA) had previously issued revised guidance following the consultation about the DEFRA publication “Assessing risks from land contamination - a proportionate approach. Soil Guideline Values: the Way Forward”. This resulted in a revised version of the Contaminated Land Exposure Model (CLEA) model (version 1.06) and a few of the previously published Soil Guideline Values (SGVs) were revised.

The main legislative driver for dealing with historical land affected by contamination is Part 2A of the Environmental Protection Act 1990. Revised Statutory Guidance to support Part 2A was published in April 2012. This Guidance introduced a new four-category system for classifying land under Part 2A for cases of a Significant Possibility of Significant Harm to human health,¹ where Category 1 includes land where the level of risk is clearly unacceptable and Category 4 includes land where the level of risk posed is acceptably low. The impact assessment for the new Statutory Guidance stated “The new statutory guidance will bring about a situation where the current SGVs/GACs are replaced with more pragmatic (but still strongly precautionary) Category 4 screening levels (C4SLs) which will provide a higher simple test for deciding that land is suitable for use and definitely not contaminated land”. The C4SLs are still derived using the CLEA model, but adopt a slightly different approach to toxicological assessment and exposure modelling.

In March 2014, the outcome of “SP1010 - Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination - Final Project Report” (CL:AIRE) was published. Due to slightly ambiguous wording within this report, Lord de Mauley, Parliamentary Under Secretary, DEFRA wrote to all local authorities on 3 September 2014 to confirm that the published C4SLs were final and that they can be used in risk assessment undertaken under the planning regime.

Whilst there are proposals for the industry to develop C4SLs for other contaminants, these have yet to produce any new values. BRD do not believe that C4SLs could be developed by a single organisation with sufficient confidence. BRD has therefore employed other, more conservative guidance based on the CLEA model (detailed below) within this assessment for compounds where C4SLs are not available. However, it should be noted that the results of this investigation may need to be reinterpreted as new C4SLs become available.

Due to the limited number of published C4SL values at this time, the Chartered Institute of Environmental health (CIEH) and Land Quality Management Ltd (LQM) have produced Generic Assessment Criteria (GAC) known as Suitable for Use Levels (S4ULs), for use in contaminated land human health risk assessment. These S4ULs (2014) have been derived for a large number of substances using the current CLEA model and are therefore consistent with current guidance. They also incorporate the revised exposure parameters as adopted by the C4SL programme, but have not adopted the revised toxicological approach adopted by the C4SLs and so remain a more conservative assessment criteria. The substances for which SGVs were previously published have also been revised as new S4ULs in light of the new exposure parameters proposed by the C4SL programme, and therefore effectively replace the existing SGVs.

In addition, in December 2009, other GAC for less common substances were produced by the Environmental Industries Commission (EIC), The Association of Geotechnical and Geoenvironmental Specialists (AGS) and Contaminated Land: Applications in Real Environments (CL:AIRE) using the CLEA model. These are referred to as the EIC/AGS/CLAIRE GAC.

In summary, C4SLs have been used where these are available. For those substances where C4SLs have yet to be issued, then the S4ULs have been adopted or in some cases, the EIC/AGS/CLAIRE GAC. All of the previously produced SGVs have now either been withdrawn, or superseded by the respective C4SLs or S4ULs.

The only exception to this approach is the PAH compound benzo(a)pyrene (BaP) where a C4SL guideline value has been produced, whereas BRD has adopted the S4UL value. The C4SL for BaP relates to its use as a surrogate marker compound representing all of the genotoxic PAH compounds as a mixture, rather than this individual compound. BRD has therefore adopted the compound specific S4UL value as the initial screening value, for consistency with the other PAH compounds before then employing the C4SL is necessary.

It should be noted that unless otherwise stated, all the assessment criteria adopted within this report have been derived based on a sandy loam soil at pH 7 and the values quoted are for a conservative soil organic matter content of 1% where applicable (i.e. organic contaminants).

Human Health - Soil Generic Assessment Criteria

The results of the soils analysis have been compared to generic assessment criteria for the default exposure scenarios comprising either residential land with plant uptake, residential land without plant uptake, or commercial/industrial land use. The criteria values selected are listed in the table below and full details on the source are referred to above. Where applicable, the results have also been assessed with reference to the required statistical tests presented within CLAIRE document "Guidance on comparing soil contamination data with a critical concentration".

ANALYSIS	GENERIC ASSESSMENT CRITERIA (mg/kg unless stated)			SOURCE
	RESIDENTIAL WITH PLANT UPTAKE	RESIDENTIAL WITHOUT PLANT UPTAKE	COMMERCIAL / INDUSTRIAL	
Arsenic	37	40	640	C4SL
Cadmium	22	150	410	
Chromium (total) ⁵	910	910	8,600	S4UL
Chromium VI	21	21	49	C4SL
Lead	200	310	2,330	
Mercury*	11	15	320	S4UL
Selenium	250	430	12,000	
Nickel	180	180	980	
Copper	2400	7,100	68,000	
Zinc	3,700	40,000	730,000	
pH	<5 - 10> units			Professional judgement
Naphthalene	2.3	2.3	190	S4UL
Acenaphthylene	170	2,900	83,000	
Acenaphthene	210	3,000	84,000	
Fluorene	170	2,800	63,000	
Phenanthrene	95	1,300	22,000	
Anthracene	2,400	31,000	520,000	
Fluoranthene	280	1,500	23,000	
Pyrene	620	3,700	54,000	
Benzo(a)anthracene	7.2	11	170	
Chrysene	15	30	350	
Benzo(b)fluoranthene	2.6	3.9	44	
Benzo(k)fluoranthene	77	110	1,200	
Benzo(a)pyrene	2.2	3.2	35	
Indeno(1,2,3-cd)pyrene	27	45	500	
Dibenzo(a,h)anthracene	0.24	0.31	3.5	S4UL
Benzo(ghi)perylene	320	360	3,900	
TPH Aliphatic C5-C6	42	42	3,200	
TPH Aliphatic C6-C8	100	100	7,800	
TPH Aliphatic C8-C10	27	27	2,000	
TPH Aliphatic C10-C12	130	130	9,700	
TPH Aliphatic C12-C16	1,100	1,100	59,000	
TPH Aliphatic C16-C35	65,000	65,000	1,600,000	
TPH Aliphatic C35-C44	65,000	65,000	1,600,000	

ANALYSIS	GENERIC ASSESSMENT CRITERIA (mg/kg unless stated)			SOURCE
	RESIDENTIAL WITH PLANT UPTAKE	RESIDENTIAL WITHOUT PLANT UPTAKE	COMMERCIAL / INDUSTRIAL	
TPH Aromatic C5-C7	70	370	26,000	
TPH Aromatic C7-C8	130	860	56,000	
TPH Aromatic C8-C10	34	47	3,500	
TPH Aromatic C10-C12	74	250	16,000	
TPH Aromatic C12-C16	140	1,800	36,000	
TPH Aromatic C16-C21	260	1,900	28,000	
TPH Aromatic C21-C35	1,100	1,900	28,000	
TPH Aromatic C35-C44	1,100	1,900	28,000	
Benzene	0.87	3.3	98	C4SL
Toluene	130	880	56,000	S4UL
Ethylbenzene	47	83	5,700	EIC / AGS / CL: AIRE GAC
Xylene [^]	56	79	5,900	
MTBE	49	73	7,900	

Notes:

* The S4UL for methyl mercury has been adopted as the worst case mercury compound as generally there is no desk study evidence to suggest the potential for elemental mercury on the majority of sites.

[^] The lowest S4UL of either p-xylene, o-xylene or m-xylene has been adopted for each land use as a conservative measure.

[§] S4UL for Chromium III adopted, as in the absence of Chromium VI it is likely that all of the chromium will be in this form as these are the two most common and stable forms of chromium in the soil environment.

Where no GAC is available, any concentrations exceeding the laboratory limit of detection are identified and discussed in more detail.

Water Environment - Soil Generic Assessment Criteria

There are no UK published Generic Assessment Criteria for soil test results in respect of the risk to the water environment and therefore risk estimation is on the basis of the professional judgement and experience of BRD to employ values that are a reasonable concentration above which concern for water resources is valid.

The Total PAH GAC employed is the sum of the 16No. priority PAH compounds regularly tested for in contaminated land analysis (i.e. US EPA 16PAHs). BRD employ a soil screening based upon the total PAH limit for 'inert waste' of 100mg/kg. The rationale is based on PAHs are recognised to be generally of low solubility and the risk to the water environment is correspondingly low.

In respect of Total Petroleum Hydrocarbons, BRD employ a value of 500 mg/kg as a screening value in comparison to the sum of the component aliphatic and aromatic TPH carbon bands. The employed soil screening value is based upon:

- In common with some other consultants, the professional judgement and experience of BRD suggests that this value is a reasonable concentration above which concern for water resources is valid. The rationale is based on the fact that lower concentrations of fuel based contaminants are more likely to naturally degrade than migrate any great distance.
- BRD is aware of regional Environment Agency groundwater and contaminated land teams historically employing 500 mg/kg as a screening value for considering whether or not TPH could represent a risk to water resources.
- The value mirrors the mineral oil Waste Acceptance Criteria limits for what is considered 'inert waste'.

Should elevated contaminants that pose a potential risk to the water environment be identified then site specific assessment criteria should be developed.

Building Materials and Services - Soil Generic Assessment Criteria

Some hydrocarbon compounds are known to both attack and permeate through certain plastic pipe materials, with the primary concern being the degradation and tainting of water supplies. The UK Water Industry Research (UKWIR) has therefore produced a document 'Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites' (ref. 10/WM/03/21) that specifies threshold criteria for the adoption of 'standard' polythene (PE) or PVC pipes, protective barrier pipe and ductile iron/steel/copper pipes.

The UKWIR threshold assessment criteria from Table 3.1 of this document for standard PE pipes have been employed. It should be noted that the approach taken by UKWIR is very conservative, and both the document and research are flawed. However, it is these values that are being using to specify water pipe materials and therefore it is appropriate to consider them.

The UKWIR guidance is particularly flawed in respect of the chemical analysis it expects as it seeks a limit of detection that is generally below limits that are reasonable or commonly employed in contaminated land assessment. The UKWIR seeks that where a substance is below the limit of detection it should be taken as being present at half this concentration. For the larger suite of chemicals where the limit is against a sum of compounds, this approach would mean that a sample of virgin sub-soil from a greenfield site with absolutely no contamination would actually fail the criteria for using standard PE pipes. To avoid this situation, BRD have adopted the approach of summing only those compounds detected above their respective limits of detection.

In terms of building materials, the primary concern is in respect of concrete as certain commonly occurring natural ground conditions can adversely impact on buried concrete as discussed in 'Special digest 1:2005 Concrete in aggressive ground', BRE, 2005.

ANALYSIS	GENERIC ASSESSMENT CRITERIA	SOURCE
pH	<5.5	BRE Special Digest 1:2005
Sulphate (w/s)	500 mg/l	BRE Special Digest 1:2005
Sum of any VOC above detection limits	0.5 mg/kg	Relevant compounds adapted from UKWIR Table 3.1
Sum of SVOC + Aliphatic TPH >C5-C10 + Aromatic TPH >C5-C10 above detection limits	2 mg/kg	
Sum of Aliphatic TPH >C10-C21 + Aromatic TPH >C10-C21 above detection limits	10 mg/kg	
Sum of Aliphatic TPH >C21-C34 + Aromatic TPH >C10-C35 above detection limits	500 mg/kg	
Sum of BTEX + MTBE above detection limits	0.1 mg/kg	
Phenols	2 mg/kg	
Cresols and chlorinated phenols	2 mg/kg	
Naphthalene	0.5 mg/kg	
Benzo(a)pyrene	0.5 mg/kg	

RISK ESTIMATION - GROUNDWATER

The initial assessment of the contamination risk to groundwater is by comparing dissolved groundwater concentrations with screening values (GAC) that are protective of groundwater resources.

The reference source for the target concentrations is generally the EA's Environmental Quality Standards (EQS) (accessed July 2018: <http://evidence.environment-agency.gov.uk/ChemicalStandards/report.aspx?cid=17>), the Water Supply (Water Quality) Regulations 2016 and the DW1/DW2 criteria from the Surface Water (Abstraction for drinking water)(classification) Regulations 1996. The target concentrations are outlined in the table below. The 'Petroleum Hydrocarbons in Groundwater: Guidance on assessing petroleum hydrocarbons using existing hydrogeological risk assessment methodologies'. CL:AIRE, 2017 has also been used as reference source for the values.

ANALYSIS	GENERIC ASSESSMENT CRITERIA (GAC)	SOURCE
Arsenic	50 µg/l	DW1 & EQS
Cadmium	5 µg/l	EQS
Chromium (total)	50 µg/l	DW2 & EQS
Copper	50 µg/l	DW1
Nickel	20 µg/l	EQS
Lead	50 µg/l	DW1
Mercury	1 µg/l	WSR
Selenium	10 µg/l	WSR
Zinc	5 mg/l	DW2
Cyanide	50 µg/l	WSR
pH	6 to 9 units	EQS
Benzene	10 µg/l	EQS
Toluene	74 µg/l	EQS
Ethylbenzene	300 µg/l	WHO guideline
Xylene	30 µg/l	EQS
Methyl tert-butyl ether (MTBE)	15 µg/l	Taste and odour threshold.
Naphthalene	2 µg/l	EQS
Benzo(a)pyrene	0.0017 µg/l	EQS - Less than Limit of Detection (LOD)
Total PAH	0.2 µg/l	DW1
TPH Aliphatic C5-C6	15,000 µg/l	World Health Organization (WHO) guide values for TPHCWG fractions in drinking water
TPH Aliphatic C6-C8	15,000 µg/l	
TPH Aliphatic C8-C10	300 µg/l	
TPH Aliphatic C10-C12	300 µg/l	
TPH Aliphatic C12-C16	300 µg/l	
TPH Aromatic C5-C7	10 µg/l	
TPH Aromatic C7-C8	700 µg/l	
TPH Aromatic C8-C10	300 µg/l	
TPH Aromatic C10-C12	90 µg/l	
TPH Aromatic C12-C16	90 µg/l	
TPH Aromatic C16-C21	90 µg/l	
TPH Aromatic C21-C35	90 µg/l	

There are no available generic assessment criteria for some of the analytical parameters which have been scheduled, for example hexavalent chromium, and some VOC compounds. These parameters will be assessed based on professional judgement should they exceed the limit of detection.

RISK ESTIMATION - GROUND GAS

Introduction

A variety of potentially hazardous gases occur naturally in the ground environment. Microbial decay of organic matter under anaerobic conditions and geological processes can lead to the generation of Methane and Carbon Dioxide, but can also include traces gases such as Hydrogen sulphide and Carbon monoxide.

Methane is a colourless and odourless gas that has the hazardous properties of being flammable and, at certain air/Methane mixtures, explosive. Methane has a low toxicity, but can be a simple asphyxiant due to the displacement of oxygen.

Carbon Dioxide is a colourless, odourless and non-combustible gas that has the hazardous property of being a highly toxic chemical. At concentrations of 3% by volume, shortness of breath and headaches will occur becoming acute by 6%. At levels of above 10% by volume headache, visual distortion, tremors and rapid loss of consciousness occur. Concentrations of Carbon Dioxide above 22% by volume are likely to be fatal. The effects of Carbon Dioxide poisoning are made more severe if there is accompanying reduction in oxygen concentrations.

Hydrogen sulphide is a colourless and flammable gas that has an odour of rotten eggs. It is important that the sense of smell is over powered at higher concentrations. The gas is toxic and can be an asphyxiant.

Carbon monoxide is a colourless, odourless and explosive gas in air mixtures that has the hazardous property of being a highly toxic chemical.

Radon is a naturally occurring colourless and odourless gas that is radioactive. It is formed by the radioactive decay of radium which in turn is derived from the radioactive decay of uranium, both of which are minerals that can be found in many soil types. Whilst it is recognised that the air inside every building contains radon, some buildings built in certain defined areas of the country might have unacceptably high concentrations and require special precautions to be taken. The maps contained within BRE211:2015 'Radon: guidance on protective measures for new buildings' identify areas where no radon protection measures are necessary or where higher concentrations are present that either basic or full radon protection measures are required to be fitted to all new buildings, extensions or refurbishments.

Basis of Gas Assessment

In order to classify the level of risk and need, if any, for gas protection measures at a site with the potential for a gas problem, consideration of each of the following is necessary:

- The source of the gas.*
- The generation potential of the gas.*
- The location of the source and the geological setting.*
- Boreholes flow rate and estimated surface emission rate.*
- The nature of the proposed development.*
- Confidence in the knowledge of the gas regime.*

The gas assessment is made with reference to 'C665 - Assessing risks posed by hazardous ground gases to buildings', Construction Industry Research and Information Association (CIRIA), 2007 and 'BS8485:2015 - Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings' BSI 2015.

Gas Screening Value

The methods within CIRIA C665 and BS8485 both use the gas concentrations together with the borehole flow rates to define a characteristic situation for a site based on the limiting borehole gas volume flow for Methane and Carbon Dioxide. This limiting borehole gas volume flow is called the Gas Screening Value (GSV) and is expressed below:

$$\text{Gas Screening Value (l / hr)} = \text{borehole flow rate (l/hr)} \times \text{gas concentration (fraction)}$$

The calculation of GSV is completed for both Methane and Carbon Dioxide and then the 'worse case' maximum values are used in the assessment. The assessment is to determine the gas regime at the site is dependent upon the nature of the development.

Characteristic Gas Situation

The characteristic situation for many sites is determined from evaluation of the Gas Screening Value derived against the criteria in the following table.

Characteristic situation	Hazard potential	Gas Screening Value (CH ₄ or CO ₂ l/hr)	Additional factors
CS1	Very low risk	<0.07	Typically Methane ≤1% and/or Carbon Dioxide ≤5%. Otherwise consider an increase to characteristic situation 2.
CS2	Low risk	0.07 to <0.7	Borehole air flow rate not to exceed 70 l/hr. Otherwise consider an increase to characteristic situation 3.
CS3	Moderate risk	0.7 to <3.5	-
CS4	Moderate to high risk	3.5 to <15	-
CS5	High risk	15 to <70	-
CS6	Very high risk	>70	-

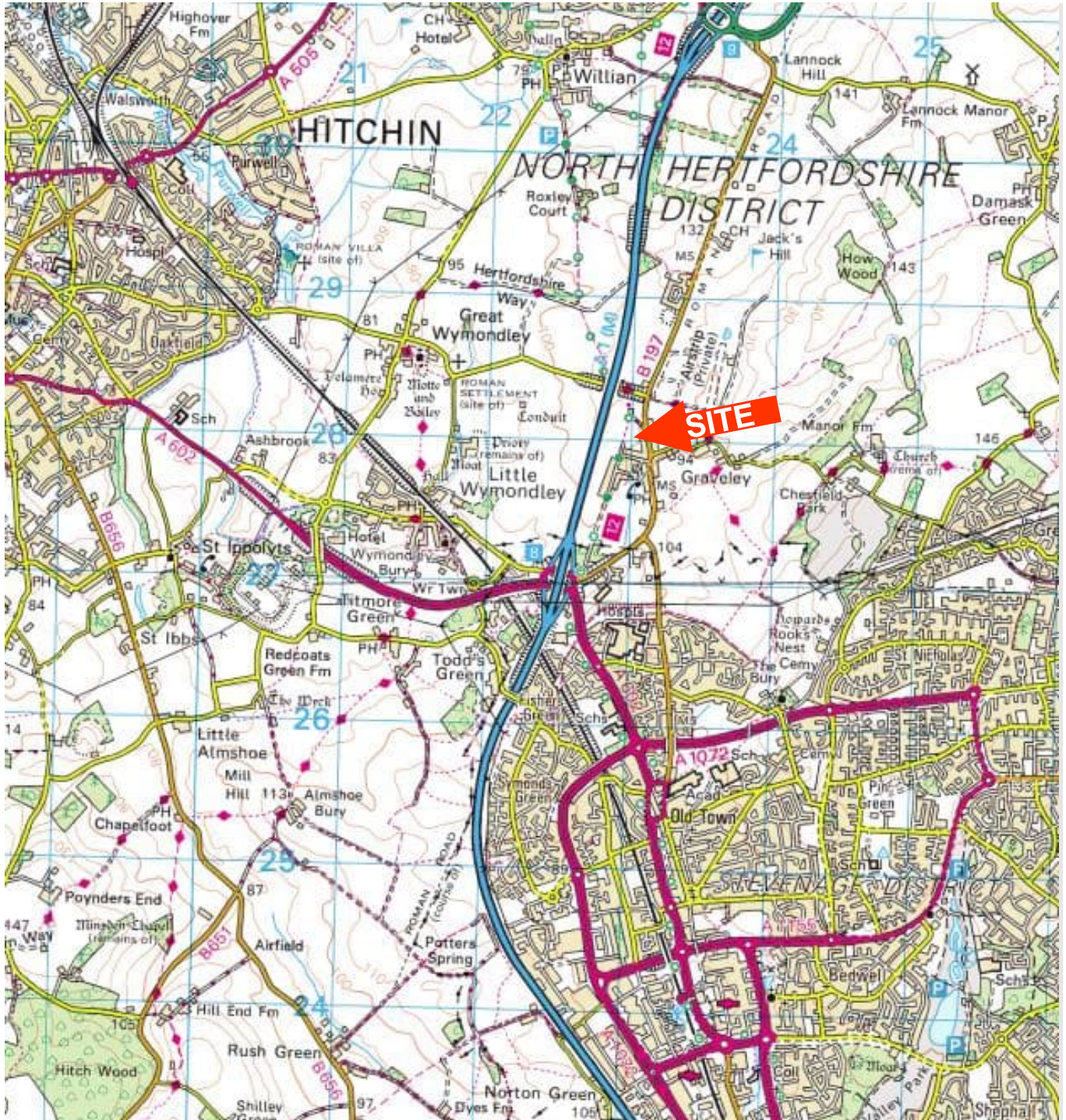
Low rise housing with gardens - NHBC 'Traffic Lights'

The NHBC model for low rise housing development considered a typical residential house with a ground floor area of 64m², suspended floor and ventilated sub-floor void of height 150mm. Where the proposed development of a site is consistent with this model, the NHBC traffic light situation of the site is determined from evaluation of the Gas Screening Value against the criteria in the following table.

Traffic Lights	Methane		Carbon Dioxide	
	Typical maximum concentrations (%)	Gas Screening Value (l/hr)	Typical maximum concentrations (%)	Gas Screening Value (l/hr)
Green	≤1	≤0.16	≤5	≤0.78
Amber 1	1 > to ≤5	>0.16 to ≤0.63	>5 to ≤10	>0.78 to ≤1.56
Amber 2	5 > to ≤20	>0.63 to ≤1.56	>10 to ≤30	>1.56 to ≤3.13
Red	>20	>1.56	>30	>3.13

APPENDIX 1

Site Location Plan



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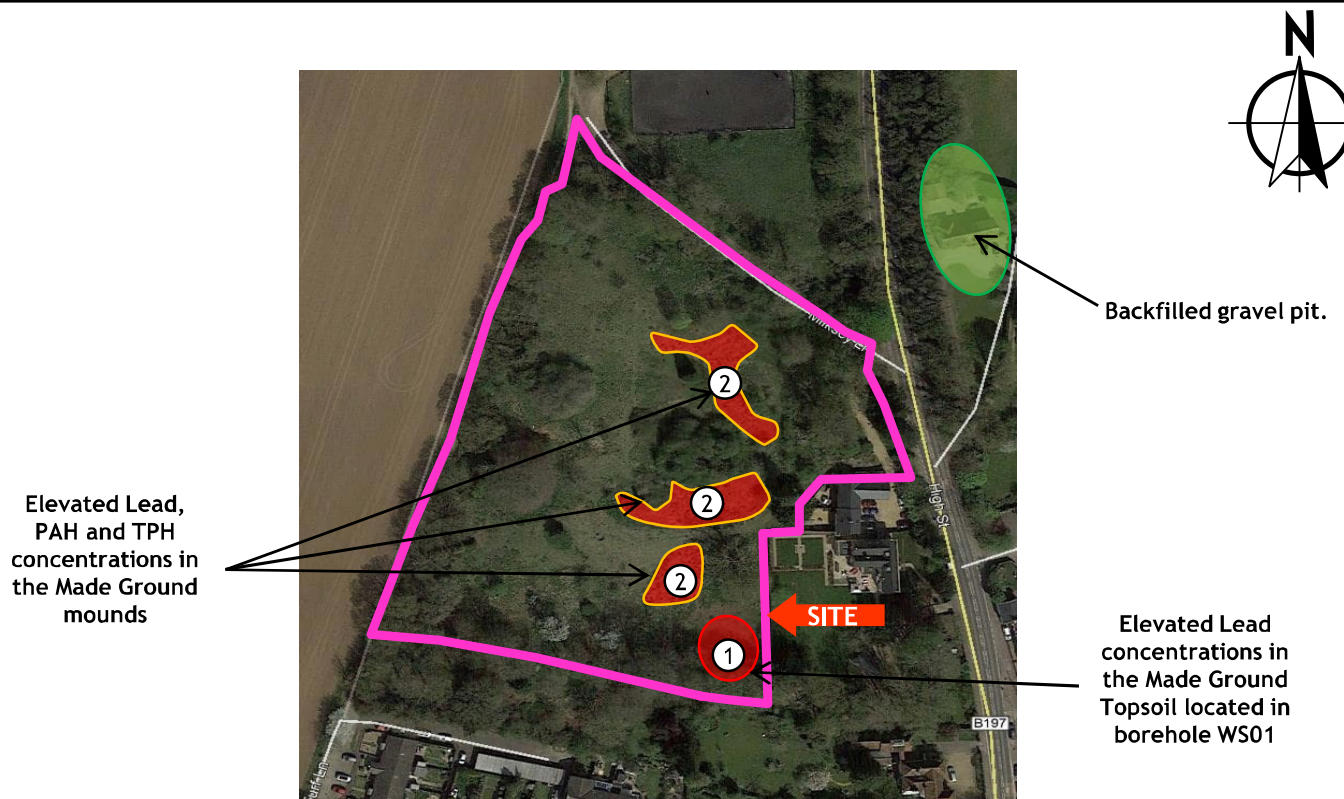
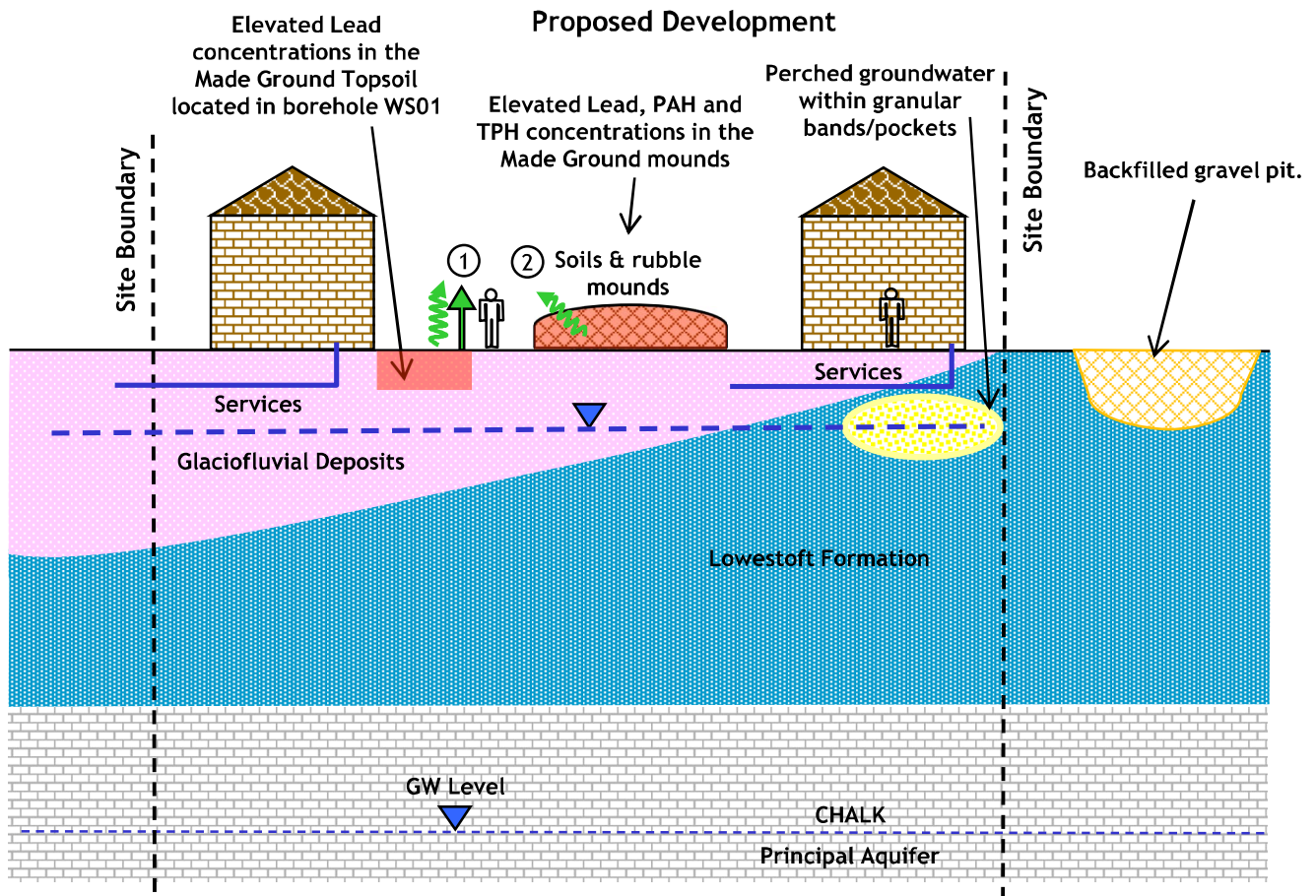
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Not to scale.

Project Title: Milksey Lane, Graveley
 Client: Gade Homes
 BRD Reference: BRD3930-OP2-A
 Date Issued: June 2021


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Revised Conceptual Model



Project Title: Milksey Lane, Graveley
 Client: Gade Homes
 BRD Reference: BRD930-OP7-A
 Date Issued: July 2021

NOTES

- Contractors must check all dimensions on site. Only figured dimensions are to be worked from. Discrepancies must be referred to the Engineer before proceeding.
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REV	DESCRIPTION	DIN	CHK	DATE
1	PRELIMINARY			
2	CONSTRUCTION			
3	AS BUILT			
4	INFORMATION			
5	TENDER			
6	SCALE	1:500 @ A2	DATE	JULY 2021
7	DRAWN	AJS	CHK	JAL
8	DRAWING NO.	18945/1000	REV	-
9	TITLE	Land South Of Milksey Lane Graveley		
10	DETAILS	Proposed Sketch Layout		

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Revision	Date	Description	Drawn	Approved
B	06/08/21	Soil sample locations included	RM	BD
A	16/07/21	First Issue	RM	BD

EXPLORATORY POINT PLAN

Project title	MILKSEY LANE, GRAVELEY
Client	GADE HOMES
Scale	1:750
Drawn	RM
Checked	RM
Approved	BD
Date	06/08/2021
Drawing Number	BRD3930-OD1
Rev	B

BRD

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APPENDIX 2

TRIAL PIT RECORD

Client: Gade Homes Project Title: Milksey Lane, Graveley Project No: BRD3930 Logged By: R Marina Date Completed: 28/06/2021 Method Used: 180° Backhoe excavator (JCB 3CX type)				Trial Pit No. TP01		
				Sheet 1 of 1		
Samples & Tests			Description of Strata	Depth / (Level)	Geology	Legend
Depth	Type & No	Value				
0.10	J1	60/54/62 kPa	TOPSOIL: Grass over, dark brown, slightly sandy clay with rootlets. Occasional gravel is fine to coarse, subangular to subrounded flint. Firm, brown, slightly sandy, silty CLAY with occasional gravel of fine to coarse, subangular to subrounded flint.	0.20 ()	TS GLACIOFLUVIAL DEPOSITS	
0.60	J2		Firm, brown, occasional light grey, gravelly, silty CLAY. Gravel is fine to coarse of subangular to subrounded flint, chalk, limestone and fossil fragments.	0.90 ()		
0.70	D1					
0.80	SV					
1.20	B1					
1.60	B2		Moist, brown, orangish brown, gravelly, silty SAND. Gravel is fine to coarse, subangular to subrounded flint and chalk. 1.70 m: Water seepage.	1.35 ()		
				1.90 ()		
				2		
				3		
				4		
Pit Stability: Generally stable throughout Groundwater: Seepage at 1.70m bgl.					Surface Elevation Level:	
Plan of Trial Pit: 			General Remarks: Trial pit terminated at 1.90m bgl for soakage testing.		All dimensions in metres Log Scale 1:25	
					Telephone: 01295 272244 Email: info@brduk.com	

TRIAL PIT RECORD

Client: Gade Homes Project Title: Milksey Lane, Graveley Project No: BRD3930 Logged By: R Marina Date Completed: 28/06/2021 Method Used: 180° Backhoe excavator (JCB 3CX type)				Trial Pit No. TP02		
				Sheet 1 of 1		
Samples & Tests			Description of Strata	Depth / (Level)	Geology	Legend
Depth	Type & No	Value				
0.15	J1		TOPSOIL: Grass over, dark brown, slightly sandy clay with rootlets. Occasional gravel is fine to coarse, subangular to subrounded flint. Firm, brown and occasional orangish brown, slightly sandy, silty CLAY with occasional gravel of fine to coarse, subangular to subrounded flint, chalk and quartzite.	0.20 ()	TS	
0.80 0.80	J2 SV	110/100/98 kPa	Firm to stiff, light brown mottled light grey and orangish brown, very gravelly, sandy, CLAY. Gravel is fine to coarse, subangular to subrounded flint, chalk and limestone. 0.60 m: Land drain in Face C.	0.60 ()	GF	
1.20	B1			1	GLACIAL TILL	
1.70	SV	140x3 kPa	1.60 m: Becoming grey mottled brown in colour. Occasional coal fragments.	1.90 ()		
				2		
				3		
				4		
Pit Stability: Generally stable throughout Groundwater: Not encountered					Surface Elevation Level:	
Plan of Trial Pit: 			General Remarks: Trial pit terminated at 1.90m bgl for soakage testing.			
All dimensions in metres Log Scale 1:25					 Telephone: 01295 272244 Email: info@brduk.com	

TRIAL PIT RECORD

Client: Gade Homes Project Title: Milksey Lane, Graveley Project No: BRD3930 Logged By: R Marina Date Completed: 28/06/2021 Method Used: 180° Backhoe excavator (JCB 3CX type)				Trial Pit No. TP03		
				Sheet 1 of 1		
Samples & Tests			Description of Strata	Depth / (Level)	Geology	Legend
Depth	Type & No	Value				
0.10	J1		MADE GROUND TOPSOIL: Grass over, dark brown, sandy clay with rootlets. Occasional gravel is fine to coarse, subangular to subrounded flint, quartzite, charcoal and brick fragments.	0.20 ()	TS	
0.70	J2		Firm, brown, orangish brown and light grey, sandy, silty CLAY. Occasional gravel is fine to coarse, subangular to subrounded flint, chalk and quartzite. Occasional ferruginous concretions.		GLACIOFLUVIAL	
0.80	D1	50/60/54 kPa				
0.80	SV		Firm, brown and orangish brown, sandy, silty CLAY. Gravel is fine to coarse, subangular flint and chalk. Occasional ferruginous concretions.	0.95 ()		
1.30	D2	60/40/64 kPa			GLACIAL TILL	
1.40	SV		Firm to stiff, light brown mottled orange brown and light grey, very gravelly, silty CLAY with occasional sandy pockets. Gravel is fine to cobbles, subangular to subrounded flint, chalk and limestone.	1.50 ()		
2.20	D3			2		
2.50	SV	80/84/90 kPa				
				3	3.00 ()	
				4		
Pit Stability: Generally stable throughout Groundwater: Not encountered					Surface Elevation Level:	
Plan of Trial Pit: 			General Remarks: Trial pit terminated at 3.0m bgl.			
All dimensions in metres Log Scale 1:25					 Telephone: 01295 272244 Email: info@brduk.com	

TRIAL PIT RECORD

Client: Gade Homes Project Title: Milksey Lane, Graveley Project No: BRD3930 Logged By: R Marina Date Completed: 28/06/2021 Method Used: 180° Backhoe excavator (JCB 3CX type)				Trial Pit No. TP04		
				Sheet 1 of 1		
Samples & Tests			Description of Strata	Depth / (Level)	Geology	Legend
Depth	Type & No	Value				
0.15	J1		TOPSOIL: Dark brown, slightly sandy, silty, organic CLAY. Occasional gravel is fine to coarse, subangular to subrounded flint. Firm, brown, slightly gravelly, slightly sandy CLAY. Gravel is fine to coarse, subangular to subrounded flint and chalk.	0.25 ()	TS	
0.70	J2		WESTERN HALF OF THE TRIAL PIT: Firm, brown mottled light grey, very gravelly, silty CLAY. Gravel is fine to coarse, subangular to subrounded flint, chalk and quartzite. EASTERN HALF OF THE TRIAL PIT: Firm, grey, very gravelly, silty CLAY. Gravel is fine to cobbles, subangular to subrounded flint, chalk and quartzite. 1.00 - 1.50 m: lense of chalk gravel crossing from face B to face D.	0.50 ()	GF	
1.20	D1		1.20 m: Sample D1 of western half of pits soils.	1	GLACIAL TILL	
1.30	D2		1.30 m: Sample D2 of eastern half of pits soils.			
			Firm, brown and grey, very gravelly, silty CLAY. Gravel is fine to cobbles, subangular to subrounded flint, chalk and quartzite.	1.50 ()		
			Stiff, fissured, grey and brown with occasional greenish brown, very gravelly, silty CLAY. Gravel is fine to cobbles, subangular to subrounded flint, chalk and quartzite.	2 2.00 ()		
2.40	B1			2.80 ()		
				3		
				4		
Pit Stability: Generally stable throughout Groundwater: Slight seepage at 2.80m bgl.					Surface Elevation Level:	
Plan of Trial Pit: 			General Remarks: Trial pit terminated at 2.80m bgl.			
All dimensions in metres Log Scale 1:25					 Telephone: 01295 272244 Email: info@brduk.com	

TRIAL PIT RECORD

Client: Gade Homes Project Title: Milksey Lane, Graveley Project No: BRD3930 Logged By: R Marina Date Completed: 28/06/2021 Method Used: 180° Backhoe excavator (JCB 3CX type)				Trial Pit No. TP05		
				Sheet 1 of 1		
Samples & Tests			Description of Strata	Depth / (Level)	Geology	Legend
Depth	Type & No	Value				
0.30	J1		TOPSOIL: Grass over, dark, brown, slightly sandy clay with rootlets. Rare gravel is fine to coarse, subangular to subrounded flint and quartzite.	0.20 ()	TS	
			Firm, brown, orangish brown, sandy, silty CLAY. Occasional gravel is fine to coarse, subangular to subrounded flint.	0.40 ()		
0.80	J2		Firm to stiff, light grey and brown, very gravelly, silty CLAY with occasional sandy pockets. Gravel is fine to cobbles of subangular to subrounded flint, chalk, quartzite and limestone.		GLACIAL TILL	
1.00	D1		0.70 - 1.10 m: pockets of running sands.	1		
1.10	SV	110/100/102 kPa				
2.10	B1		Stiff, grey and dark grey with occasional brown and greenish brown, very gravelly, silty CLAY. Gravel is fine to cobbles of subangular to subrounded flint, chalk, quartzite and limestone. Limestone boulder (0.4mx0.5mx0.25m).	1.60 ()		
				2		
				3		
				3.00 ()		
				4		
Pit Stability: Generally stable throughout Groundwater: Slight seepage at 0.70m bgl.					Surface Elevation Level:	
Plan of Trial Pit: 			General Remarks: Trial pit terminated at 3.0m bgl.			
All dimensions in metres Log Scale 1:25						
Telephone: 01295 272244 Email: info@brduk.com						

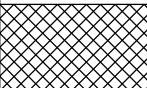
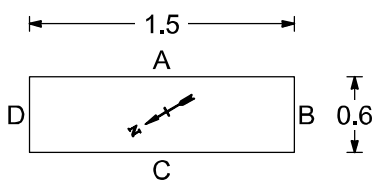
TRIAL PIT RECORD

Client: Gade Homes Project Title: Milksey Lane, Graveley Project No: BRD3930 Logged By: R Marina Date Completed: 28/06/2021 Method Used: 180° Backhoe excavator (JCB 3CX type)				Trial Pit No. TP06		
				Sheet 1 of 1		
Samples & Tests			Description of Strata	Depth / (Level)	Geology	Legend
Depth	Type & No	Value				
1.00	D1		TOPSOIL: Grass over, light brown to brown, sandy, silty clay. Occasional gravel is fine to coarse, subangular flint.	0.20 ()	TS	
			Firm, brown, slightly gravelly, sandy CLAY. Gravel is fine to coarse, subangular to subrounded flint.	0.45 ()		
			Firm, brown mottled orangish brown, gravelly, sandy CLAY. Gravel is fine to coarse, subangular to subrounded flint, chalk and quartzite.	0.80 ()		
			Firm, brown and orangish brown, slightly gravelly, sandy CLAY. Gravel is fine to coarse, subangular to subrounded flint.	1.20 ()		
1.30	D2		Firm to stiff, brown and grey, gravelly, silty CLAY. Gravel is fine to cobbles of subangular to subrounded flint, chalk, quartzite and limestone.	1.50 ()	TILL	
				2		
				3		
				4		
Pit Stability: Generally stable throughout Groundwater: Not encountered					Surface Elevation Level:	
Plan of Trial Pit: 			General Remarks: Trial pit terminated at 1.50m bgl for soakage testing.			
All dimensions in metres Log Scale 1:25					 Telephone: 01295 272244 Email: info@brduk.com	

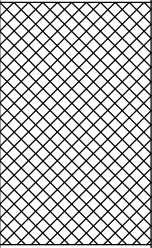
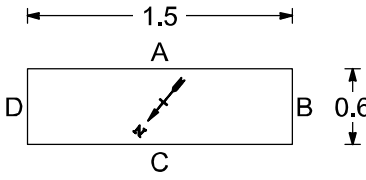
TRIAL PIT RECORD

Client: Gade Homes Project Title: Milksey Lane, Graveley Project No: BRD3930 Logged By: R Marina Date Completed: 28/06/2021 Method Used: 180° Backhoe excavator (JCB 3CX type)				Trial Pit No. TP07		
				Sheet 1 of 1		
Samples & Tests			Description of Strata	Depth / (Level)	Geology	Legend
Depth	Type & No	Value				
0.45	J1		MADE GROUND: Light brown and grey, very gravelly, silty clay. Gravel is fine to coarse, subangular to subrounded flint, chalk and limestone. Occasional brick fragments.		MADE GROUND	
			0.95m: Base of mound.			
Pit Stability: Generally stable throughout Groundwater: Not encountered				Surface Elevation Level:		
Plan of Trial Pit: 			General Remarks: Trial pit excavated through mound and terminated at 0.95m bgl at the base.			
				All dimensions in metres Log Scale 1:25		
				Telephone: 01295 272244 Email: info@brduk.com		

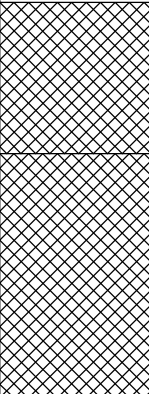
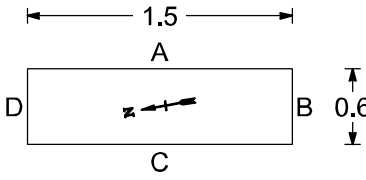
TRIAL PIT RECORD

Client: Gade Homes			Trial Pit No. TP08				
Project Title: Milksey Lane, Graveley							
Project No: BRD3930			Sheet 1 of 1				
Logged By: R Marina							
Date Completed: 28/06/2021							
Method Used: 180° Backhoe excavator (JCB 3CX type)							
Samples & Tests			Description of Strata		Depth / (Level)	Geology	Legend
Depth	Type & No	Value					
0.20	J1		MADE GROUND: Dark brown, gravelly sand with frequent brick fragments and occasional whole bricks. Gravel is fine to coarse, subangular flint.		0.30 ()	MADE GROUND	
0.60	J2		MADE GROUND: Light brown and grey, very gravelly, silty clay. Gravel is fine to coarse, subangular to subrounded flint and chalk.		0.90 ()		
			0.90m: Base of mound.		1 ()		
					2		
					3		
					4		
Pit Stability: Generally stable throughout					Surface Elevation Level:		
Groundwater: Not encountered							
Plan of Trial Pit:			General Remarks:		All dimensions in metres		
			Trial pit excavated through mound and terminated at 0.90m bgl at the base.		Log Scale 1:25		
							
					Telephone: 01295 272244 Email: info@brduk.com		

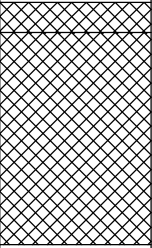
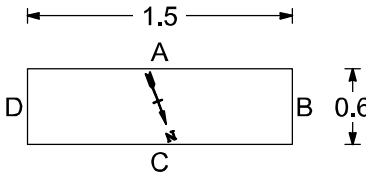
TRIAL PIT RECORD

Client: Gade Homes Project Title: Milksey Lane, Graveley Project No: BRD3930 Logged By: R Marina Date Completed: 28/06/2021 Method Used: 180° Backhoe excavator (JCB 3CX type)				Trial Pit No. TP09		
				Sheet 1 of 1		
Samples & Tests			Description of Strata	Depth / (Level)	Geology	Legend
Depth	Type & No	Value				
0.40	J1		MADE GROUND: Brown and grey, very gravelly, silty clay. Gravel is fine to coarse, subangular to subrounded flint and chalk. Occasional whole and half bricks and quartzite cobbles. Rare glass fragments and scrap metal.	0.80 ()	MADE GROUND	
			0.80m: Base of mound.			
				1		
				2		
				3		
				4		
Pit Stability: Generally stable throughout Groundwater: Not encountered				Surface Elevation Level:		
Plan of Trial Pit: 			General Remarks: Trial pit excavated through mound and terminated at 0.80m bgl at the base.			
			All dimensions in metres Log Scale 1:25			
			 Telephone: 01295 272244 Email: info@brduk.com			

TRIAL PIT RECORD

Client: Gade Homes Project Title: Milksey Lane, Graveley Project No: BRD3930 Logged By: R Marina Date Completed: 28/06/2021 Method Used: 180° Backhoe excavator (JCB 3CX type)				Trial Pit No. TP10		
				Sheet 1 of 1		
Samples & Tests			Description of Strata	Depth / (Level)	Geology	Legend
Depth	Type & No	Value				
0.30	J1		MADE GROUND: Brown, slightly clayey, sandy, gravel. Gravel is fine to coarse, subangular to subrounded flint and quartzite. Occasional brick fragments and scrap metal.	0.50 ()	MADE GROUND	
0.80	J2		MADE GROUND: Brown and grey, very gravelly, silty clay. Gravel is fine to coarse, subangular to subrounded flint and chalk.			
			1.30m: Base of mound.	1.30 ()		
				2		
				3		
				4		
Pit Stability: Generally stable throughout Groundwater: Not encountered				Surface Elevation Level:		
Plan of Trial Pit: 			General Remarks: Trial pit excavated through mound and terminated at 1.30m bgl at the base.		All dimensions in metres Log Scale 1:25	
					 Telephone: 01295 272244 Email: info@brduk.com	

TRIAL PIT RECORD

Client: Gade Homes Project Title: Milksey Lane, Graveley Project No: BRD3930 Logged By: R Marina Date Completed: 28/06/2021 Method Used: 180° Backhoe excavator (JCB 3CX type)				Trial Pit No. TP11		
				Sheet 1 of 1		
Samples & Tests			Description of Strata	Depth / (Level)	Geology	Legend
Depth	Type & No	Value				
0.50	J1		MADE GROUND: Brown, sandy clay topsoil. Frequent half bricks and whole bricks.	0.10 ()	MADE GROUND	
			MADE GROUND: Brown and grey, very gravelly, silty clay. Gravel is fine to coarse, subangular to subrounded flint and chalk.			
			0.80m: Base of mound.	0.80 ()		
				1		
				2		
				3		
				4		
Pit Stability: Generally stable throughout Groundwater: Not encountered					Surface Elevation Level:	
Plan of Trial Pit: 			General Remarks: Trial pit excavated through mound and terminated at 0.80m bgl at the base.			
All dimensions in metres Log Scale 1:25					 Telephone: 01295 272244 Email: info@brduk.com	

Trial Pit Photographs

TP01



Project Title: Milksey Lane, Graveley
Client: Gade Homes
BRD Reference: BRD930-OP6-A
Date Issued: July 2021

Trial Pit Photographs

TP02



Project Title: Milksey Lane, Graveley
Client: Gade Homes
BRD Reference: BRD930-OP6-A
Date Issued: July 2021



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Trial Pit Photographs

TP03



Project Title: Milksey Lane, Graveley
Client: Gade Homes
BRD Reference: BRD930-OP6-A
Date Issued: July 2021



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Trial Pit Photographs

TP04



Project Title: Milksey Lane, Graveley
Client: Gade Homes
BRD Reference: BRD930-OP6-A
Date Issued: July 2021



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Trial Pit Photographs

TP05



Project Title: Milksey Lane, Graveley
Client: Gade Homes
BRD Reference: BRD930-OP6-A
Date Issued: July 2021

Trial Pit Photographs

TP06



Project Title: Milksey Lane, Graveley
Client: Gade Homes
BRD Reference: BRD930-OP6-A
Date Issued: July 2021

Trial Pit Photographs

TP07



Project Title: Milksey Lane, Graveley
Client: Gade Homes
BRD Reference: BRD930-OP6-A
Date Issued: July 2021

Trial Pit Photographs

TP08



Project Title: Milksey Lane, Graveley
Client: Gade Homes
BRD Reference: BRD930-OP6-A
Date Issued: July 2021

Trial Pit Photographs

TP09



Project Title: Milksey Lane, Graveley
Client: Gade Homes
BRD Reference: BRD930-OP6-A
Date Issued: July 2021



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Trial Pit Photographs

TP10



Project Title: Milksey Lane, Graveley
Client: Gade Homes
BRD Reference: BRD930-OP6-A
Date Issued: July 2021

Trial Pit Photographs

TP11



Project Title: Milksey Lane, Graveley
Client: Gade Homes
BRD Reference: BRD930-OP6-A
Date Issued: July 2021

PROBEHOLE RECORD

Client: Gade Homes Project Title: Milksey Lane, Graveley Project No: BRD3930 Logged By: R Marina Date Commenced: 25/06/2021 Date Completed: 25/06/2021 Method Used: Windowless Percussive Sampling Rig					Borehole No. WS01			
					Sheet 1 of 1			
Samples & Tests			Water	Description of Strata	Depth / (Level)	Legend	Geology	Installation /Backfill
Depth	Type & No	Value						
0.10	J1			MADE GROUND TOPSOIL: Grass over, dark brown, sandy, silty clay with occasional gravel of fine to coarse, subangular to subrounded flint. Occasional brick and charcoal fragments.	0.20		MG	
				MADE GROUND: Firm, brown, slightly gravelly, slightly sandy clay. Gravel is fine to coarse, subangular to subrounded flint. Frequent charcoal fragments.	0.40			
0.60	J2			Firm, light brown, gravelly, slightly sandy CLAY. Gravel is medium to coarse, subangular flint.	0.70			
0.80	PEN D1	1.0/1.5/1.0 kg/cm²		Firm, light brown, slightly gravelly, slightly sandy, silty CLAY with occasional black specks.	0.95			
0.80					1.0			
1.00	D2 SPT	9 N		Firm, light brown, very sandy, silty CLAY. 1.00 m: SPT: 1,1/2,2,2,3	1.10			
1.00				Firm, yellowish brown, brown and grey, gravelly, very silty CLAY. Gravel is fine to coarse, subangular to subrounded flint and chalk.			GLACIOFLUVIAL DEPOSITS	
1.60	D3				1.75			
2.00	SPT(C)	25 N	↓	Medium dense, moist becoming wet, light brown, slightly clayey, sandy GRAVEL. Gravel is fine to coarse, subangular to subrounded flint and chalk. 2.00 m: SPT: 3,4/5,5,7,8	2.0			
3.00	SPT(C)	30 N		3.00 m: SPT: 6,6/6,9,7,8	3.0			
					3.45			
					4.0			
General Remarks: Borehole terminated at 3.45m bgl due to collapsing well walls. Borehole installed with 50mm monitoring well, gas tap and flush metal cover.					Surface Elevation Level:		 Telephone: 01295 272244 Email: info@brduk.com	
					All dimensions in metres Log Scale 1:25			

PROBEHOLE RECORD

Client: Gade Homes Project Title: Milksey Lane, Graveley Project No: BRD3930 Logged By: R Marina Date Commenced: 25/06/2021 Date Completed: 25/06/2021 Method Used: Windowless Percussive Sampling Rig					Borehole No. WS02			
					Sheet 1 of 2			
Samples & Tests			Water	Description of Strata	Depth / (Level)	Legend	Geology	Installation /Backfill
Depth	Type & No	Value						
0.10	J1			MADE GROUND TOPSOIL: Grass over, dark brown, sandy, silty clay with occasional gravel of fine to coarse, subangular to subrounded flint. Occasional brick and charcoal fragments.	0.25		MG	
				MADE GROUND: Firm, brown, slightly gravelly, slightly sandy clay. Gravel is fine to coarse, subangular to subrounded flint. Frequent charcoal fragments.	0.35			
0.70	J2	1.0x3		Medium dense, brown, occasional orangish brown, clayey, sandy GRAVEL. Gravel is fine to coarse, subangular to subrounded flint and chalk.	0.55			
0.70	PEN	kg/cm²						
0.80	D1			Firm, brown, light grey and reddish brown, slightly gravelly, slightly sandy, silty CLAY with black specks. Gravel is fine to coarse, subangular flint.	0.90			
1.00	SPT	10 N			1.0			
1.10	D2			Medium dense, brown, occasional reddish brown and light grey, clayey SAND. Occasional gravel is fine to coarse, angular flint.	1.05			
				1.00 m: SPT: 1,1/2,2,2,4	1.35			
				Firm, light brown and light grey mottled orangish brown, slightly sandy, silty CLAY.				
1.70	D3			Firm, light brown mottled light grey, silty CLAY. Rare gravel is fine, rounded chalk.				
2.00	D4	10 N		2.00 m: SPT: 2,2/2,2,3,3	2.0		GLACIAL TILL	
2.00	SPT				2.40			
				Firm, light grey and orangish brown, sandy, silty CLAY.				
2.80	D5				2.90			
3.00	D6	8 N		Wet, light brown to orange brown, clayey SAND.	3.0			
3.00	SPT			3.00 m: SPT: 4,4/2,2,2,2	3.35			
			Firm, dark grey, slightly gravelly, silty CLAY. Gravel is fine to medium, subangular to subrounded flint and chalk.					
3.80	D7	1.5/2.0/2.0	Firm to stiff, grey and brown, gravelly, silty CLAY. Gravel is fine to coarse, subangular to subrounded, flint, chalk and quartzite.	3.70				
3.80	PEN	kg/cm²		4.0		GLACIAL TILL		
4.00	D8	19 N	4.00 m: SPT: 1,3/3,4,6,6	4.50				
4.00	SPT							

General Remarks: Borehole installed with 50mm monitoring well, gas tap and flush metal cover.	Surface Elevation Level:	
	All dimensions in metres Log Scale 1:25	
		Telephone: 01295 272244 Email: info@brduk.com

PROBEHOLE RECORD

Client: Gade Homes Project Title: Milksey Lane, Graveley Project No: BRD3930 Logged By: R Marina Date Commenced: 25/06/2021 Date Completed: 25/06/2021 Method Used: Windowless Percussive Sampling Rig						Borehole No. WS02		
						Sheet 2 of 2		
Samples & Tests			Water	Description of Strata	Depth / (Level)	Legend	Geology	Installation /Backfill
Depth	Type & No	Value						
4.50	D9			Continued from 3.70m: Firm to stiff, grey and brown, gravelly, silty CLAY. Gravel is fine to coarse, subangular to subrounded, flint, chalk and quartzite.			GLACIAL TILL	
5.00 5.00	D10 SPT	24 N		5.00 m: SPT: 2,3/5,5,6,8 5.00 m: Becoming dark grey in colour.	5.0 5.45			
					6.0 7.0 8.0 9.0			
General Remarks: Borehole installed with 50mm monitoring well, gas tap and flush metal cover.					Surface Elevation Level:		 Telephone: 01295 272244 Email: info@brduk.com	
					All dimensions in metres Log Scale 1:25			

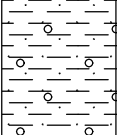
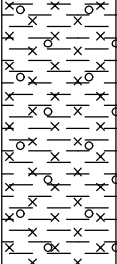
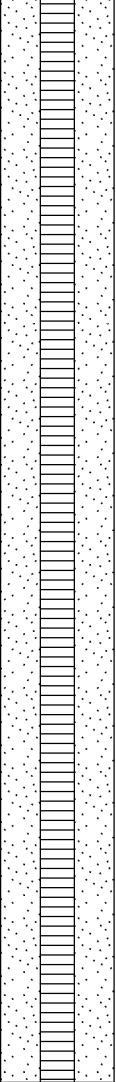
PROBEHOLE RECORD

Client: Gade Homes Project Title: Milksey Lane, Graveley Project No: BRD3930 Logged By: R Marina Date Commenced: 25/06/2021 Date Completed: 25/06/2021 Method Used: Windowless Percussive Sampling Rig						Borehole No. WS03		
						Sheet 1 of 2		
Samples & Tests			Water	Description of Strata	Depth / (Level)	Legend	Geology	Installation /Backfill
Depth	Type & No	Value						
0.10	J1			TOPSOIL: Grass over, light brown to brown, sandy, silty clay. Occasional gravel is fine to coarse, subangular flint.	0.25		TS	
0.50	J2			Firm, brown, slightly gravelly, sandy CLAY. Gravel is fine to coarse, subangular to subrounded flint.	0.55		GLACIOFLUVIAL	
0.70	D1			Firm, brown, mottled orangish brown, gravelly, sandy CLAY with occasional balck specks. Gravel is fine to coarse, subangular to subrounded flint, chalk and quartzite.	0.80			
0.90	D2			Medium dense, brown, orangish brown, slightly gravelly, clayey SAND.	1.0			
1.00	SPT	5 N		1.00 m: SPT: 1,0/1,1,2,1	1.05			
1.60	D3	2.5/2.0/2.5		Firm to stiff, light grey and brown, very gravelly, silty CLAY. Gravel is fine to coarse, subangular to subrounded chalk and occasional quartzite, flint and limestone. Occasional fossil shells.			GLACIAL TILL	
1.60	PEN	kg/cm²						
2.00	SPT	17 N		2.00 m: SPT: 2,2/3,4,5,5	2.0			
2.00	D4							
2.70	D5	3.5/3.0/3.5		2.50 m: Becoming dark grey mottled greenish brown.				
2.70	PEN	kg/cm²						
3.00	SPT	17 N		3.00 m: SPT: 2,2/3,4,5,5	3.0			
3.00	D6							
3.60	D7							
4.00	SPT	31 N		4.00 m: SPT: 4,5/6,7,8,10	4.0			
4.00	D8							
					4.50			
General Remarks: Borehole installed with 50mm monitoring well, gas tap and flush metal cover.					Surface Elevation Level:		 Telephone: 01295 272244 Email: info@brduk.com	
					All dimensions in metres Log Scale 1:25			

PROBEHOLE RECORD

Client: Gade Homes Project Title: Milksey Lane, Graveley Project No: BRD3930 Logged By: R Marina Date Commenced: 25/06/2021 Date Completed: 25/06/2021 Method Used: Windowless Percussive Sampling Rig						Borehole No. WS03		
						Sheet 2 of 2		
Samples & Tests			Water	Description of Strata	Depth / (Level)	Legend	Geology	Installation /Backfill
Depth	Type & No	Value						
4.80	D9	3.5/3.5/3.5		Stiff, dark grey with occasional greenish grey, very gravelly, silty CLAY. Gravel is fine to coarse, subangular to subrounded flint, quartzite, chalk, limestone and slate. Rare coal fragments. 5.00 m: SPT: 6,6/8,9,10,10	5.0		GLACIAL TILL	
4.80	PEN	kg/cm²			5.45			
5.00	SPT	37 N			6.0			
5.00	D10				7.0			
					8.0			
					9.0			
General Remarks: Borehole installed with 50mm monitoring well, gas tap and flush metal cover.					Surface Elevation Level:			
					All dimensions in metres Log Scale 1:25			
					Telephone: 01295 272244 Email: info@brduk.com			

PROBEHOLE RECORD

Client: Gade Homes Project Title: Milksey Lane, Graveley Project No: BRD3930 Logged By: R Marina Date Commenced: 25/06/2021 Date Completed: 25/06/2021 Method Used: Windowless Percussive Sampling Rig						Borehole No. WS04			
						Sheet 1 of 2			
Samples & Tests			Water	Description of Strata	Depth / (Level)	Legend	Geology	Installation /Backfill	
Depth	Type & No	Value							
0.10	J1			MADE GROUND TOPSOIL: Grass over, moist, dark brown, sandy clay. Occasional gravel is fine to coarse, subangular to subrounded flint. Rare charcoal fragments.	0.20		TS		
0.50 0.60	PEN D1	1.0x3 kg/cm²		Firm, brown, slightly gravelly, sandy CLAY. Gravel is fine to coarse, subangular to subrounded flint.	0.70		GLACIOF.		
0.75 0.90 0.90 1.00 1.00	J2 PEN D2 SPT D3	1.5/1.0/1.5 kg/cm² 9 N		Firm to stiff, light brown, yellowish brown, very gravelly, silty CLAY. Gravel is fine to coarse, subangular to subrounded flint, chalk and limestone.	1.0		GLACIAL TILL		
1.60	D4			1.00 m: SPT: 2,2/1,2,3,3					
1.80 2.00 2.00	PEN SPT D5	1.5/1.0/1.5 kg/cm² 10 N		2.00 m: SPT: 2,2/2,2,3,3 2.00 - 2.40 m: Moist, light brown, very gravelly, sandy CLAY.	2.0				
2.70	D6								
3.00 3.00	SPT D7	20 N		3.00 m: SPT: 2,3/4,4,5,7	3.0				
3.60 3.70	D8 PEN	3.0/3.5/3.0 kg/cm²		Stiff, brown, grey and dark grey with occasional greenish grey, very gravelly, silty CLAY. Gravel is fine to coarse, subangular to subrounded, flint, chalk, slate and limestone.	3.40				
4.00 4.00	SPT D9	22 N		4.00 m: SPT: 2,3/4,5,6,7	4.0				
					4.50				
General Remarks: Borehole installed with 50mm monitoring well, gas tap and flush metal cover.				Surface Elevation Level:		 Telephone: 01295 272244 Email: info@brduk.com			
				All dimensions in metres Log Scale 1:25					

PROBEHOLE RECORD

Client: Gade Homes Project Title: Milksey Lane, Graveley Project No: BRD3930 Logged By: R Marina Date Commenced: 25/06/2021 Date Completed: 25/06/2021 Method Used: Windowless Percussive Sampling Rig						Borehole No. WS04		
						Sheet 2 of 2		
Samples & Tests			Water	Description of Strata	Depth / (Level)	Legend	Geology	Installation /Backfill
Depth	Type & No	Value						
4.60	D10			Continued from 3.4m: Stiff, brown, grey and dark grey with occasional greenish grey, very gravelly, silty CLAY. Gravel is fine to coarse, subangular to subrounded, flint, chalk, slate and limestone.	4.80		GLACIAL TILL	
5.00	SPT	25 N	Stiff, fissured, dark grey with orangish brown staining on surfaces, slightly gravelly, silty CLAY. Gravel is fine to coarse, subangular to subrounded chalk, flint and limestone. 4.90 - 5.00 m: Firm, moist, light brown and light grey very silty CLAY. 5.00 m: SPT: 9,9/7,7,6,5	5.0				
					5.45			
					6.0			
					7.0			
					8.0			
					9.0			
General Remarks: Borehole installed with 50mm monitoring well, gas tap and flush metal cover.					Surface Elevation Level:			
					All dimensions in metres Log Scale 1:25			
					Telephone: 01295 272244 Email: info@brduk.com			



SOIL INFILTRATION RATE

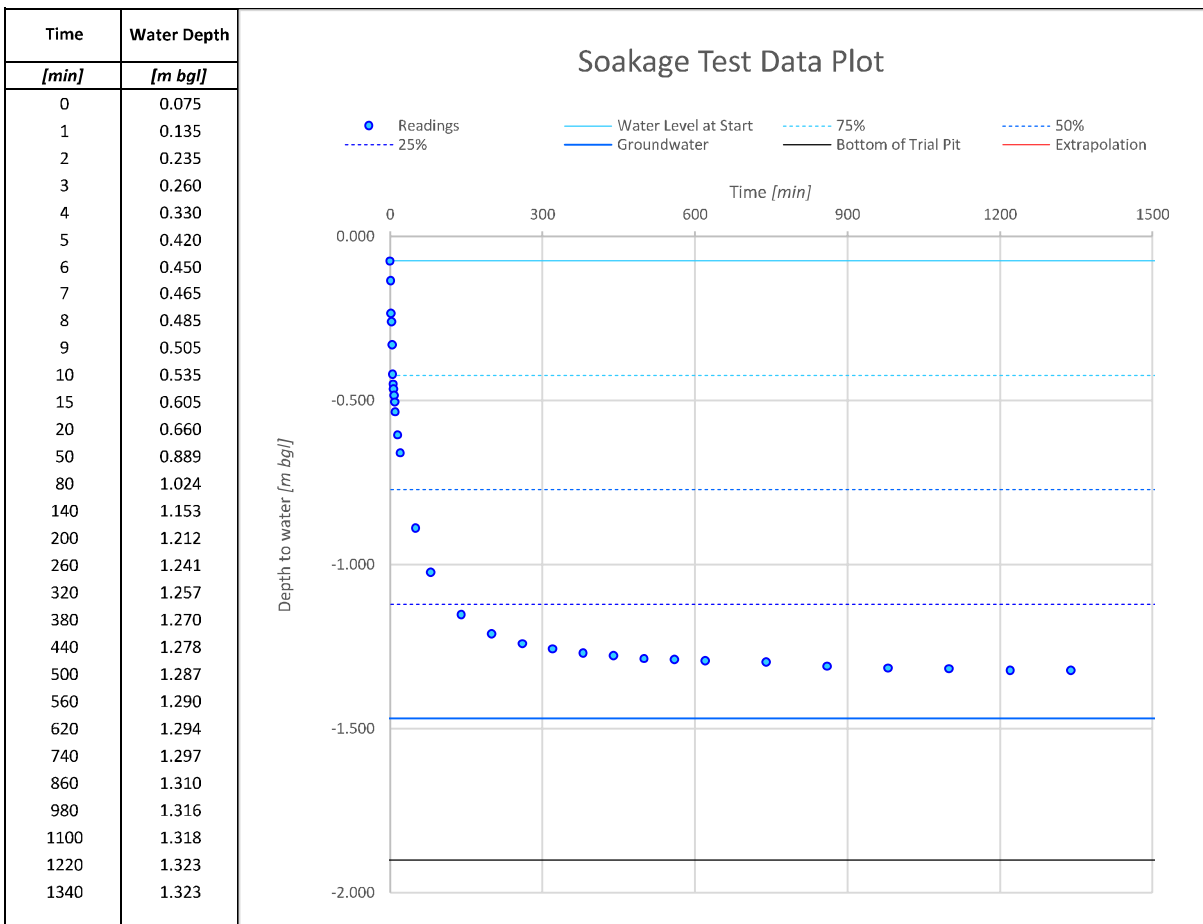
In accordance with BRE Digest 365:2016 - Soakaway Design

Client: Gade Homes
Project Title: Milksey Lane, Graveley
Project No: BRD3930

Trial Pit No: TP01
Test No: 1
Date: 28/06/2021
Logged by: DB

Length [m]: 1.80
Depth [m]: 1.90
Width [m]: 0.60
Groundwater [m bgl]: 1.47

Ground	Conditions	from - to [m bgl]		Description
		0.20	0.90	Firm, brown, slightly sandy, silty CLAY with occasional gravel.
		0.90	1.35	Firm, brown, occasional light grey, gravelly, silty CLAY.
		1.35	1.90	Moist, brown, orangish brown, gravelly, silty SAND.



Soil Infiltration Rate [m/s]:
$$f = \frac{V_{p75-25}}{a_{s50} \times t_{p75-25}}$$

with:

V_{p75-25} as Effective Storage Volume of water between 75% and 25% effective storage depth [m³] **0.75**

a_{s50} as Internal Surface Area of the soakage trial pit up to 50% storage depth including the base area [m²] **4.43**

t_{p75-25} as Time for the water level to fall from 75% to 25% effective storage depth [s] **7.2.E+03**

Soil Infiltration Rate [m/s]: 2.36E-05

Remarks:



SOIL INFILTRATION RATE

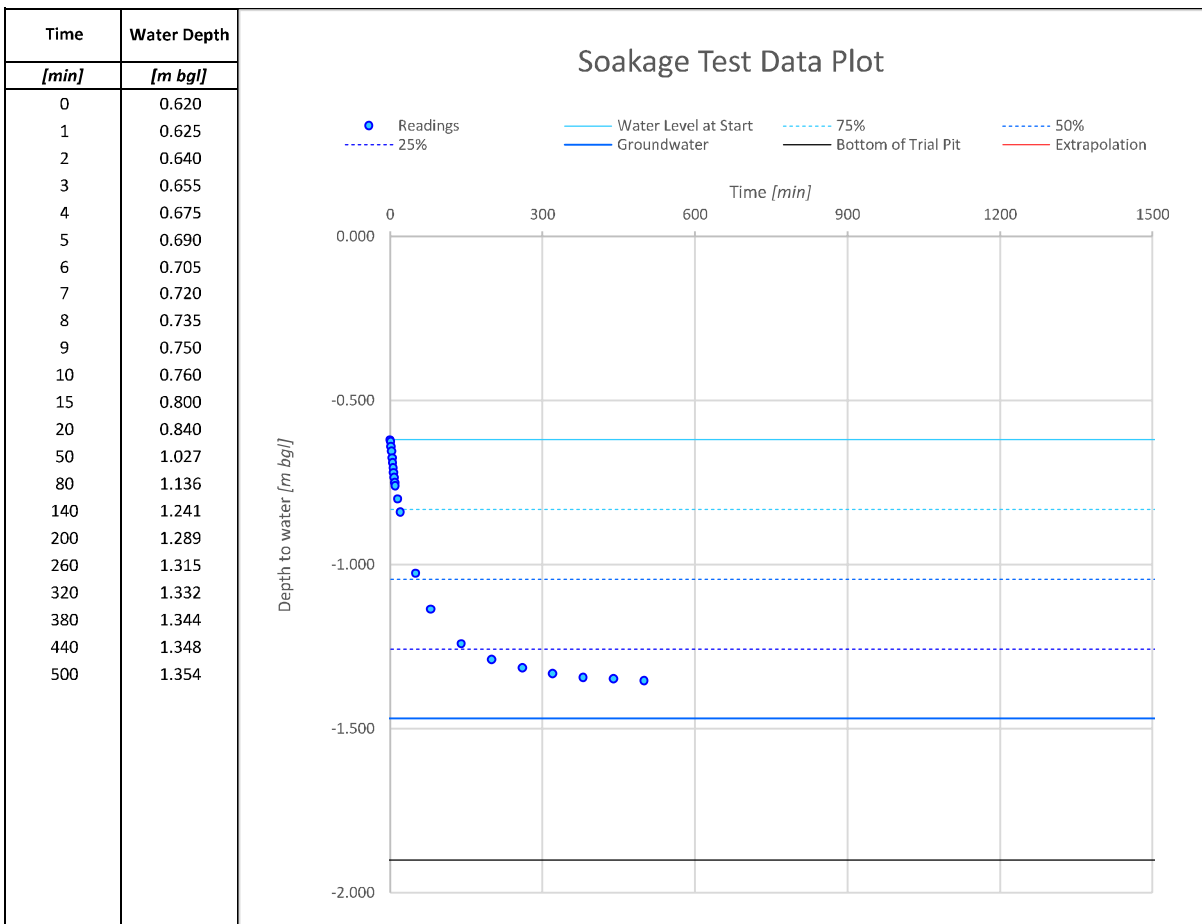
In accordance with BRE Digest 365:2016 - Soakaway Design

Client: Gade Homes
Project Title: Milksey Lane, Graveley
Project No: BRD3930

Trial Pit No: TP01
Test No: 2
Date: 29/07/2021
Logged by: DB

Length [m]: 1.80
Depth [m]: 1.90
Width [m]: 0.60
Groundwater [m bgl]: 1.47

Ground	Conditions	from - to [m bgl]		Description
		0.20	0.90	Firm, brown, slightly sandy, silty CLAY with occasional gravel.
		0.90	1.35	Firm, brown, occasional light grey, gravelly, silty CLAY.
		1.35	1.90	Moist, brown, orangish brown, gravelly, silty SAND.



Soil Infiltration Rate [m/s]:

$$f = \frac{V_{p75-25}}{a_{s50} \times t_{p75-25}}$$

with:

V_{p75-25} as Effective Storage Volume of water between 75% and 25% effective storage depth [m³] **0.46**

a_{s50} as Internal Surface Area of the soakage trial pit up to 50% storage depth including the base area [m²] **3.12**

t_{p75-25} as Time for the water level to fall from 75% to 25% effective storage depth [s] **8.5.E+03**

Soil Infiltration Rate [m/s]: 1.73E-05

Remarks:



SOIL INFILTRATION RATE

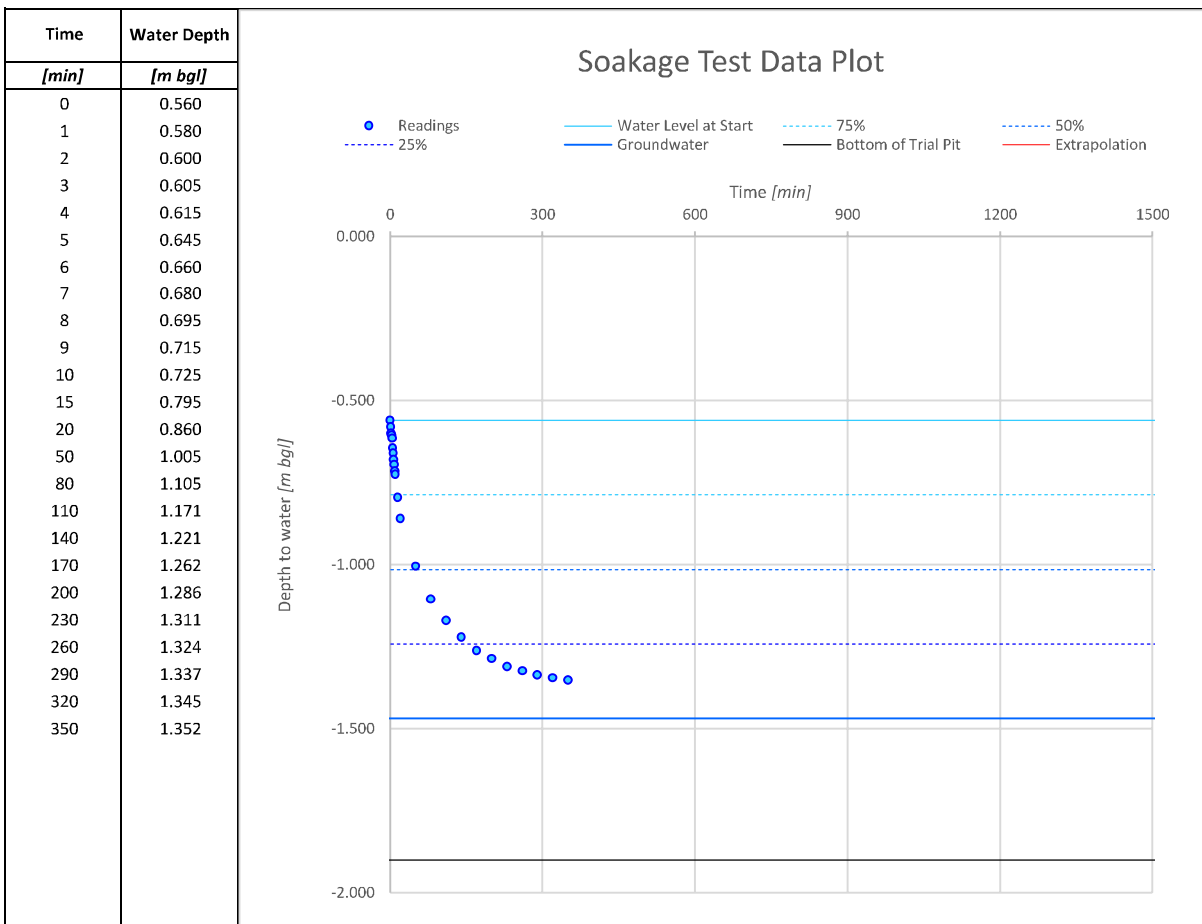
In accordance with BRE Digest 365:2016 - Soakaway Design

Client: Gade Homes
Project Title: Milksey Lane, Graveley
Project No: BRD3930

Trial Pit No: TP01
Test No: 3
Date: 30/06/2021
Logged by: DB

Length [m]: 1.80
Depth [m]: 1.90
Width [m]: 0.60
Groundwater [m bgl]: 1.47

Ground	Conditions	from - to [m bgl]		Description
		0.20	0.90	Firm, brown, slightly sandy, silty CLAY with occasional gravel.
		0.90	1.35	Firm, brown, occasional light grey, gravelly, silty CLAY.
		1.35	1.90	Moist, brown, orangish brown, gravelly, silty SAND.



Soil Infiltration Rate [m/s]:
$$f = \frac{V_{p75-25}}{a_{s50} \times t_{p75-25}}$$

with:

V_{p75-25} as Effective Storage Volume of water between 75% and 25% effective storage depth [m³] **0.49**

a_{s50} as Internal Surface Area of the soakage trial pit up to 50% storage depth including the base area [m²] **3.26**

t_{p75-25} as Time for the water level to fall from 75% to 25% effective storage depth [s] **8.5.E+03**

Soil Infiltration Rate [m/s]: 1.78E-05

Remarks:



SOIL INFILTRATION RATE

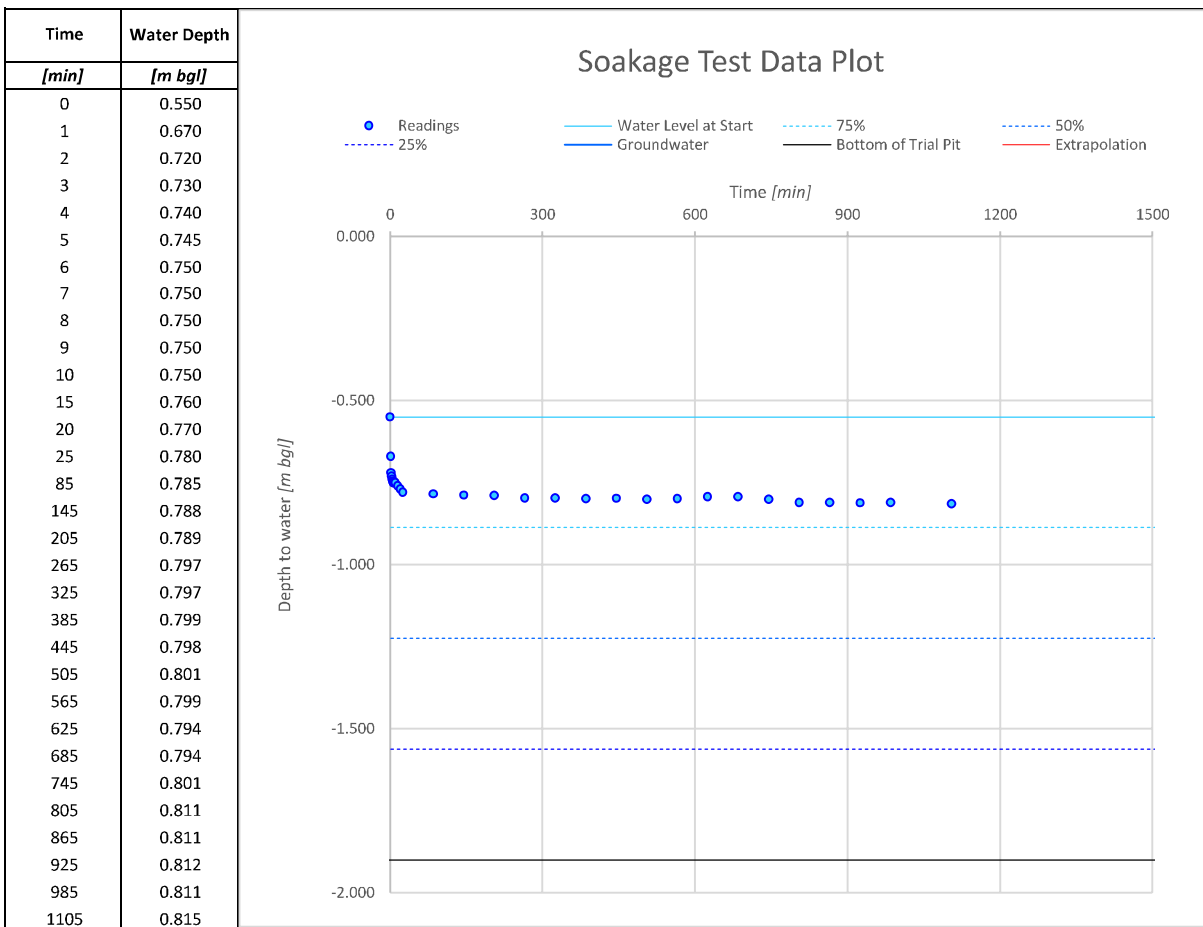
In accordance with BRE Digest 365:2016 - Soakaway Design

Client: Gade Homes
Project Title: Milksey Lane, Graveley
Project No: BRD3930

Trial Pit No: TP02
Test No: 1
Date: 28/07/2021
Logged by: DB

Length [m]: 1.40
Depth [m]: 1.90
Width [m]: 0.60
Groundwater [m bgl]: Dry

Ground	Conditions	from - to [m bgl]		Description
		0.20	0.60	Firm, brown and occasional orangish brown, slightly sandy, silty CLAY.
		0.60	1.90	Firm to stiff, light brown mottled light grey and orangish brown, very gravelly, silty CLAY.



Soil Infiltration Rate [m/s]:

$$f = \frac{V_{p75-25}}{a_{s50} \times t_{p75-25}}$$

with:

V_{p75-25} as Effective Storage Volume of water between 75% and 25% effective storage depth [m^3] **0.57**

a_{s50} as Internal Surface Area of the soakage trial pit up to 50% storage depth including the base area [m^2] **3.54**

t_{p75-25} as Time for the water level to fall from 75% to 25% effective storage depth [s] **n/a**

Soil Infiltration Rate [m/s]: **n/a**

Remarks: Result could not be calculated. Soakage test failed.



SOIL INFILTRATION RATE

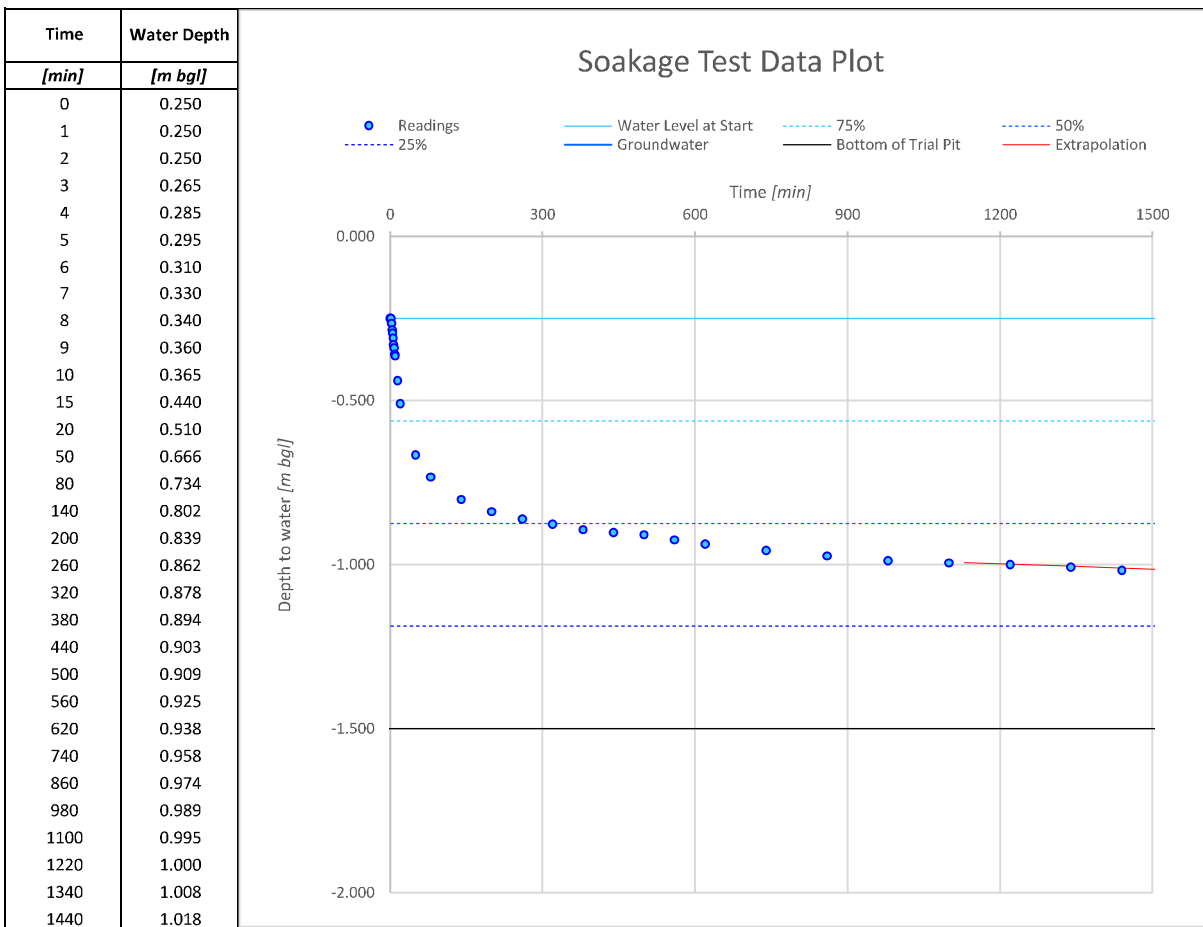
In accordance with BRE Digest 365:2016 - Soakaway Design

Client: Gade Homes
Project Title: Milksey Lane, Graveley
Project No: BRD3930

Trial Pit No: TP06
Test No: 1
Date: 28/06/2021
Logged by: DB

Length [m]: 1.40
Depth [m]: 1.50
Width [m]: 0.60
Groundwater [m bgl]: Dry

Ground	Conditions	from - to [m bgl]		Description
		0.20	0.45	Firm, brown, slightly gravelly, sandy CLAY.
		0.45	0.80	Firm, brown mottled orangish brown, gravelly, sandy CLAY.
		0.80	1.30	Firm, brown and orangish brown, slightly gravelly, sandy CLAY.
		1.30	1.50	Firm to stiff, brown and grey, gravelly, silty CLAY.



Soil Infiltration Rate [m/s]:

$$f = \frac{V_{p75-25}}{a_{s50} \times t_{p75-25}}$$

with:

V_{p75-25} as Effective Storage Volume of water between 75% and 25% effective storage depth [m³] **0.53**

a_{s50} as Internal Surface Area of the soakage trial pit up to 50% storage depth including the base area [m²] **3.34**

t_{p75-25} as Time for the water level to fall from 75% to 25% effective storage depth [s] **6.0.E+05**

Soil Infiltration Rate [m/s]: 2.62E-07

Remarks: Calculation of soil infiltration rate based on extrapolated results.



SOIL INFILTRATION RATE

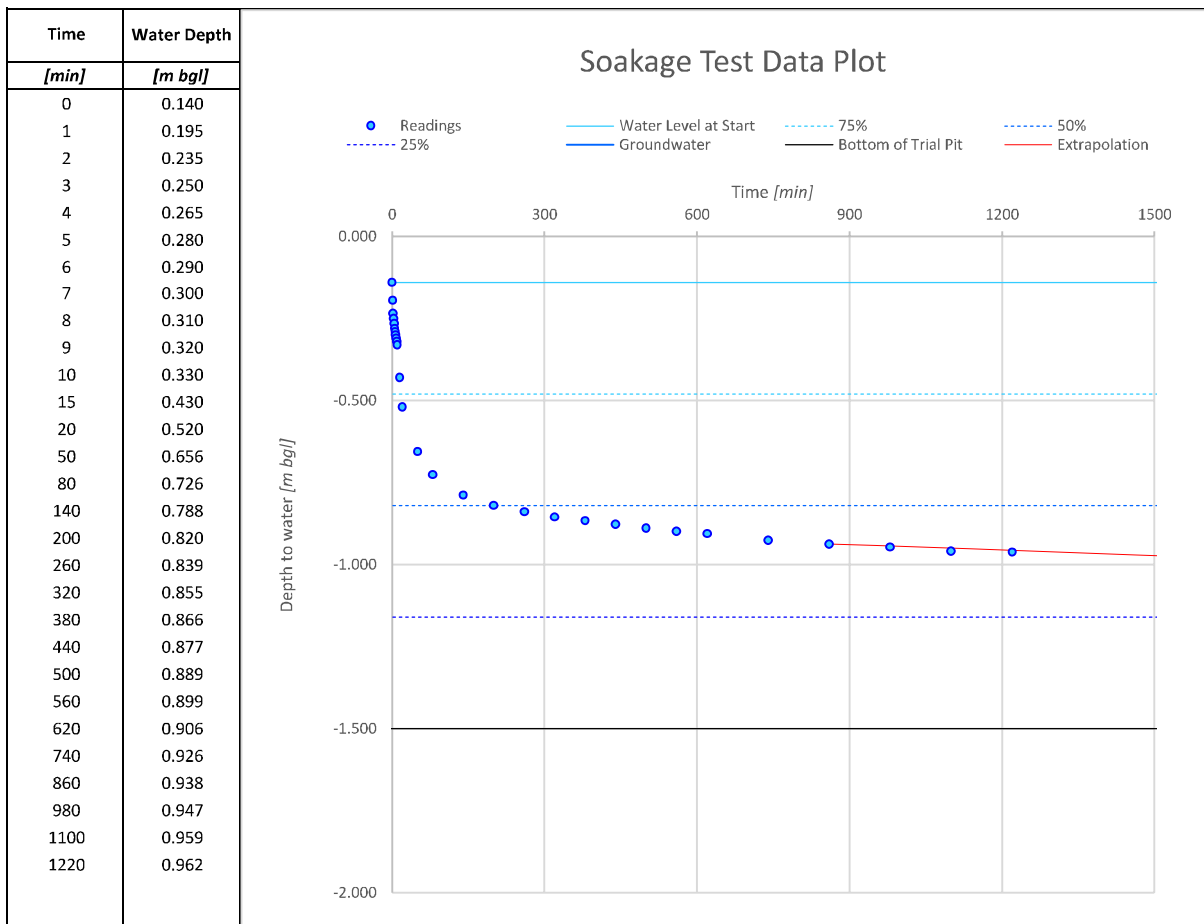
In accordance with BRE Digest 365:2016 - Soakaway Design

Client: Gade Homes
Project Title: Milksey Lane, Graveley
Project No: BRD3930

Trial Pit No: TP06
Test No: 2
Date: 29/06/2021
Logged by: DB

Length [m]: 1.40
Depth [m]: 1.50
Width [m]: 0.60
Groundwater [m bgl]: Dry

Ground	Conditions	from - to [m bgl]		Description
		0.20	0.45	Firm, brown, slightly gravelly, sandy CLAY.
		0.45	0.80	Firm, brown mottled orangish brown, gravelly, sandy CLAY.
		0.80	1.30	Firm, brown and orangish brown, slightly gravelly, sandy CLAY.
		1.30	1.50	Firm to stiff, brown and grey, gravelly, silty CLAY.



Soil Infiltration Rate [m/s]:
$$f = \frac{V_{p75-25}}{a_{s50} \times t_{p75-25}}$$

with:

V_{p75-25} as Effective Storage Volume of water between 75% and 25% effective storage depth [m^3] **0.57**

a_{s50} as Internal Surface Area of the soakage trial pit up to 50% storage depth including the base area [m^2] **3.56**

t_{p75-25} as Time for the water level to fall from 75% to 25% effective storage depth [s] **1.0.E+06**

Soil Infiltration Rate [m/s]: 1.60E-07

Remarks: Calculation of soil infiltration rate based on extrapolated results.

BRD															Project Name: Milksey Lane, Graveley Client: Gade Homes Project No: BRD3930																				
Date:		30/06/2021		Ground conditions:		Dry in places. Soft in others.		Recorded by:		DB		Time at start:		12:11		Weather conditions:		Overcast and Warm		Pressure trend:		Steady		Time at finish:		12:41		Air Temperature (°C):		15		Monitor serial no:		G501688	
The gas monitoring equipment is a Geotech GA5000 portable analyser. As per manufacturers recommendations this is factory calibrated every six months and in addition BRD undertake calibration checks against bottled standard gases on at least a monthly basis. Gas monitor pump is run for three minutes unless otherwise stated and the steady readings are an average reading taken over this pump run time. Vapour monitoring equipment is miniRAE lite PGM-7350 Photo Ionisation Detector (PID) with 10.6 eV lamp calibrated for isobutylene. PID calibration check is performed on site against ambient air and also against a 100ppm isobutylene standard gas. Barometric pressure trend and ambient air temperature is recorded from weather websites at the nearest reported weather station. CH₄ = Methane CO₂ = Carbon Dioxide O₂ = Oxygen H₂S = Hydrogen Sulphide CO = Carbon Monoxide NR = Not Recorded PID = Photo Ionisation Detector GWL = Groundwater level measured from ground surface and top of standpipe. Base = Base of standpipe measured from ground surface.																																			
Borehole	Monitoring point						Gas Concentration										Pressure	Flow rate	Vapour	Comments															
	GWL Ground (m)	GWL Pipe (m)	Base Ground (m)	Steady			Peak			Minimum	CO ₂ (%)	O ₂ (%)	Peak		H ₂ S (ppm)																				
				CH ₄ (%)	CO ₂ (%)	O ₂ (%)	CH ₄ (%)	CO ₂ (ppm)																											
WS01	1.65	1.55	2.60	0.0	1.1	19.3	0.0	0.0	1.1	19.2	0	0	0	1007	0.0	N/A																			
WS02	Dry	Dry	4.00	0.0	2.0	18.4	0.0	0.0	2.0	18.4	0	0	0	1007	0.0	N/A																			
WS03	Dry	Dry	4.00	0.0	1.9	18.8	0.0	0.0	1.9	18.8	0	0	0	1006	0.0	N/A																			
WS04	Dry	Dry	5.00	0.0	0.1	20.5	0.0	0.0	0.1	20.5	0	0	0	1006	0.1	N/A																			

Gas Monitoring Record												Project Name: Milksey Lane, Graveley Client: Gade Homes Project No: BRD3930		
Date:		09/07/2021		Ground conditions:		Dry		Recorded by:		RD				
Time at start:		10:31 AM		Weather conditions:		Fair		Pressure trend:		Rising				
Time at finish:		11:05 AM		Air Temperature (°C):		20		Monitor serial no:		G501688				
The gas monitoring equipment is a Geotech GA5000 portable analyser. As per manufacturers recommendations this is factory calibrated every six months and in addition BRD undertake calibration checks against bottled standard gases on at least a monthly basis. Gas monitor pump is run for three minutes unless otherwise stated and the steady readings are an average reading taken over this pump run time. Vapour monitoring equipment is miniRAE lite PGM-7350 Photo Ionisation Detector (PID) with 10.6 eV lamp calibrated for isobutylene. PID calibration check is performed on site against ambient air and also against a 100ppm isobutylene standard gas. Barometric pressure trend and ambient air temperature is recorded from weather websites at the nearest reported weather station. CH₄ = Methane CO₂ = Carbon Dioxide O₂ = Oxygen H₂S = Hydrogen Sulphide CO = Carbon Monoxide NR = Not Recorded PID = Photo Ionisation Detector GWL = Groundwater level measured from ground surface and top of standpipe. Base = Base of standpipe measured from ground surface.														
Borehole	Monitoring point			Gas Concentration						Pressure	Flow rate	Vapour	Comments	
	GWL Ground (m)	GWL Pipe (m)	Base Ground (m)	Steady			Peak			Baro - metric (mb)	Steady (l/hr)	PID (ppm)		
				CH ₄ (%)	CO ₂ (%)	O ₂ (%)	CH ₄ (%)	CO (ppm)	H ₂ S (ppm)					
WS01	1.40	1.31	2.59	0.0	1.9	17.1	0.0	1.9	17.1	1	1010	-0.1	0.0	
WS02	3.07	2.93	4.24	0.0	2.5	16.9	0.0	2.5	16.9	1	1011	0.0	0.0	
WS03	Dry	Dry	5.00	0.0	2.1	17.8	0.0	2.4	17.8	0	1011	-0.1	0.0	
WS04	4.98	4.88	4.98	0.0	0.0	19.8	0.0	2.1	19.1	1	1011	0.0	0.0	

Gas Monitoring Record															
Project Name: Milksey Lane, Graveley Client: Gade Homes Project No: BRD3930															
Date: 16/07/2021		Ground conditions: Dry and Hard		Recorded by: DB											
Time at start: 9:15 AM		Weather conditions: Clear and Warm		Pressure trend: Steady											
Time at finish: 10:00 AM		Air Temperature (°C): 18		Monitor serial no: G501688											
The gas monitoring equipment is a Geotech GA5000 portable analyser. As per manufacturers recommendations this is factory calibrated every six months and in addition BRD undertake calibration checks against bottled standard gases on at least a monthly basis. Gas monitor pump is run for three minutes unless otherwise stated and the steady readings are an average reading taken over this pump run time. Vapour monitoring equipment is miniRAE lite PGM-7350 Photo Ionisation Detector (PID) with 10.6 eV lamp calibrated for isobutylene. PID calibration check is performed on site against ambient air and also against a 100ppm isobutylene standard gas. Barometric pressure trend and ambient air temperature is recorded from weather websites at the nearest reported weather station.															
CH ₄ = Methane CO ₂ = Carbon Dioxide O ₂ = Oxygen H ₂ S = Hydrogen Sulphide CO = Carbon Monoxide NR = Not Recorded PID = Photo Ionisation Detector				GWL = Groundwater level measured from ground surface and top of standpipe. Base = Base of standpipe measured from ground surface.											
Borehole	Monitoring point			Gas Concentration						Pressure	Flow rate	Vapour	Comments		
	GWL Ground (m)	Pipe (m)	Base Ground (m)	Steady			Peak		Minimum O ₂ (%)	CO ₂ (%)	H ₂ S (ppm)				
				CH ₄ (%)	CO ₂ (%)	O ₂ (%)	CH ₄ (%)	CO (ppm)							
WS01	1.70	1.60	2.60	0.0	0.1	20.4	0.0	0.1	20.3	0	1	1016	-0.5	0.0	Ants nest located within hole. Cleared nest and took gas bung off. Retested 20 mins later
WS02	3.15	3.00	4.15	0.0	3.0	16.6	0.0	3.0	16.6	0	1	1016	-0.1	0.0	
WS03	Dry	Dry	4.00	0.0	1.7	18.6	0.0	1.7	18.6	0	1	1016	0.0	0.0	Ants nest located within hole. Cleared nest and took gas bung off. Retested 20 mins later
WS04	Dry	Dry	4.99	0.0	0.1	20.6	0.0	0.1	20.6	0	0	1017	0.0	0.0	

BRD Gas Monitoring Record Project Name: Milksey Lane, Graveley Client: Gade Homes Project No: BRD3930													
Date: 28/07/2021		Ground conditions: Dry		Recorded by: DB									
Time at start: 11:57 AM		Weather conditions: Slight rain and occasional sun		Pressure trend: Falling									
Time at finish: 12:18 PM		Air Temperature (°C): 19		Monitor serial no: G501315									
The gas monitoring equipment is a Geotech GA5000 portable analyser. As per manufacturers recommendations this is factory calibrated every six months and in addition BRD undertake calibration checks against bottled standard gases on at least a monthly basis. Gas monitor pump is run for three minutes unless otherwise stated and the steady readings are an average reading taken over this pump run time. Vapour monitoring equipment is miniRAE lite PGM-7350 Photo Ionisation Detector (PID) with 10.6 eV lamp calibrated for isobutylene. PID calibration check is performed on site against ambient air and also against a 100ppm isobutylene standard gas. Barometric pressure trend and ambient air temperature is recorded from weather websites at the nearest reported weather station. CH₄ = Methane CO₂ = Carbon Dioxide O₂ = Oxygen H₂S = Hydrogen Sulphide CO = Carbon Monoxide NR = Not Recorded PID = Photo Ionisation Detector GWL = Groundwater level measured from ground surface and top of standpipe. Base = Base of standpipe measured from ground surface.													
Borehole	Monitoring point			Gas Concentration						Pressure	Flow rate	Vapour	Comments
	GWL Ground (m)	GWL Pipe (m)	Base Ground (m)	Steady			Peak		Minimum	Baro - metric (mb)	Steady (l/hr)	PID (ppm)	
				CH ₄ (%)	CO ₂ (%)	O ₂ (%)	CH ₄ (%)	CO ₂ (ppm)					
WS01	1.92	1.83	2.16	0.1	2.6	17.8	0.1	2.6	0	996	0.0	N/R	Note to be removed: All metal covers have been left open due to ants nest in covers on previous visits.
WS02	3.22	3.09	4.16	0.0	3.2	17.4	0.1	3.2	0	997	-0.2	N/R	
WS03	Dry	Dry	4.00	0.0	1.5	18.7	0.0	1.5	0	997	-0.2	N/R	
WS04	Dry	Dry	4.99	0.0	0.1	18.7	0.0	0.1	0	997	-0.2	N/R	

Gas Monitoring Record															Project Name: Milksey Lane, Graveley
															Client: Gade Homes
															Project No: BRD3930
Date:		16/08/2021		Ground conditions:		Damp and firm		Recorded by:		CB					
Time at start:		9:31 AM		Weather conditions:		Overcast		Pressure trend:		Rising					
Time at finish:		10:02 AM		Air Temperature (°C):		14		Monitor serial no:		G501688					
The gas monitoring equipment is a Geotech GA5000 portable analyser. As per manufacturers recommendations this is factory calibrated every six months and in addition BRD undertake calibration checks against bottled standard gases on at least a monthly basis. Gas monitor pump is run for three minutes unless otherwise stated and the steady readings are an average reading taken over this pump run time. Vapour monitoring equipment is miniRAE lite PGM-7350 Photo Ionisation Detector (PID) with 10.6 eV lamp calibrated for isobutylene. PID calibration check is performed on site against ambient air and also against a 100ppm isobutylene standard gas. Barometric pressure trend and ambient air temperature is recorded from weather websites at the nearest reported weather station. CH₄ = Methane CO₂ = Carbon Dioxide O₂ = Oxygen H₂S = Hydrogen Sulphide CO = Carbon Monoxide NR = Not Recorded PID = Photo Ionisation Detector GWL = Groundwater level measured from ground surface and top of standpipe. Base = Base of standpipe measured from ground surface.															
Borehole	Monitoring point			Gas Concentration							Pressure	Flow rate	Vapour	Comments	
	GWL Ground (m)	GWL Pipe (m)	Base Ground (m)	Steady			Peak		Minimum	Peak		Baro - metric (mb)	Steady (l/hr)		PID (ppm)
				CH ₄ (%)	CO ₂ (%)	O ₂ (%)	CH ₄ (%)	CO (ppm)		H ₂ S (ppm)					
WS01	2.12	2.22	2.55	0.0	0.1	20.3	0.0	0.2	20.2	0	0	1006	0.0	0.0	
WS02	3.24	3.37	4.18	0.0	1.7	19.9	0.0	1.7	19.9	0	0	1005	0.1	0.2	
WS03	Dry	Dry	4.93	0.0	3.2	19.2	0.0	3.3	19.0	0	0	1006	0.1	0.0	
WS04	Dry	Dry	4.99	0.0	2.4	19.2	0.0	2.4	19.2	0	0	1006	0.0	0.0	

Gas Monitoring Record														Project Name: Milksey Lane, Graveley	
														Client: Gade Homes	
														Project No: BRD3930	
Date:	28/08/2021			Ground conditions:			Damp and firm			Recorded by:			BC & CB		
Time at start:	10:11 AM			Weather conditions:			Overcast			Pressure trend:			Falling		
Time at finish:	10:46 AM			Air Temperature (°C):			15			Monitor serial no:			G501688		
The gas monitoring equipment is a Geotech GA5000 portable analyser. As per manufacturers recommendations this is factory calibrated every six months and in addition BRD undertake calibration checks against bottled standard gases on at least a monthly basis. Gas monitor pump is run for three minutes unless otherwise stated and the steady readings are an average reading taken over this pump run time. Vapour monitoring equipment is miniRAE lite PGM-7350 Photo Ionisation Detector (PID) with 10.6 eV lamp calibrated for isobutylene. PID calibration check is performed on site against ambient air and also against a 100ppm isobutylene standard gas. Barometric pressure trend and ambient air temperature is recorded from weather websites at the nearest reported weather station. CH₄ = Methane CO₂ = Carbon Dioxide O₂ = Oxygen H₂S = Hydrogen Sulphide CO = Carbon Monoxide NR = Not Recorded PID = Photo Ionisation Detector GWL = Groundwater level measured from ground surface and top of standpipe. Base = Base of standpipe measured from ground surface.															
Borehole	Monitoring point			Gas Concentration						Pressure	Flow rate	Vapour	Comments		
	GWL Ground (m)	GWL Pipe (m)	Base Ground (m)	Steady			Peak			Baro - metric (mb)	Steady (l/hr)	PID (ppm)			
				CH ₄ (%)	CO ₂ (%)	O ₂ (%)	CH ₄ (%)	CO (ppm)	H ₂ S (ppm)						
WS01	2.29	2.38	2.57	0.1	0.2	20.1	0.1	0.2	20.1	0	0	1012	0.0	0.0	
WS02	3.31	3.42	4.16	0.0	0.1	20.5	0.1	1.3	20.0	0	0	1013	0.0	0.0	
WS03	Dry	Dry	4.92	0.0	3.1	19.1	0.2	3.1	19.1	0	0	1013	0.0	0.0	
WS04	Dry	Dry	5.01	0.0	2.4	19.2	0.1	2.5	19.1	0	0	1013	0.0	0.0	



Groundwater Monitoring Record

Project: Milksey Lane, Graveley Client: Gade Homes Project No: BRD3930									
Borehole name	Date	Monitored by (initials)	Borehole depth (m)	Qty free product detected (mm)	Groundwater level below ground surface (m)	Groundwater level below top of standpipe (m)	Amount purged (l)	Post purge groundwater level below top of standpipe (m)	Comments
WS01	30/06/2021	DB	2.60	-	1.65	1.55	-	-	
WS02	30/06/2021	DB	4.00	-	dry	-	-	-	
WS03	30/06/2021	DB	4.00	-	dry	-	-	-	
WS04	30/06/2021	DB	5.00	-	dry	-	-	-	

APPENDIX 3



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DETS Report No: 21-08346

Site Reference: Milksey Lane, Gravely

Project / Job Ref: BRD3930

Order No: None Supplied

Sample Receipt Date: 30/06/2021

Sample Scheduled Date: 30/06/2021

Report Issue Number: 1

Reporting Date: 06/07/2021

Authorised by:



Dave Ashworth
Technical Manager

Dates of laboratory activities for each tested analyte are available upon request.

Opinions and interpretations are outside the laboratory's scope of ISO 17025 accreditation. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.

For Topsoil and WAC analysis the expanded uncertainty measurement should be considered while evaluating results against compliance values.



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Soil Analysis Certificate						
DETS Report No: 21-08346	Date Sampled	28/06/21	28/06/21	28/06/21	25/06/21	25/06/21
BRD Environmental Ltd	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: Milksey Lane, Gravely	TP / BH No	TP03	TP04	TP02	WS01	WS02
Project / Job Ref: BRD3930	Additional Refs	J2	J2	J1	J1	J1
Order No: None Supplied	Depth (m)	0.70	0.75	0.15	0.10	0.10
Reporting Date: 06/07/2021	DETS Sample No	552219	552220	552221	552222	552223

Determinand	Unit	RL	Accreditation					
Asbestos Quantification ^(S)	%	< 0.001	ISO17025					
pH	pH Units	N/a	MCERTS	7.4	8.2	6.1	7.0	7.0
W/S Sulphate as SO ₄ (2:1)	mg/l	< 10	MCERTS	18	35	12	14	14
W/S Sulphate as SO ₄ (2:1)	g/l	< 0.01	MCERTS	0.02	0.04	0.01	0.01	0.01
Organic Matter (SOM)	%	< 0.1	MCERTS	0.8	0.6	2.9	4	2.9
Arsenic (As)	mg/kg	< 2	MCERTS	15	11	18	28	22
Cadmium (Cd)	mg/kg	< 0.2	NONE	0.2	< 0.2	0.2	0.5	0.4
Chromium (Cr)	mg/kg	< 2	MCERTS	23	15	25	22	21
Chromium (hexavalent)	mg/kg	< 2	NONE	< 2	< 2	< 2	< 2	< 2
Copper (Cu)	mg/kg	< 4	MCERTS	12	13	16	26	19
Lead (Pb)	mg/kg	< 3	MCERTS	15	10	58	316	78
Mercury (Hg)	mg/kg	< 1	MCERTS	< 1	< 1	< 1	< 1	< 1
Nickel (Ni)	mg/kg	< 3	MCERTS	19	19	20	24	21
Selenium (Se)	mg/kg	< 2	MCERTS	< 3	< 3	< 3	< 3	< 3
Zinc (Zn)	mg/kg	< 3	MCERTS	69	52	76	165	114

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30°C. The Method Description page describes if the test is performed on the dried or as-received portion
Subcontracted analysis (S)



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Soil Analysis Certificate						
DETS Report No: 21-08346	Date Sampled	25/06/21	25/06/21	28/06/21	28/06/21	28/06/21
BRD Environmental Ltd	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: Milksey Lane, Gravely	TP / BH No	WS03	WS04	TP07	TP08	TP10
Project / Job Ref: BRD3930	Additional Refs	J1	J1	J1	J1	J1
Order No: None Supplied	Depth (m)	0.10	0.10	0.45	0.20	0.30
Reporting Date: 06/07/2021	DETS Sample No	552224	552225	552226	552227	552228

Determinand	Unit	RL	Accreditation					
Asbestos Quantification ^(S)	%	< 0.001	ISO17025			< 0.001	< 0.001	< 0.001
pH	pH Units	N/a	MCERTS	6.0	6.1	7.2	7.3	7.5
W/S Sulphate as SO ₄ (2:1)	mg/l	< 10	MCERTS	< 10	13	18	16	10
W/S Sulphate as SO ₄ (2:1)	g/l	< 0.01	MCERTS	< 0.01	0.01	0.02	0.02	0.01
Organic Matter (SOM)	%	< 0.1	MCERTS	5	4	1.2	6.4	2.5
Arsenic (As)	mg/kg	< 2	MCERTS	18	18	17	30	24
Cadmium (Cd)	mg/kg	< 0.2	NONE	< 0.2	0.4	0.2	0.6	0.3
Chromium (Cr)	mg/kg	< 2	MCERTS	22	23	14	20	17
Chromium (hexavalent)	mg/kg	< 2	NONE	< 2	< 2	< 2	< 2	< 2
Copper (Cu)	mg/kg	< 4	MCERTS	11	19	22	27	16
Lead (Pb)	mg/kg	< 3	MCERTS	36	83	1080	411	117
Mercury (Hg)	mg/kg	< 1	MCERTS	< 1	< 1	< 1	< 1	< 1
Nickel (Ni)	mg/kg	< 3	MCERTS	14	21	21	22	18
Selenium (Se)	mg/kg	< 2	MCERTS	< 3	< 3	< 3	< 3	< 3
Zinc (Zn)	mg/kg	< 3	MCERTS	79	96	193	272	91

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30°C. The Method Description page describes if the test is performed on the dried or as-received portion
Subcontracted analysis (S)



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Soil Analysis Certificate						
DETS Report No: 21-08346	Date Sampled	28/06/21	28/06/21	28/06/21	28/06/21	
BRD Environmental Ltd	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	
Site Reference: Milksey Lane, Gravely	TP / BH No	TP09	TP11	TP10	TP05	
Project / Job Ref: BRD3930	Additional Refs	J1	J1	J2	J2	
Order No: None Supplied	Depth (m)	0.40	0.50	0.80	0.80	
Reporting Date: 06/07/2021	DETS Sample No	552229	552230	552231	552232	

Determinand	Unit	RL	Accreditation				
Asbestos Quantification ^(S)	%	< 0.001	ISO17025	< 0.001	< 0.001		
pH	pH Units	N/a	MCERTS				
W/S Sulphate as SO ₄ (2:1)	mg/l	< 10	MCERTS				
W/S Sulphate as SO ₄ (2:1)	g/l	< 0.01	MCERTS				
Organic Matter (SOM)	%	< 0.1	MCERTS				
Arsenic (As)	mg/kg	< 2	MCERTS				
Cadmium (Cd)	mg/kg	< 0.2	NONE				
Chromium (Cr)	mg/kg	< 2	MCERTS				
Chromium (hexavalent)	mg/kg	< 2	NONE				
Copper (Cu)	mg/kg	< 4	MCERTS				
Lead (Pb)	mg/kg	< 3	MCERTS				
Mercury (Hg)	mg/kg	< 1	MCERTS				
Nickel (Ni)	mg/kg	< 3	MCERTS				
Selenium (Se)	mg/kg	< 2	MCERTS				
Zinc (Zn)	mg/kg	< 3	MCERTS				

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30°C. The Method Description page describes if the test is performed on the dried or as-received portion
Subcontracted analysis (S)



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Soil Analysis Certificate - Speciated PAHs						
DETS Report No: 21-08346	Date Sampled	28/06/21	28/06/21	28/06/21	25/06/21	25/06/21
BRD Environmental Ltd	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: Milksey Lane, Gravely	TP / BH No	TP03	TP04	TP02	WS01	WS02
Project / Job Ref: BRD3930	Additional Refs	J2	J2	J1	J1	J1
Order No: None Supplied	Depth (m)	0.70	0.75	0.15	0.10	0.10
Reporting Date: 06/07/2021	DETS Sample No	552219	552220	552221	552222	552223

Determinand	Unit	RL	Accreditation					
Naphthalene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthylene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Fluorene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Phenanthrene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	0.22	0.28
Anthracene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Fluoranthene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	0.55	0.43
Pyrene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	0.49	0.36
Benzo(a)anthracene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	0.30	0.12
Chrysene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	0.37	0.20
Benzo(b)fluoranthene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	0.45	0.20
Benzo(k)fluoranthene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	0.14	< 0.1
Benzo(a)pyrene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	0.30	0.12
Indeno(1,2,3-cd)pyrene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	0.26	0.13
Dibenz(a,h)anthracene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(ghi)perylene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	0.27	< 0.1
Total EPA-16 PAHs	mg/kg	< 1.6	MCERTS	< 1.6	< 1.6	< 1.6	3.3	1.8



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Soil Analysis Certificate - Speciated PAHs						
DETS Report No: 21-08346	Date Sampled	25/06/21	25/06/21	28/06/21	28/06/21	28/06/21
BRD Environmental Ltd	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: Milksey Lane, Gravely	TP / BH No	WS03	WS04	TP07	TP08	TP10
Project / Job Ref: BRD3930	Additional Refs	J1	J1	J1	J1	J1
Order No: None Supplied	Depth (m)	0.10	0.10	0.45	0.20	0.30
Reporting Date: 06/07/2021	DETS Sample No	552224	552225	552226	552227	552228

Determinand	Unit	RL	Accreditation					
Naphthalene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	0.30	< 0.1
Acenaphthylene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	0.40	< 0.1
Acenaphthene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Fluorene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	0.53	< 0.1
Phenanthrene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	8.36	< 0.1
Anthracene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	3.23	< 0.1
Fluoranthene	mg/kg	< 0.1	MCERTS	< 0.1	0.29	< 0.1	23.90	0.17
Pyrene	mg/kg	< 0.1	MCERTS	< 0.1	0.29	< 0.1	20.70	0.17
Benzo(a)anthracene	mg/kg	< 0.1	MCERTS	< 0.1	0.17	< 0.1	11.60	< 0.1
Chrysene	mg/kg	< 0.1	MCERTS	< 0.1	0.20	< 0.1	9.09	0.11
Benzo(b)fluoranthene	mg/kg	< 0.1	MCERTS	< 0.1	0.29	< 0.1	9.52	0.14
Benzo(k)fluoranthene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	4.24	< 0.1
Benzo(a)pyrene	mg/kg	< 0.1	MCERTS	< 0.1	0.18	< 0.1	10.70	< 0.1
Indeno(1,2,3-cd)pyrene	mg/kg	< 0.1	MCERTS	< 0.1	0.13	< 0.1	4.44	< 0.1
Dibenz(a,h)anthracene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	1.06	< 0.1
Benzo(ghi)perylene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	3.19	< 0.1
Total EPA-16 PAHs	mg/kg	< 1.6	MCERTS	< 1.6	< 1.6	< 1.6	111	< 1.6



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Soil Analysis Certificate - TPH LQM Banded

DETS Report No: 21-08346	Date Sampled	28/06/21	28/06/21	28/06/21	28/06/21	28/06/21
BRD Environmental Ltd	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: Milksey Lane, Gravely	TP / BH No	TP03	TP04	TP07	TP08	TP10
Project / Job Ref: BRD3930	Additional Refs	J2	J2	J1	J1	J1
Order No: None Supplied	Depth (m)	0.70	0.75	0.45	0.20	0.30
Reporting Date: 06/07/2021	DETS Sample No	552219	552220	552226	552227	552228

Determinand	Unit	RL	Accreditation					
Aliphatic >C5 - C6	mg/kg	< 0.01	NONE	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aliphatic >C6 - C8	mg/kg	< 0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Aliphatic >C8 - C10	mg/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	< 2
Aliphatic >C10 - C12	mg/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	< 2
Aliphatic >C12 - C16	mg/kg	< 3	MCERTS	< 3	< 3	< 3	< 3	< 3
Aliphatic >C16 - C35	mg/kg	< 10	MCERTS	< 10	< 10	< 10	< 10	< 10
Aliphatic >C35 - C44	mg/kg	< 10	NONE	< 10	< 10	< 10	< 10	< 10
Aliphatic (C5 - C44)	mg/kg	< 30	NONE	< 30	< 30	< 30	< 30	< 30
Aromatic >C5 - C7	mg/kg	< 0.01	NONE	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aromatic >C7 - C8	mg/kg	< 0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Aromatic >C8 - C10	mg/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	< 2
Aromatic >C10 - C12	mg/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	< 2
Aromatic >C12 - C16	mg/kg	< 2	MCERTS	< 2	< 2	< 2	4	< 2
Aromatic >C16 - C21	mg/kg	< 3	MCERTS	< 3	< 3	< 3	69	< 3
Aromatic >C21 - C35	mg/kg	< 10	MCERTS	< 10	< 10	< 10	142	< 10
Aromatic >C35 - C44	mg/kg	< 10	NONE	< 10	< 10	< 10	< 10	< 10
Aromatic (>C5 - C44)	mg/kg	< 30	NONE	< 30	< 30	< 30	214	< 30
Total >C5 - C44	mg/kg	< 60	NONE	< 60	< 60	< 60	214	< 60



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Soil Analysis Certificate - BTEX / MTBE						
DETS Report No: 21-08346	Date Sampled	28/06/21	28/06/21	28/06/21	28/06/21	28/06/21
BRD Environmental Ltd	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: Milksey Lane, Gravely	TP / BH No	TP03	TP04	TP07	TP08	TP10
Project / Job Ref: BRD3930	Additional Refs	J2	J2	J1	J1	J1
Order No: None Supplied	Depth (m)	0.70	0.75	0.45	0.20	0.30
Reporting Date: 06/07/2021	DETS Sample No	552219	552220	552226	552227	552228

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



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Soil Analysis Certificate - Semi Volatile Organic Compounds (SVOC)						
DETS Report No: 21-08346	Date Sampled	28/06/21	28/06/21			
BRD Environmental Ltd	Time Sampled	None Supplied	None Supplied			
Site Reference: Milksey Lane, Gravely	TP / BH No	TP03	TP04			
Project / Job Ref: BRD3930	Additional Refs	J2	J2			
Order No: None Supplied	Depth (m)	0.70	0.75			
Reporting Date: 06/07/2021	DETS Sample No	552219	552220			

Determinand	Unit	RL	Accreditation				
Phenol	mg/kg	< 0.1	NONE	< 0.1	< 0.1		
1,2,4-Trichlorobenzene	mg/kg	< 0.1	ISO17025	< 0.1	< 0.1		
2-Nitrophenol	mg/kg	< 0.1	NONE	< 0.1	< 0.1		
Nitrobenzene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1		
0-Cresol	mg/kg	< 0.1	NONE	< 0.1	< 0.1		
bis(2-chloroethoxy)methane	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1		
bis(2-chloroethyl)ether	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1		
2,4-Dichlorophenol	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1		
2-Chlorophenol	mg/kg	< 0.1	ISO17025	< 0.1	< 0.1		
1,3-Dichlorobenzene	mg/kg	< 0.1	ISO17025	< 0.1	< 0.1		
1,4-Dichlorobenzene	mg/kg	< 0.1	ISO17025	< 0.1	< 0.1		
1,2-Dichlorobenzene	mg/kg	< 0.1	ISO17025	< 0.1	< 0.1		
2,4-Dimethylphenol	mg/kg	< 0.15	ISO17025	< 0.15	< 0.15		
Isophorone	mg/kg	< 0.1	NONE	< 0.1	< 0.1		
Hexachloroethane	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1		
p-Cresol	mg/kg	< 0.15	MCERTS	< 0.15	< 0.15		
2,4,6-Trichlorophenol	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1		
2,4,5-Trichlorophenol	mg/kg	< 0.15	MCERTS	< 0.15	< 0.15		
2-Nitroaniline	mg/kg	< 0.1	NONE	< 0.1	< 0.1		
4-Chloro-3-methylphenol	mg/kg	< 0.1	NONE	< 0.1	< 0.1		
2-Methylnaphthalene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1		
Hexachlorocyclopentadiene	mg/kg	< 0.1	NONE	< 0.1	< 0.1		
Hexachlorobutadiene	mg/kg	< 0.1	ISO17025	< 0.1	< 0.1		
2,6-Dinitrotoluene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1		
Dimethyl phthalate	mg/kg	< 0.1	NONE	< 0.1	< 0.1		
2-Chloronaphthalene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1		
4-Chloroaniline	mg/kg	< 0.15	NONE	< 0.15	< 0.15		
4-Nitrophenol	mg/kg	< 0.1	NONE	< 0.1	< 0.1		
4-Chlorophenyl phenyl ether	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1		
3-Nitroaniline	mg/kg	< 0.1	NONE	< 0.1	< 0.1		
4-Nitroaniline	mg/kg	< 0.1	NONE	< 0.1	< 0.1		
4-Bromophenyl phenyl ether	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1		
Hexachlorobenzene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1		
2,4-Dinitrotoluene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1		
Diethyl phthalate	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1		
Dibenzofuran	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1		
Azobenzene	mg/kg	< 0.1	NONE	< 0.1	< 0.1		
Dibutyl phthalate	mg/kg	< 0.1	ISO17025	< 0.1	< 0.1		
Carbazole	mg/kg	< 0.1	ISO17025	< 0.1	< 0.1		
bis(2-ethylhexyl)phthalate	mg/kg	< 0.15	MCERTS	< 0.15	< 0.15		
Benzyl butyl phthalate	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1		
Di-n-octyl phthalate	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1		

Waste Acceptance Criteria Analytical Certificate - BS EN 12457/3																																							
DETS Report No: 21-08346		Date Sampled		28/06/21		<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th colspan="3" style="text-align: left; padding: 5px;">Landfill Waste Acceptance Criteria Limits</th> </tr> <tr> <th style="width: 33%; padding: 5px;">Inert Waste Landfill</th> <th style="width: 33%; padding: 5px;">Stable Non-reactive HAZARDOUS waste in non-hazardous Landfill</th> <th style="width: 33%; padding: 5px;">Hazardous Waste Landfill</th> </tr> </thead> <tbody> <tr> <td style="text-align: center; padding: 5px;">3%</td> <td style="text-align: center; padding: 5px;">5%</td> <td style="text-align: center; padding: 5px;">6%</td> </tr> <tr> <td style="text-align: center; padding: 5px;">—</td> <td style="text-align: center; padding: 5px;">—</td> <td style="text-align: center; padding: 5px;">10%</td> </tr> <tr> <td style="text-align: center; padding: 5px;">6</td> <td style="text-align: center; padding: 5px;">—</td> <td style="text-align: center; padding: 5px;">—</td> </tr> <tr> <td style="text-align: center; padding: 5px;">1</td> <td style="text-align: center; padding: 5px;">—</td> <td style="text-align: center; padding: 5px;">—</td> </tr> <tr> <td style="text-align: center; padding: 5px;">500</td> <td style="text-align: center; padding: 5px;">—</td> <td style="text-align: center; padding: 5px;">—</td> </tr> <tr> <td style="text-align: center; padding: 5px;">100</td> <td style="text-align: center; padding: 5px;">—</td> <td style="text-align: center; padding: 5px;">—</td> </tr> <tr> <td style="text-align: center; padding: 5px;">—</td> <td style="text-align: center; padding: 5px;">>6</td> <td style="text-align: center; padding: 5px;">—</td> </tr> <tr> <td style="text-align: center; padding: 5px;">—</td> <td style="text-align: center; padding: 5px; color: red;">To be evaluated</td> <td style="text-align: center; padding: 5px; color: red;">To be evaluated</td> </tr> </tbody> </table>				Landfill Waste Acceptance Criteria Limits			Inert Waste Landfill	Stable Non-reactive HAZARDOUS waste in non-hazardous Landfill	Hazardous Waste Landfill	3%	5%	6%	—	—	10%	6	—	—	1	—	—	500	—	—	100	—	—	—	>6	—	—	To be evaluated	To be evaluated
Landfill Waste Acceptance Criteria Limits																																							
Inert Waste Landfill	Stable Non-reactive HAZARDOUS waste in non-hazardous Landfill	Hazardous Waste Landfill																																					
3%	5%	6%																																					
—	—	10%																																					
6	—	—																																					
1	—	—																																					
500	—	—																																					
100	—	—																																					
—	>6	—																																					
—	To be evaluated	To be evaluated																																					
BRD Environmental Ltd		Time Sampled		None Supplied																																			
Site Reference: Milksey Lane, Gravely		TP / BH No		TP10																																			
Project / Job Ref: BRD3930		Additional Refs		J2																																			
Order No: None Supplied		Depth (m)		0.80																																			
Reporting Date: 06/07/2021		DETS Sample No		552231																																			
Determinand		Unit		MDL																																			
TOC ^{MU}		%		< 0.1		0.8																																	
Loss on Ignition		%		< 0.01		4.20																																	
BTEX ^{MU}		mg/kg		< 0.05		< 0.05																																	
Sum of PCBs		mg/kg		< 0.1		< 0.1																																	
Mineral Oil ^{MU}		mg/kg		< 10		< 10																																	
Total PAH ^{MU}		mg/kg		< 1.7		< 1.7																																	
pH ^{MU}		pH Units		N/a		7.7																																	
Acid Neutralisation Capacity		mol/kg (+/-)		< 1		2.4																																	
Eluate Analysis				2:1 mg/l		8:1 mg/l		Cumulative 10:1 mg/kg		Limit values for compliance leaching test using BS EN 12457-3 at L/S 10 l/kg (mg/kg)																													
Arsenic ^U				< 0.01		< 0.01		< 0.2		0.5																													
Barium ^U				< 0.02		< 0.02		0.1		20																													
Cadmium ^U				< 0.0005		< 0.0005		< 0.02		0.04																													
Chromium ^U				< 0.005		< 0.005		< 0.20		0.5																													
Copper ^U				< 0.01		0.03		< 0.5		2																													
Mercury ^U				< 0.0005		< 0.0005		< 0.005		0.01																													
Molybdenum ^U				0.001		0.002		< 0.1		0.5																													
Nickel ^U				< 0.007		< 0.007		< 0.2		0.4																													
Lead ^U				< 0.005		< 0.005		< 0.2		0.5																													
Antimony ^U				< 0.005		< 0.005		< 0.05		0.06																													
Selenium ^U				< 0.005		< 0.005		< 0.05		0.1																													
Zinc ^U				0.006		0.013		< 0.2		4																													
Chloride ^U				3		18		165		800																													
Fluoride ^U				0.6		< 0.5		< 1		10																													
Sulphate ^U				4		13		125		1000																													
TDS				110		139		1368		4000																													
Phenol Index				< 0.01		< 0.01		< 0.5		1																													
DOC				7.1		19.5		186		500																													
Leach Test Information																																							
Sample Mass (kg)				0.20																																			
Dry Matter (%)				85.4																																			
Moisture (%)				17																																			
Stage 1																																							
Volume Eluate L2 (litres)				0.32																																			
Filtered Eluate VE1 (litres)				0.13																																			

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30°C. The Samples Descriptions page describes if the test is performed on the dried or as-received portion

Stated limits are for guidance only and DETS Ltd cannot be held responsible for any discrepancies with current legislation

M Denotes MCERTS accredited test

U Denotes ISO17025 accredited test

Waste Acceptance Criteria Analytical Certificate - BS EN 12457/3									
DETS Report No: 21-08346		Date Sampled		28/06/21		Inert Waste Landfill Stable Non-reactive HAZARDOUS waste in non-hazardous Landfill Hazardous Waste Landfill			
BRD Environmental Ltd		Time Sampled		None Supplied					
Site Reference: Milksey Lane, Gravely		TP / BH No		TP05					
Project / Job Ref: BRD3930		Additional Refs		J2					
Order No: None Supplied		Depth (m)		0.80					
Reporting Date: 06/07/2021		DETS Sample No		552232					
Determinand		Unit		MDL					
TOC ^{MU}		%		< 0.1		0.2			
Loss on Ignition		%		< 0.01		2.70			
BTEX ^{MU}		mg/kg		< 0.05		< 0.05			
Sum of PCBs		mg/kg		< 0.1		< 0.1			
Mineral Oil ^{MU}		mg/kg		< 10		< 10			
Total PAH ^{MU}		mg/kg		< 1.7		< 1.7			
pH ^{MU}		pH Units		N/a		7.7			
Acid Neutralisation Capacity		mol/kg (+/-)		< 1		2.4			
Eluate Analysis				2:1 mg/l		8:1 mg/l		Cumulative 10:1 mg/kg	
Arsenic ^U				< 0.01		< 0.01		< 0.2	
Barium ^U				0.03		< 0.02		0.2	
Cadmium ^U				< 0.0005		< 0.0005		< 0.02	
Chromium ^U				< 0.005		< 0.005		< 0.20	
Copper ^U				< 0.01		0.02		< 0.5	
Mercury ^U				< 0.0005		< 0.0005		< 0.005	
Molybdenum ^U				< 0.001		0.001		< 0.1	
Nickel ^U				< 0.007		< 0.007		< 0.2	
Lead ^U				< 0.005		< 0.005		< 0.2	
Antimony ^U				< 0.005		< 0.005		< 0.05	
Selenium ^U				< 0.005		< 0.005		< 0.05	
Zinc ^U				< 0.005		0.008		< 0.2	
Chloride ^U				2		13		123	
Fluoride ^U				1.1		0.8		8.2	
Sulphate ^U				4		7		71	
TDS				99		123		1210	
Phenol Index				< 0.01		< 0.01		< 0.5	
DOC				4.6		11.6		110	
Leach Test Information									
Sample Mass (kg)				0.20					
Dry Matter (%)				86.9					
Moisture (%)				15					
Stage 1									
Volume Eluate L2 (litres)				0.32					
Filtered Eluate VE1 (litres)				0.14					

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30°C. The Samples Descriptions page describes if the test is performed on the dried or as-received portion

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Tel : 01622 850410



Soil Analysis Certificate - Sample Descriptions

DETS Report No: 21-08346	
BRD Environmental Ltd	
Site Reference: Milksey Lane, Gravely	
Project / Job Ref: BRD3930	
Order No: None Supplied	
Reporting Date: 06/07/2021	

DETS Sample No	TP / BH No	Additional Refs	Depth (m)	Moisture Content (%)	Sample Matrix Description
552219	TP03	J2	0.70	14.7	Light brown sandy clay
552220	TP04	J2	0.75	11.7	Light brown sandy clay with chalk
552221	TP02	J1	0.15	16.5	Brown sandy clay
552222	WS01	J1	0.10	13.8	Brown loamy sand with vegetation
552223	WS02	J1	0.10	14.8	Brown sandy clay
552224	WS03	J1	0.10	15.1	Brown loamy sand with vegetation
552225	WS04	J1	0.10	18.5	Brown sandy clay with stones and vegetation
552226	TP07	J1	0.45	14.6	Brown sandy clay with chalk
552227	TP08	J1	0.20	14.4	Brown loamy sand with stones
552228	TP10	J1	0.30	7.3	Brown sandy clay with stones
552231	TP10	J2	0.80	14.5	Brown sandy clay with chalk
552232	TP05	J2	0.80	13.1	Light brown sandy clay with chalk

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

Insufficient Sample ^{I/S}

Unsuitable Sample ^{U/S}



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Soil Analysis Certificate - Methodology & Miscellaneous Information

DETS Report No: 21-08346

BRD Environmental Ltd

Site Reference: Milksey Lane, Gravely

Project / Job Ref: BRD3930

Order No: None Supplied

Reporting Date: 06/07/2021

Matrix	Analysed On	Determinand	Brief Method Description	Method No
Soil	D	Boron - Water Soluble	Determination of water soluble boron in soil by 2:1 hot water extract followed by ICP-OES	E012
Soil	AR	BTEX	Determination of BTEX by headspace GC-MS	E001
Soil	D	Cations	Determination of cations in soil by aqua-regia digestion followed by ICP-OES	E002
Soil	D	Chloride - Water Soluble (2:1)	Determination of chloride by extraction with water & analysed by ion chromatography	E009
Soil	AR	Chromium - Hexavalent	Determination of hexavalent chromium in soil by extraction in water then by acidification, addition of 1,5 diphénylcarbazine followed by colorimetry	E016
Soil	AR	Cyanide - Complex	Determination of complex cyanide by distillation followed by colorimetry	E015
Soil	AR	Cyanide - Free	Determination of free cyanide by distillation followed by colorimetry	E015
Soil	AR	Cyanide - Total	Determination of total cyanide by distillation followed by colorimetry	E015
Soil	D	Cyclohexane Extractable Matter (CEM)	Gravimetrically determined through extraction with cyclohexane	E011
Soil	AR	Diesel Range Organics (C10 - C24)	Determination of hexane/acetone extractable hydrocarbons by GC-FID	E004
Soil	AR	Electrical Conductivity	Determination of electrical conductivity by addition of saturated calcium sulphate followed by electrometric measurement	E022
Soil	AR	Electrical Conductivity	Determination of electrical conductivity by addition of water followed by electrometric measurement	E023
Soil	D	Elemental Sulphur	Determination of elemental sulphur by solvent extraction followed by GC-MS	E020
Soil	AR	EPH (C10 - C40)	Determination of acetone/hexane extractable hydrocarbons by GC-FID	E004
Soil	AR	EPH Product ID	Determination of acetone/hexane extractable hydrocarbons by GC-FID	E004
Soil	AR	EPH TEXAS (C6-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C40)	Determination of acetone/hexane extractable hydrocarbons by GC-FID for C8 to C40. C6 to C8 by headspace GC-MS	E004
Soil	D	Fluoride - Water Soluble	Determination of Fluoride by extraction with water & analysed by ion chromatography	E009
Soil	D	Fraction Organic Carbon (FOC)	Determination of TOC by combustion analyser.	E027
Soil	D	Organic Matter (SOM)	Determination of TOC by combustion analyser.	E027
Soil	D	TOC (Total Organic Carbon)	Determination of TOC by combustion analyser.	E027
Soil	AR	Exchangeable Ammonium	Determination of ammonium by discrete analyser.	E029
Soil	D	FOC (Fraction Organic Carbon)	Determination of fraction of organic carbon by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	D	Loss on Ignition @ 450oC	Determination of loss on ignition in soil by gravimetrically with the sample being ignited in a muffle furnace	E019
Soil	D	Magnesium - Water Soluble	Determination of water soluble magnesium by extraction with water followed by ICP-OES	E025
Soil	D	Metals	Determination of metals by aqua-regia digestion followed by ICP-OES	E002
Soil	AR	Mineral Oil (C10 - C40)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge	E004
Soil	AR	Moisture Content	Moisture content; determined gravimetrically	E003
Soil	D	Nitrate - Water Soluble (2:1)	Determination of nitrate by extraction with water & analysed by ion chromatography	E009
Soil	D	Organic Matter	Determination of organic matter by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	AR	PAH - Speciated (EPA 16)	Determination of PAH compounds by extraction in acetone and hexane followed by GC-MS with the use of surrogate and internal standards	E005
Soil	AR	PCB - 7 Congeners	Determination of PCB by extraction with acetone and hexane followed by GC-MS	E008
Soil	D	Petroleum Ether Extract (PEE)	Gravimetrically determined through extraction with petroleum ether	E011
Soil	AR	pH	Determination of pH by addition of water followed by electrometric measurement	E007
Soil	AR	Phenols - Total (monohydric)	Determination of phenols by distillation followed by colorimetry	E021
Soil	D	Phosphate - Water Soluble (2:1)	Determination of phosphate by extraction with water & analysed by ion chromatography	E009
Soil	D	Sulphate (as SO4) - Total	Determination of total sulphate by extraction with 10% HCl followed by ICP-OES	E013
Soil	D	Sulphate (as SO4) - Water Soluble (2:1)	Determination of sulphate by extraction with water & analysed by ion chromatography	E009
Soil	D	Sulphate (as SO4) - Water Soluble (2:1)	Determination of water soluble sulphate by extraction with water followed by ICP-OES	E014
Soil	AR	Sulphide	Determination of sulphide by distillation followed by colorimetry	E018
Soil	D	Sulphur - Total	Determination of total sulphur by extraction with aqua-regia followed by ICP-OES	E024
Soil	AR	SVOC	Determination of semi-volatile organic compounds by extraction in acetone and hexane followed by GC-MS	E006
Soil	AR	Thiocyanate (as SCN)	Determination of thiocyanate by extraction in caustic soda followed by acidification followed by addition of ferric nitrate followed by colorimetry	E017
Soil	D	Toluene Extractable Matter (TEM)	Gravimetrically determined through extraction with toluene	E011
Soil	D	Total Organic Carbon (TOC)	Determination of organic matter by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	AR	TPH CWG (ali: C5- C6, C6-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C34, aro: C5-C7, C7-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C35)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge for C8 to C35. C5 to C8 by headspace GC-MS	E004
Soil	AR	TPH LQM (ali: C5-C6, C6-C8, C8-C10, C10-C12, C12-C16, C16-C35, C35-C44, aro: C5-C7, C7-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C35, C35-C44)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge for C8 to C44. C5 to C8 by headspace GC-MS	E004
Soil	AR	VOCs	Determination of volatile organic compounds by headspace GC-MS	E001
Soil	AR	VPH (C6-C8 & C8-C10)	Determination of hydrocarbons C6-C8 by headspace GC-MS & C8-C10 by GC-FID	E001

D Dried
AR As Received



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Water Analysis Certificate - Methodology & Miscellaneous Information

DETS Report No: 21-08346

BRD Environmental Ltd

Site Reference: Milksey Lane, Gravely

Project / Job Ref: BRD3930

Order No: None Supplied

Reporting Date: 06/07/2021

Matrix	Analysed On	Determinand	Brief Method Description	Method No
Water	UF	Alkalinity	Determination of alkalinity by titration against hydrochloric acid using bromocresol green as the end point	E103
Water	F	Ammoniacal Nitrogen	Determination of ammoniacal nitrogen by discrete analyser.	E126
Water	UF	BTEX	Determination of BTEX by headspace GC-MS	E101
Water	F	Cations	Determination of cations by filtration followed by ICP-MS	E102
Water	UF	Chemical Oxygen Demand (COD)	Determination using a COD reactor followed by colorimetry	E112
Water	F	Chloride	Determination of chloride by filtration & analysed by ion chromatography	E109
Water	F	Chromium - Hexavalent	Determination of hexavalent chromium by acidification, addition of 1,5 diphenylcarbazine followed by	E116
Water	UF	Cyanide - Complex	Determination of complex cyanide by distillation followed by colorimetry	E115
Water	UF	Cyanide - Free	Determination of free cyanide by distillation followed by colorimetry	E115
Water	UF	Cyanide - Total	Determination of total cyanide by distillation followed by colorimetry	E115
Water	UF	Cyclohexane Extractable Matter (CEM)	Gravimetrically determined through liquid:liquid extraction with cyclohexane	E111
Water	F	Diesel Range Organics (C10 - C24)	Determination of liquid:liquid extraction with hexane followed by GC-FID	E104
Water	F	Dissolved Organic Content (DOC)	Determination of DOC by filtration followed by low heat with persulphate addition followed by IR dete	E110
Water	UF	Electrical Conductivity	Determination of electrical conductivity by electrometric measurement	E123
Water	F	EPH (C10 - C40)	Determination of liquid:liquid extraction with hexane followed by GC-FID	E104
Water	F	EPH TEXAS (C6-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C40)	Determination of liquid:liquid extraction with hexane followed by GC-FID for C8 to C40. C6 to C8 by headspace GC-MS	E104
Water	F	Fluoride	Determination of Fluoride by filtration & analysed by ion chromatography	E109
Water	F	Hardness	Determination of Ca and Mg by ICP-MS followed by calculation	E102
Leachate	F	Leachate Preparation - NRA	Based on National Rivers Authority leaching test 1994	E301
Leachate	F	Leachate Preparation - WAC	Based on BS EN 12457 Pt1, 2, 3	E302
Water	F	Metals	Determination of metals by filtration followed by ICP-MS	E102
Water	F	Mineral Oil (C10 - C40)	Determination of liquid:liquid extraction with hexane followed by GI-FID	E104
Water	F	Nitrate	Determination of nitrate by filtration & analysed by ion chromatography	E109
Water	UF	Monohydric Phenol	Determination of phenols by distillation followed by colorimetry	E121
Water	F	PAH - Speciated (EPA 16)	Determination of PAH compounds by concentration through SPE cartridge, collection in dichloromethane followed by GC-MS	E105
Water	F	PCB - 7 Congeners	Determination of PCB compounds by concentration through SPE cartridge, collection in dichloromethane	E108
Water	UF	Petroleum Ether Extract (PEE)	Gravimetrically determined through liquid:liquid extraction with petroleum ether	E111
Water	UF	pH	Determination of pH by electrometric measurement	E107
Water	F	Phosphate	Determination of phosphate by filtration & analysed by ion chromatography	E109
Water	UF	Redox Potential	Determination of redox potential by electrometric measurement	E113
Water	F	Sulphate (as SO4)	Determination of sulphate by filtration & analysed by ion chromatography	E109
Water	UF	Sulphide	Determination of sulphide by distillation followed by colorimetry	E118
Water	F	SVOC	Determination of semi-volatile organic compounds by concentration through SPE cartridge, collection in dichloromethane followed by GC-MS	E106
Water	UF	Toluene Extractable Matter (TEM)	Gravimetrically determined through liquid:liquid extraction with toluene	E111
Water	UF	Total Organic Carbon (TOC)	Low heat with persulphate addition followed by IR detection	E110
Water	F	TPH CWG (ali: C5-C6, C6-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C34, aro: C5-C7, C7-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C35)	Determination of liquid:liquid extraction with hexane, fractionating with SPE followed by GC-FID for C8 to C35. C5 to C8 by headspace GC-MS	E104
Water	F	TPH LQM (ali: C5-C6, C6-C8, C8-C10, C10-C12, C12-C16, C16-C35, C35-C44, aro: C5-C7, C7-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C35, C35-C44)	Determination of liquid:liquid extraction with hexane, fractionating with SPE followed by GC-FID for C8 to C44. C5 to C8 by headspace GC-MS	E104
Water	UF	VOCs	Determination of volatile organic compounds by headspace GC-MS	E101
Water	UF	VPH (C6-C8 & C8-C10)	Determination of hydrocarbons C6-C8 by headspace GC-MS & C8-C10 by GC-FID	E101

Key

F Filtered
UF Unfiltered

Parameter	Matrix Type	Suite Reference	Expanded Uncertainty Measurement	Unit
TOC	Soil	BS EN 12457	20.0	%
Loss on Ignition	Soil	BS EN 12457	35.0	%
BTEX	Soil	BS EN 12457	14.0	%
Sum of PCBs	Soil	BS EN 12457	23.0	%
Mineral Oil	Soil	BS EN 12457	9.0	%
Total PAH	Soil	BS EN 12457	11.6	%
pH	Soil	BS EN 12457	0.28	Units
Acid Neutralisation Capacity	Soil	BS EN 12457	18.0	%
Arsenic	Leachate	BS EN 12457	18.7	%
Barium	Leachate	BS EN 12457	11.6	%
Cadmium	Leachate	BS EN 12457	20.3	%
Chromium	Leachate	BS EN 12457	18.3	%
Copper	Leachate	BS EN 12457	24.3	%
Mercury	Leachate	BS EN 12457	23.7	%
Molybdenum	Leachate	BS EN 12457	14.7	%
Nickel	Leachate	BS EN 12457	16.1	%
Lead	Leachate	BS EN 12457	15.7	%
Antimony	Leachate	BS EN 12457	17.9	%
Selenium	Leachate	BS EN 12457	22.0	%
Zinc	Leachate	BS EN 12457	17.4	%
Chloride	Leachate	BS EN 12457	15.3	%
Fluoride	Leachate	BS EN 12457	16.4	%
Sulphate	Leachate	BS EN 12457	20.6	%
TDS	Leachate	BS EN 12457	12.0	%
Phenol Index	Leachate	BS EN 12457	14.0	%
DOC	Leachate	BS EN 12457	10.0	%
Clay Content	Soil	BS 3882: 2015	15.0	%
Silt Content	Soil	BS 3882: 2015	14.0	%
Sand Content	Soil	BS 3882: 2015	13.0	%
Loss on Ignition	Soil	BS 3882: 2015	35.0	%
pH	Soil	BS 3882: 2015	0.14	Units
Carbonate	Soil	BS 3882: 2015	16.0	%
Total Nitrogen	Soil	BS 3882: 2015	12.0	%
Phosphorus (Extractable)	Soil	BS 3882: 2015	24.0	%
Potassium (Extractable)	Soil	BS 3882: 2015	20.0	%
Magnesium (Extractable)	Soil	BS 3882: 2015	26.0	%
Zinc	Soil	BS 3882: 2015	14.9	%
Copper	Soil	BS 3882: 2015	16.0	%
Nickel	Soil	BS 3882: 2015	17.7	%
Available Sodium	Soil	BS 3882: 2015	23.0	%
Available Calcium	Soil	BS 3882: 2015	23.0	%
Electrical Conductivity	Soil	BS 3882: 2015	10.0	%



Ramiro Marina
BRD Environmental Ltd
Hawthorne Villa
1 Old Parr Road
Banbury
Oxfordshire
OX16 5HT

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Unit 1
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ME17 2JN
t: 01622 850410

DETS Report No: 21-08347

Site Reference: Milksey Lane, Graveley

Project / Job Ref: BRD3930

Order No: None Supplied

Sample Receipt Date: 30/06/2021

Sample Scheduled Date: 30/06/2021

Report Issue Number: 1

Reporting Date: 06/07/2021

Authorised by:

Dave Ashworth
Technical Manager

Dates of laboratory activities for each tested analyte are available upon request.

Opinions and interpretations are outside the laboratory's scope of ISO 17025 accreditation. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.



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Soil Analysis Certificate						
DETS Report No: 21-08347	Date Sampled	25/06/21	25/06/21	25/06/21	25/06/21	25/06/21
BRD Environmental Ltd	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: Milksey Lane, Graveley	TP / BH No	WS01	WS01	WS02	WS02	WS03
Project / Job Ref: BRD3930	Additional Refs	D1	D3	D3	D6	D5
Order No: None Supplied	Depth (m)	0.80	1.60	1.70	3.00	2.70
Reporting Date: 06/07/2021	DETS Sample No	552233	552234	552235	552236	552237

Determinand	Unit	RL	Accreditation					
pH	pH Units	N/a	MCERTS	7.6	7.6	7.6	7.6	7.8
Total Sulphate as SO ₄	mg/kg	< 200	MCERTS	211	302	< 200	500	333
Total Sulphate as SO ₄	%	< 0.02	MCERTS	0.02	0.03	< 0.02	0.05	0.03
W/S Sulphate as SO ₄ (2:1)	mg/l	< 10	MCERTS	< 10	11	< 10	< 10	40
W/S Sulphate as SO ₄ (2:1)	g/l	< 0.01	MCERTS	< 0.01	0.01	< 0.01	< 0.01	0.04
Total Sulphur	%	< 0.02	NONE	< 0.02	< 0.02	< 0.02	< 0.02	0.02

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30°C. The Method Description page describes if the test is performed on the dried or as-received portion
 Subcontracted analysis (S)



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Soil Analysis Certificate						
DETS Report No: 21-08347	Date Sampled	25/06/21	28/06/21	28/06/21		
BRD Environmental Ltd	Time Sampled	None Supplied	None Supplied	None Supplied		
Site Reference: Milksey Lane, Graveley	TP / BH No	WS04	TP06	TP04		
Project / Job Ref: BRD3930	Additional Refs	D2	D2	D2		
Order No: None Supplied	Depth (m)	0.90	1.30	1.30		
Reporting Date: 06/07/2021	DETS Sample No	552238	552239	552240		

Determinand	Unit	RL	Accreditation				
pH	pH Units	N/a	MCERTS	7.8	7.9	7.8	
Total Sulphate as SO ₄	mg/kg	< 200	MCERTS	338	294	383	
Total Sulphate as SO ₄	%	< 0.02	MCERTS	0.03	0.03	0.04	
W/S Sulphate as SO ₄ (2:1)	mg/l	< 10	MCERTS	11	25	22	
W/S Sulphate as SO ₄ (2:1)	g/l	< 0.01	MCERTS	0.01	0.02	0.02	
Total Sulphur	%	< 0.02	NONE	< 0.02	< 0.02	< 0.02	

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30°C. The Method Description page describes if the test is performed on the dried or as-received portion
 Subcontracted analysis (S)



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Soil Analysis Certificate - Sample Descriptions

DETS Report No: 21-08347	
BRD Environmental Ltd	
Site Reference: Milksey Lane, Graveley	
Project / Job Ref: BRD3930	
Order No: None Supplied	
Reporting Date: 06/07/2021	

DETS Sample No	TP / BH No	Additional Refs	Depth (m)	Moisture Content (%)	Sample Matrix Description
552233	WS01	D1	0.80	15.8	Light brown sandy clay
552234	WS01	D3	1.60	12.1	Light brown sandy clay
552235	WS02	D3	1.70	13.8	Light brown clay
552236	WS02	D6	3.00	9.7	Brown sandy clay
552237	WS03	D5	2.70	13.4	Brown sandy clay with chalk
552238	WS04	D2	0.90	14	Light brown sandy clay with chalk
552239	TP06	D2	1.30	12.2	Light brown sandy clay with chalk
552240	TP04	D2	1.30	13.4	Brown sandy clay with chalk

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

Insufficient Sample ^{I/S}

Unsuitable Sample ^{U/S}



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Soil Analysis Certificate - Methodology & Miscellaneous Information

DETS Report No: 21-08347

BRD Environmental Ltd

Site Reference: Milksey Lane, Graveley

Project / Job Ref: BRD3930

Order No: None Supplied

Reporting Date: 06/07/2021

Matrix	Analysed On	Determinand	Brief Method Description	Method No
Soil	D	Boron - Water Soluble	Determination of water soluble boron in soil by 2:1 hot water extract followed by ICP-OES	E012
Soil	AR	BTEX	Determination of BTEX by headspace GC-MS	E001
Soil	D	Cations	Determination of cations in soil by aqua-regia digestion followed by ICP-OES	E002
Soil	D	Chloride - Water Soluble (2:1)	Determination of chloride by extraction with water & analysed by ion chromatography	E009
Soil	AR	Chromium - Hexavalent	Determination of hexavalent chromium in soil by extraction in water then by acidification, addition of 1,5 diphénylcarbazine followed by colorimetry	E016
Soil	AR	Cyanide - Complex	Determination of complex cyanide by distillation followed by colorimetry	E015
Soil	AR	Cyanide - Free	Determination of free cyanide by distillation followed by colorimetry	E015
Soil	AR	Cyanide - Total	Determination of total cyanide by distillation followed by colorimetry	E015
Soil	D	Cyclohexane Extractable Matter (CEM)	Gravimetrically determined through extraction with cyclohexane	E011
Soil	AR	Diesel Range Organics (C10 - C24)	Determination of hexane/acetone extractable hydrocarbons by GC-FID	E004
Soil	AR	Electrical Conductivity	Determination of electrical conductivity by addition of saturated calcium sulphate followed by electrometric measurement	E022
Soil	AR	Electrical Conductivity	Determination of electrical conductivity by addition of water followed by electrometric measurement	E023
Soil	D	Elemental Sulphur	Determination of elemental sulphur by solvent extraction followed by GC-MS	E020
Soil	AR	EPH (C10 - C40)	Determination of acetone/hexane extractable hydrocarbons by GC-FID	E004
Soil	AR	EPH Product ID	Determination of acetone/hexane extractable hydrocarbons by GC-FID	E004
Soil	AR	EPH TEXAS (C6-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C40)	Determination of acetone/hexane extractable hydrocarbons by GC-FID for C8 to C40. C6 to C8 by headspace GC-MS	E004
Soil	D	Fluoride - Water Soluble	Determination of Fluoride by extraction with water & analysed by ion chromatography	E009
Soil	D	Fraction Organic Carbon (FOC)	Determination of TOC by combustion analyser.	E027
Soil	D	Organic Matter (SOM)	Determination of TOC by combustion analyser.	E027
Soil	D	TOC (Total Organic Carbon)	Determination of TOC by combustion analyser.	E027
Soil	AR	Exchangeable Ammonium	Determination of ammonium by discrete analyser.	E029
Soil	D	FOC (Fraction Organic Carbon)	Determination of fraction of organic carbon by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	D	Loss on Ignition @ 450oC	Determination of loss on ignition in soil by gravimetrically with the sample being ignited in a muffle furnace	E019
Soil	D	Magnesium - Water Soluble	Determination of water soluble magnesium by extraction with water followed by ICP-OES	E025
Soil	D	Metals	Determination of metals by aqua-regia digestion followed by ICP-OES	E002
Soil	AR	Mineral Oil (C10 - C40)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge	E004
Soil	AR	Moisture Content	Moisture content; determined gravimetrically	E003
Soil	D	Nitrate - Water Soluble (2:1)	Determination of nitrate by extraction with water & analysed by ion chromatography	E009
Soil	D	Organic Matter	Determination of organic matter by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	AR	PAH - Speciated (EPA 16)	Determination of PAH compounds by extraction in acetone and hexane followed by GC-MS with the use of surrogate and internal standards	E005
Soil	AR	PCB - 7 Congeners	Determination of PCB by extraction with acetone and hexane followed by GC-MS	E008
Soil	D	Petroleum Ether Extract (PEE)	Gravimetrically determined through extraction with petroleum ether	E011
Soil	AR	pH	Determination of pH by addition of water followed by electrometric measurement	E007
Soil	AR	Phenols - Total (monohydric)	Determination of phenols by distillation followed by colorimetry	E021
Soil	D	Phosphate - Water Soluble (2:1)	Determination of phosphate by extraction with water & analysed by ion chromatography	E009
Soil	D	Sulphate (as SO4) - Total	Determination of total sulphate by extraction with 10% HCl followed by ICP-OES	E013
Soil	D	Sulphate (as SO4) - Water Soluble (2:1)	Determination of sulphate by extraction with water & analysed by ion chromatography	E009
Soil	D	Sulphate (as SO4) - Water Soluble (2:1)	Determination of water soluble sulphate by extraction with water followed by ICP-OES	E014
Soil	AR	Sulphide	Determination of sulphide by distillation followed by colorimetry	E018
Soil	D	Sulphur - Total	Determination of total sulphur by extraction with aqua-regia followed by ICP-OES	E024
Soil	AR	SVOC	Determination of semi-volatile organic compounds by extraction in acetone and hexane followed by GC-MS	E006
Soil	AR	Thiocyanate (as SCN)	Determination of thiocyanate by extraction in caustic soda followed by acidification followed by addition of ferric nitrate followed by colorimetry	E017
Soil	D	Toluene Extractable Matter (TEM)	Gravimetrically determined through extraction with toluene	E011
Soil	D	Total Organic Carbon (TOC)	Determination of organic matter by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	AR	TPH CWG (ali: C5- C6, C6-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C34, aro: C5-C7, C7-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C35)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge for C8 to C35. C5 to C8 by headspace GC-MS	E004
Soil	AR	TPH LQM (ali: C5-C6, C6-C8, C8-C10, C10-C12, C12-C16, C16-C35, C35-C44, aro: C5-C7, C7-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C35, C35-C44)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge for C8 to C44. C5 to C8 by headspace GC-MS	E004
Soil	AR	VOCs	Determination of volatile organic compounds by headspace GC-MS	E001
Soil	AR	VPH (C6-C8 & C8-C10)	Determination of hydrocarbons C6-C8 by headspace GC-MS & C8-C10 by GC-FID	E001

D Dried
AR As Received



Ramiro Marina
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Derwentside Environmental Testing Services Ltd
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DETS Report No: 21-09528

Site Reference: Milksey Lane, Graveley

Project / Job Ref: BRD3930

Order No: None Supplied

Sample Receipt Date: 30/07/2021

Sample Scheduled Date: 30/07/2021

Report Issue Number: 1

Reporting Date: 03/08/2021

Authorised by:

Dave Ashworth
Technical Manager

Dates of laboratory activities for each tested analyte are available upon request.

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Soil Analysis Certificate						
DETS Report No: 21-09528	Date Sampled	28/07/21	28/07/21	28/07/21	28/07/21	28/07/21
BRD Environmental Ltd	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: Milksey Lane, Graveley	TP / BH No	TS01	TS02	TS03	TS04	TS05
Project / Job Ref: BRD3930	Additional Refs	J1	J1	J1	J1	J1
Order No: None Supplied	Depth (m)	0.15	0.15	0.15	0.15	0.15
Reporting Date: 03/08/2021	DETS Sample No	557384	557385	557386	557387	557388

Determinand	Unit	RL	Accreditation					
Lead (Pb)	mg/kg	< 3	MCERTS	477	165	349	221	298

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30°C. The Method Description page describes if the test is performed on the dried or as-received portion
Subcontracted analysis (S)



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Soil Analysis Certificate - Sample Descriptions

DETS Report No: 21-09528	
BRD Environmental Ltd	
Site Reference: Milksey Lane, Graveley	
Project / Job Ref: BRD3930	
Order No: None Supplied	
Reporting Date: 03/08/2021	

DETS Sample No	TP / BH No	Additional Refs	Depth (m)	Moisture Content (%)	Sample Matrix Description
557384	TS01	J1	0.15	13.8	Brown sandy clay with stones
557385	TS02	J1	0.15	15.4	Brown sandy clay with vegetation
557386	TS03	J1	0.15	18.8	Brown sandy clay with stones and vegetation
557387	TS04	J1	0.15	18.5	Brown sandy clay with vegetation
557388	TS05	J1	0.15	15.2	Brown sandy clay with vegetation

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

Insufficient Sample ^{I/S}

Unsuitable Sample ^{U/S}



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Soil Analysis Certificate - Methodology & Miscellaneous Information

DETS Report No: 21-09528

BRD Environmental Ltd

Site Reference: Milksey Lane, Graveley

Project / Job Ref: BRD3930

Order No: None Supplied

Reporting Date: 03/08/2021

Matrix	Analysed On	Determinand	Brief Method Description	Method No
Soil	D	Boron - Water Soluble	Determination of water soluble boron in soil by 2:1 hot water extract followed by ICP-OES	E012
Soil	AR	BTEX	Determination of BTEX by headspace GC-MS	E001
Soil	D	Cations	Determination of cations in soil by aqua-regia digestion followed by ICP-OES	E002
Soil	D	Chloride - Water Soluble (2:1)	Determination of chloride by extraction with water & analysed by ion chromatography	E009
Soil	AR	Chromium - Hexavalent	Determination of hexavalent chromium in soil by extraction in water then by acidification, addition of 1,5 diphénylcarbazine followed by colorimetry	E016
Soil	AR	Cyanide - Complex	Determination of complex cyanide by distillation followed by colorimetry	E015
Soil	AR	Cyanide - Free	Determination of free cyanide by distillation followed by colorimetry	E015
Soil	AR	Cyanide - Total	Determination of total cyanide by distillation followed by colorimetry	E015
Soil	D	Cyclohexane Extractable Matter (CEM)	Gravimetrically determined through extraction with cyclohexane	E011
Soil	AR	Diesel Range Organics (C10 - C24)	Determination of hexane/acetone extractable hydrocarbons by GC-FID	E004
Soil	AR	Electrical Conductivity	Determination of electrical conductivity by addition of saturated calcium sulphate followed by electrometric measurement	E022
Soil	AR	Electrical Conductivity	Determination of electrical conductivity by addition of water followed by electrometric measurement	E023
Soil	D	Elemental Sulphur	Determination of elemental sulphur by solvent extraction followed by GC-MS	E020
Soil	AR	EPH (C10 - C40)	Determination of acetone/hexane extractable hydrocarbons by GC-FID	E004
Soil	AR	EPH Product ID	Determination of acetone/hexane extractable hydrocarbons by GC-FID	E004
Soil	AR	EPH TEXAS (C6-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C40)	Determination of acetone/hexane extractable hydrocarbons by GC-FID for C8 to C40. C6 to C8 by headspace GC-MS	E004
Soil	D	Fluoride - Water Soluble	Determination of Fluoride by extraction with water & analysed by ion chromatography	E009
Soil	D	Fraction Organic Carbon (FOC)	Determination of TOC by combustion analyser.	E027
Soil	D	Organic Matter (SOM)	Determination of TOC by combustion analyser.	E027
Soil	D	TOC (Total Organic Carbon)	Determination of TOC by combustion analyser.	E027
Soil	AR	Exchangeable Ammonium	Determination of ammonium by discrete analyser.	E029
Soil	D	FOC (Fraction Organic Carbon)	Determination of fraction of organic carbon by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	D	Loss on Ignition @ 450oC	Determination of loss on ignition in soil by gravimetrically with the sample being ignited in a muffle furnace	E019
Soil	D	Magnesium - Water Soluble	Determination of water soluble magnesium by extraction with water followed by ICP-OES	E025
Soil	D	Metals	Determination of metals by aqua-regia digestion followed by ICP-OES	E002
Soil	AR	Mineral Oil (C10 - C40)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge	E004
Soil	AR	Moisture Content	Moisture content; determined gravimetrically	E003
Soil	D	Nitrate - Water Soluble (2:1)	Determination of nitrate by extraction with water & analysed by ion chromatography	E009
Soil	D	Organic Matter	Determination of organic matter by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	AR	PAH - Speciated (EPA 16)	Determination of PAH compounds by extraction in acetone and hexane followed by GC-MS with the use of surrogate and internal standards	E005
Soil	AR	PCB - 7 Congeners	Determination of PCB by extraction with acetone and hexane followed by GC-MS	E008
Soil	D	Petroleum Ether Extract (PEE)	Gravimetrically determined through extraction with petroleum ether	E011
Soil	AR	pH	Determination of pH by addition of water followed by electrometric measurement	E007
Soil	AR	Phenols - Total (monohydric)	Determination of phenols by distillation followed by colorimetry	E021
Soil	D	Phosphate - Water Soluble (2:1)	Determination of phosphate by extraction with water & analysed by ion chromatography	E009
Soil	D	Sulphate (as SO4) - Total	Determination of total sulphate by extraction with 10% HCl followed by ICP-OES	E013
Soil	D	Sulphate (as SO4) - Water Soluble (2:1)	Determination of sulphate by extraction with water & analysed by ion chromatography	E009
Soil	D	Sulphate (as SO4) - Water Soluble (2:1)	Determination of water soluble sulphate by extraction with water followed by ICP-OES	E014
Soil	AR	Sulphide	Determination of sulphide by distillation followed by colorimetry	E018
Soil	D	Sulphur - Total	Determination of total sulphur by extraction with aqua-regia followed by ICP-OES	E024
Soil	AR	SVOC	Determination of semi-volatile organic compounds by extraction in acetone and hexane followed by GC-MS	E006
Soil	AR	Thiocyanate (as SCN)	Determination of thiocyanate by extraction in caustic soda followed by acidification followed by addition of ferric nitrate followed by colorimetry	E017
Soil	D	Toluene Extractable Matter (TEM)	Gravimetrically determined through extraction with toluene	E011
Soil	D	Total Organic Carbon (TOC)	Determination of organic matter by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	AR	TPH CWG (ali: C5- C6, C6-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C34, aro: C5-C7, C7-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C35)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge for C8 to C35. C5 to C8 by headspace GC-MS	E004
Soil	AR	TPH LQM (ali: C5-C6, C6-C8, C8-C10, C10-C12, C12-C16, C16-C35, C35-C44, aro: C5-C7, C7-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C35, C35-C44)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge for C8 to C44. C5 to C8 by headspace GC-MS	E004
Soil	AR	VOCs	Determination of volatile organic compounds by headspace GC-MS	E001
Soil	AR	VPH (C6-C8 & C8-C10)	Determination of hydrocarbons C6-C8 by headspace GC-MS & C8-C10 by GC-FID	E001

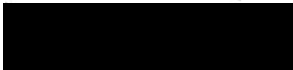
D Dried
AR As Received



TEST REPORT

ISSUED BY SOIL PROPERTY TESTING LTD
DATE ISSUED: 21/07/2021



Contract	Milksey Lane, Graveley		
Serial No.	39029_1		
Client:		<i>Soil Property Testing Ltd</i>	
BRD Environmental Ltd BRD Environmental Ltd Hawthorne Villa 1 Old Parr Road Banbury Oxfordshire OX16 5HT		15, 16, 18 Halcyon Court, St Margaret's Way, Stukeley Meadows, Huntingdon, Cambridgeshire, PE29 6DG Tel: 01480 455579 Email: enquiries@soilpropertytesting.com Website: www.soilpropertytesting.com	
Samples Submitted By: BRD Environmental Ltd		Approved Signatories:	
Samples Labelled: Milksey Lane, Graveley		☐ J.C. Garner B.Eng (Hons) FGS Technical Director & Quality Manager ☐ W. Johnstone Materials Lab Manager ☒ D. Sabnis Operations Manager 	
Date Received: 05/07/2021		Samples Tested Between: 05/07/2021 and 21/07/2021	
Remarks: For the attention of Ramiro Marina Your Reference No: BRD3930			
Notes:	1 All remaining samples or remnants from this contract will be disposed of after 21 days from today, unless we are notified to the contrary. 2 Opinions and interpretations expressed herein are outside the scope of UKAS accreditation. 3 Tests marked "NOT UKAS ACCREDITED" in this test report are not included in the UKAS Accreditation Schedule for this testing laboratory. 4 This test report may not be reproduced other than in full except with the prior written approval of the issuing laboratory. 5 The results within this report only relate to the items tested or sampled.		



TEST REPORT

ISSUED BY SOIL PROPERTY TESTING LTD
DATE ISSUED: 21/07/2021



0998

Contract	Milksey Lane, Graveley
Serial No.	39029_1

SUMMARY OF WATER CONTENT, LIQUID LIMIT, PLASTIC LIMIT, PLASTICITY INDEX AND LIQUIDITY INDEX

Borehole /Pit No.	Depth (m)	Type	Ref.	Water Content (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Liquid-ity Index	Sample Preparation				Description	Class
									Method	Ret'd 0.425mm (%)	Corr'd W/C <0.425mm	Curing Time (hrs)		
TP01	1.60	B	2	12.2	32	16	16	-0.24	Wet Sieved	45 (M)	22.2*	24	Dark orangish brown slightly gravelly sandy silty CLAY. Gravel is black, brown and white angular to subrounded chert with rare brown and white quartzite and orangish brown ironstone and sandstone	CL
TP02	1.20	B	1	17.8	45	18	27	-0.01	Wet Sieved	18 (M)	21.7*	25	Olive brown slightly gravelly slightly sandy silty CLAY. Gravel is black, brown and white subangular and subrounded chert and chalk	CI
TP03	1.30	D	2	16.7	33	15	18	0.10	Wet Sieved	21 (M)	21.2*	24	Firm orangish brown slightly gravelly slightly sandy silty CLAY. Gravel is black, brown and white fine and medium angular and subangular chert	CL
TP03	2.20	D	3	15.8	31	15	16	0.05	Wet Sieved	14 (M)	18.4*	24	Stiff light yellowish brown slightly gravelly slightly sandy silty CLAY. Gravel is white fine and medium angular to subrounded chalk and rare chert	CL
TP04	2.40	B	1	18.2	46	19	27	-0.03	Wet Sieved	10 (M)	20.3*	25	Very stiff dark grey slightly gravelly slightly sandy silty CLAY with a network of decayed roots. Gravel is white fine and medium angular to subrounded chalk	CI
TP06	1.00	D	1	16.8	37	16	21	0.04	Wet Sieved	21 (M)	21.3*	25	Stiff yellowish brown slightly gravelly slightly sandy silty CLAY. Gravel is black, brown and white fine and medium angular to subrounded chert	CI
WS02	0.80	D	1	18.6	25	15	10	0.36	Wet Sieved	11 (M)	20.9*	26	Soft dark yellowish brown slightly gravelly slightly sandy silty CLAY. Gravel is black, brown and white fine and medium angular and subangular chert	CL
WS02	2.80	D	5	17.4	30	13	17	0.26	From Natural	0 (A)		27	Stiff mottled light grey and yellowish brown slightly sandy silty CLAY.	CL

Method Of Preparation: BS EN ISO: 17892-1: 2014 & BS 1377: Part 2:1990:4.2

Method of Test: BS EN ISO: 17892-1: 2014 & BS 1377: Part 2:1990:3.2, 4.4, 5.3, 5.4

Type of Sample Key: U = Undisturbed, B = Bulk, D = Disturbed, J = Jar, W = Water, SPT = Split Spoon Sample, C = Core Cutter

Comments: *Corrected water content assume material greater than 0.425mm is non-porous. See BS1377: Part 2: 1990 Clause 3 Note 1.

Table Notation: Ret'd 0.425mm: (A) = Assumed, (M) = Measured



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Contract	Milksey Lane, Graveley
Serial No.	39029_1

SUMMARY OF WATER CONTENT, LIQUID LIMIT, PLASTIC LIMIT, PLASTICITY INDEX AND LIQUIDITY INDEX

Borehole /Pit No.	Depth (m)	Type	Ref.	Water Content (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Liquidity Index	Sample Preparation				Description	Class
									Method	Ret'd 0.425mm (%)	Corr'd W/C <0.425mm	Curing Time (hrs)		
WS03	0.70	D	1	14.4	31	15	16	-0.04	Wet Sieved	28 (M)	20.0*	23	Very stiff yellowish brown slightly gravelly slightly sandy silty CLAY with rare recently active roots. Gravel is black, brown and white fine and medium angular to subrounded chert	CL
WS04	1.60	D	4	17.9	33	15	18	0.16	Wet Sieved	12 (M)	20.3*	26	Firm yellowish brown slightly gravelly slightly sandy silty CLAY. Gravel is white fine and medium subangular to rounded chalk and rare chert	CL

Method Of Preparation: BS EN ISO: 17892-1: 2014 & BS 1377: Part 2:1990:4.2
Method of Test: BS EN ISO: 17892-1: 2014 & BS 1377: Part 2:1990:3.2, 4.4, 5.3, 5.4
Type of Sample Key: U = Undisturbed, B = Bulk, D = Disturbed, J = Jar, W = Water, SPT = Split Spoon Sample, C = Core Cutter
Comments: *Corrected water content assume material greater than 0.425mm is non-porous. See BS1377: Part 2: 1990 Clause 3 Note 1.
Table Notation: Ret'd 0.425mm: (A) = Assumed, (M) = Measured



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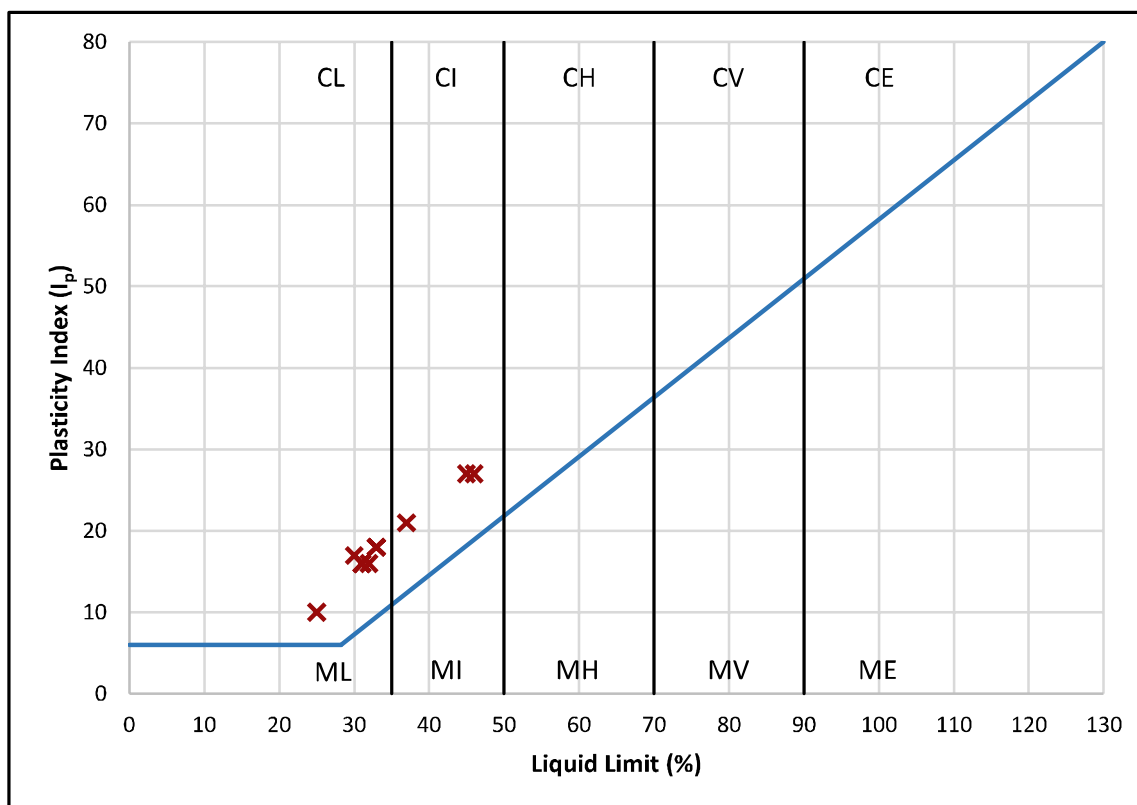


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Contract	Milksey Lane, Graveley
Serial No.	39029_1

PLOT OF PLASTICITY INDEX AGAINST LIQUID LIMIT USING CASAGRANDE CLASSIFICATION CHART

Plasticity				
Low	Medium	High	Very High	Extremely High



Plasticity Chart BS5930: 2015: Figure 8

High
Medium
Low

NHBC Volume Change Potential

Method of Preparation:	BS 1377: Part 2: 1990: 4.2
Method of Test:	BS1377: Part 2: 3.2, 4.4, 5.3, 5.4
Type of Sample Key:	U = Undisturbed, B = Bulk, D = Disturbed, J = Jar, W = Water, SPT = Split Spoon Sample, C = Core Cutter
Comments:	Volume Change Potential: NHBC Standards Chapter 4.2 Unmodified Plasticity Index



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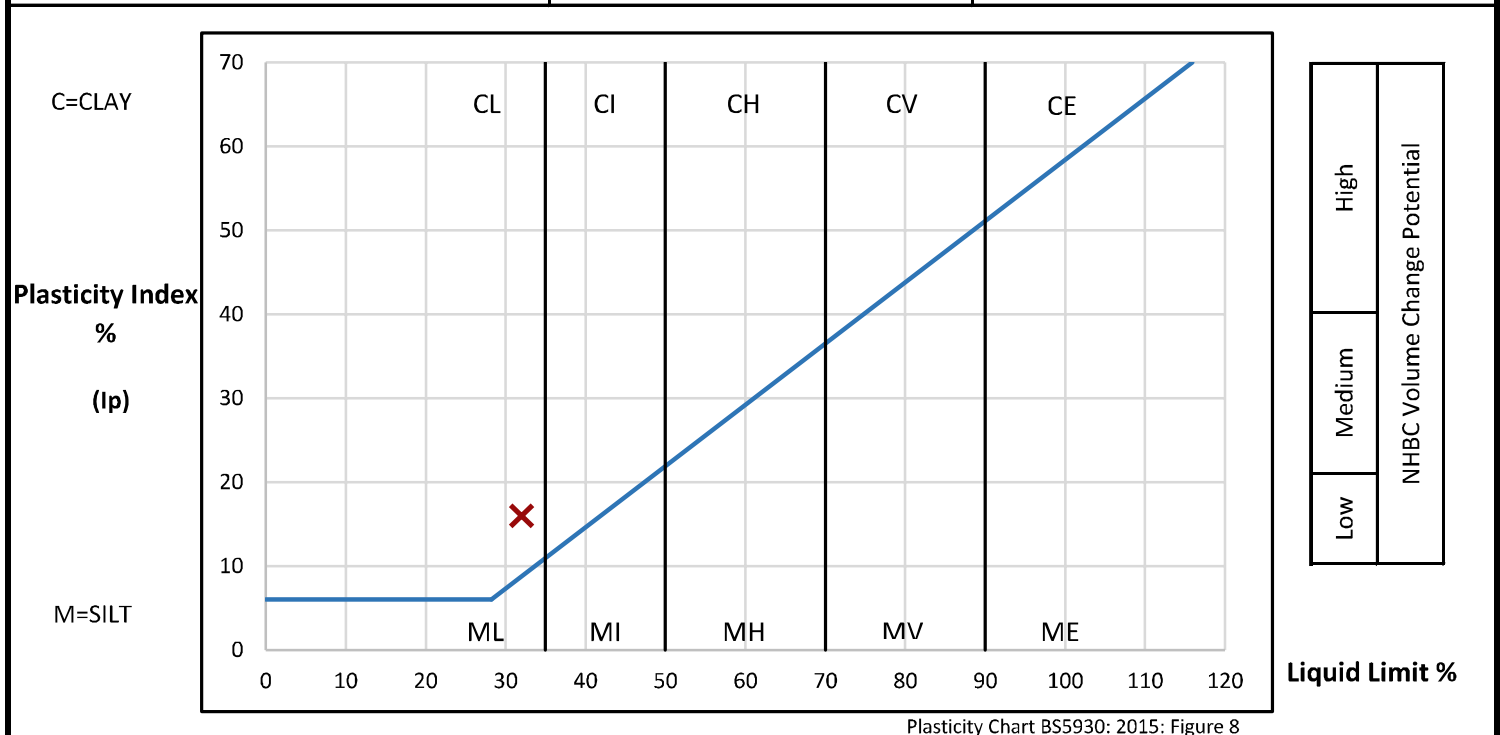
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DETERMINATION OF WATER CONTENT, LIQUID LIMIT AND PLASTIC LIMIT AND DERIVATION OF PLASTICITY INDEX AND LIQUIDITY INDEX

Borehole / Pit No.	Depth m	Sample Type	Sample Reference	Water Content (W) %	Description	Remarks
TP01	1.60	B	2	12.2	Dark orangish brown slightly gravelly sandy silty CLAY. Gravel is black, brown and white angular to subrounded chert with rare brown and white quartzite and orangish brown ironstone and sandstone	

PREPARATION			Liquid Limit	32 %	
Method of preparation		Wet sieved over 0.425mm sieve	Plastic Limit	16 %	
Sample retained 0.425mm sieve	(Measured)	45 %	Plasticity Index	16 %	
Corrected water content for material passing 0.425mm			Liquidity Index	-0.24	
Sample retained 2mm sieve	(Measured)	29 %	NHBC Modified (I'p)	9 %	
Curing time	24 hrs	Clay Content	13 %	Derived Activity	1.23



Method of Preparation: BS EN ISO: 17892-1: 2014 & BS 1377: Part 2: 1990: 4.2
 Method of Test: BS EN ISO: 17892-1: 2014 & BS 1377: Part 2: 1990: 3.2, 4.4, 5.3, 5.4
 Type of Sample Key: U=Undisturbed, B=Bulk, D=Disturbed, J=Jar, W=Water, SPT=Split Spoon Sample, C=Core Cutter
 Comments: Corrected water content assume material greater than 0.425mm non-porous. See BS1377: Part2: 1990 Clause 3 Note 1
 Volume Change Potential: NHBC Standards Chapter 4.2 Unmodified Plasticity Index
 Note: Modified Plasticity Index I'p = Ip x (% less than 425microns/100)



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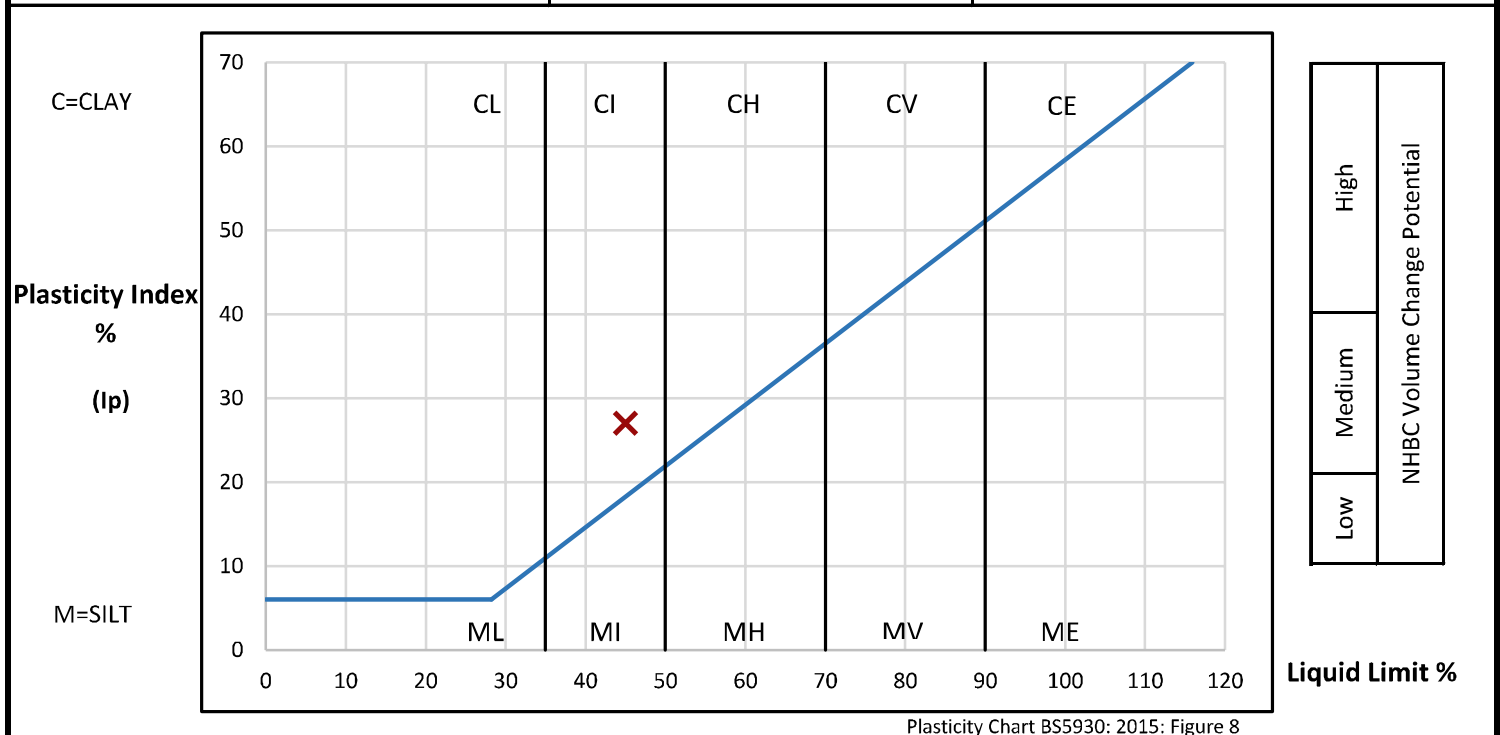
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DETERMINATION OF WATER CONTENT, LIQUID LIMIT AND PLASTIC LIMIT AND DERIVATION OF PLASTICITY INDEX AND LIQUIDITY INDEX

Borehole / Pit No.	Depth m	Sample Type	Reference	Water Content (W) %	Description	Remarks
TP02	1.20	B	1	17.8	Olive brown slightly gravelly slightly sandy silty CLAY. Gravel is black, brown and white subangular and subrounded chert and chalk	

PREPARATION			Liquid Limit	45 %	
Method of preparation		Wet sieved over 0.425mm sieve	Plastic Limit	18 %	
Sample retained 0.425mm sieve	(Measured)	18 %	Plasticity Index	27 %	
Corrected water content for material passing 0.425mm			Liquidity Index	-0.01	
Sample retained 2mm sieve	(Measured)	13 %	NHBC Modified (I'p)	22 %	
Curing time	25 hrs	Clay Content	37 %	Derived Activity	0.73



Method of Preparation: BS EN ISO: 17892-1: 2014 & BS 1377: Part 2: 1990: 4.2

Method of Test: BS EN ISO: 17892-1: 2014 & BS 1377: Part 2: 1990: 3.2, 4.4, 5.3, 5.4

Type of Sample Key: U=Undisturbed, B=Bulk, D=Disturbed, J=Jar, W=Water, SPT=Split Spoon Sample, C=Core Cutter

Comments: Corrected water content assume material greater than 0.425mm non-porous. See BS1377: Part2: 1990 Clause 3 Note 1
Volume Change Potential: NHBC Standards Chapter 4.2 Unmodified Plasticity Index
Note: Modified Plasticity Index I'p = Ip x (% less than 425microns/100)



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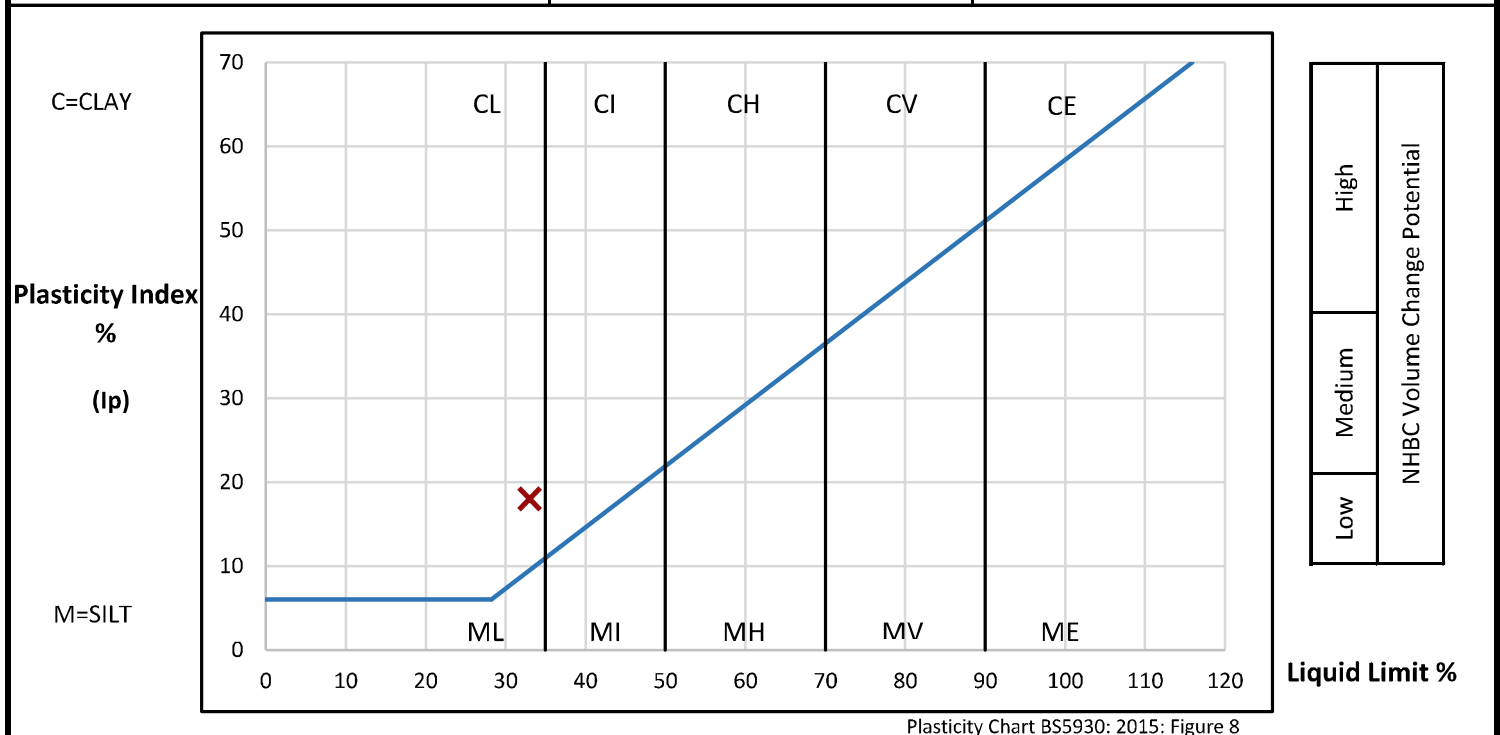
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DETERMINATION OF WATER CONTENT, LIQUID LIMIT AND PLASTIC LIMIT AND DERIVATION OF PLASTICITY INDEX AND LIQUIDITY INDEX

Borehole / Pit No.	Depth m	Sample Type	Reference	Water Content (W) %	Description	Remarks
TP03	1.30	D	2	16.7	Firm orangish brown slightly gravelly slightly sandy silty CLAY. Gravel is black, brown and white fine and medium angular and subangular chert	

PREPARATION			Liquid Limit	33 %	
Method of preparation		Wet sieved over 0.425mm sieve	Plastic Limit	15 %	
Sample retained 0.425mm sieve	(Measured)	21 %	Plasticity Index	18 %	
Corrected water content for material passing 0.425mm			Liquidity Index	0.10	
Sample retained 2mm sieve	(Measured)	16 %	NHBC Modified (I'p)	14 %	
Curing time	24 hrs	Clay Content	Not analysed	Derived Activity	Not analysed



Method of Preparation: BS EN ISO: 17892-1: 2014 & BS 1377: Part 2: 1990: 4.2

Method of Test: BS EN ISO: 17892-1: 2014 & BS 1377: Part 2: 1990: 3.2, 4.4, 5.3, 5.4

Type of Sample Key: U=Undisturbed, B=Bulk, D=Disturbed, J=Jar, W=Water, SPT=Split Spoon Sample, C=Core Cutter

Comments: Corrected water content assume material greater than 0.425mm non-porous. See BS1377: Part2: 1990 Clause 3 Note 1
Volume Change Potential: NHBC Standards Chapter 4.2 Unmodified Plasticity Index
Note: Modified Plasticity Index I'p = I_p x (% less than 425microns/100)



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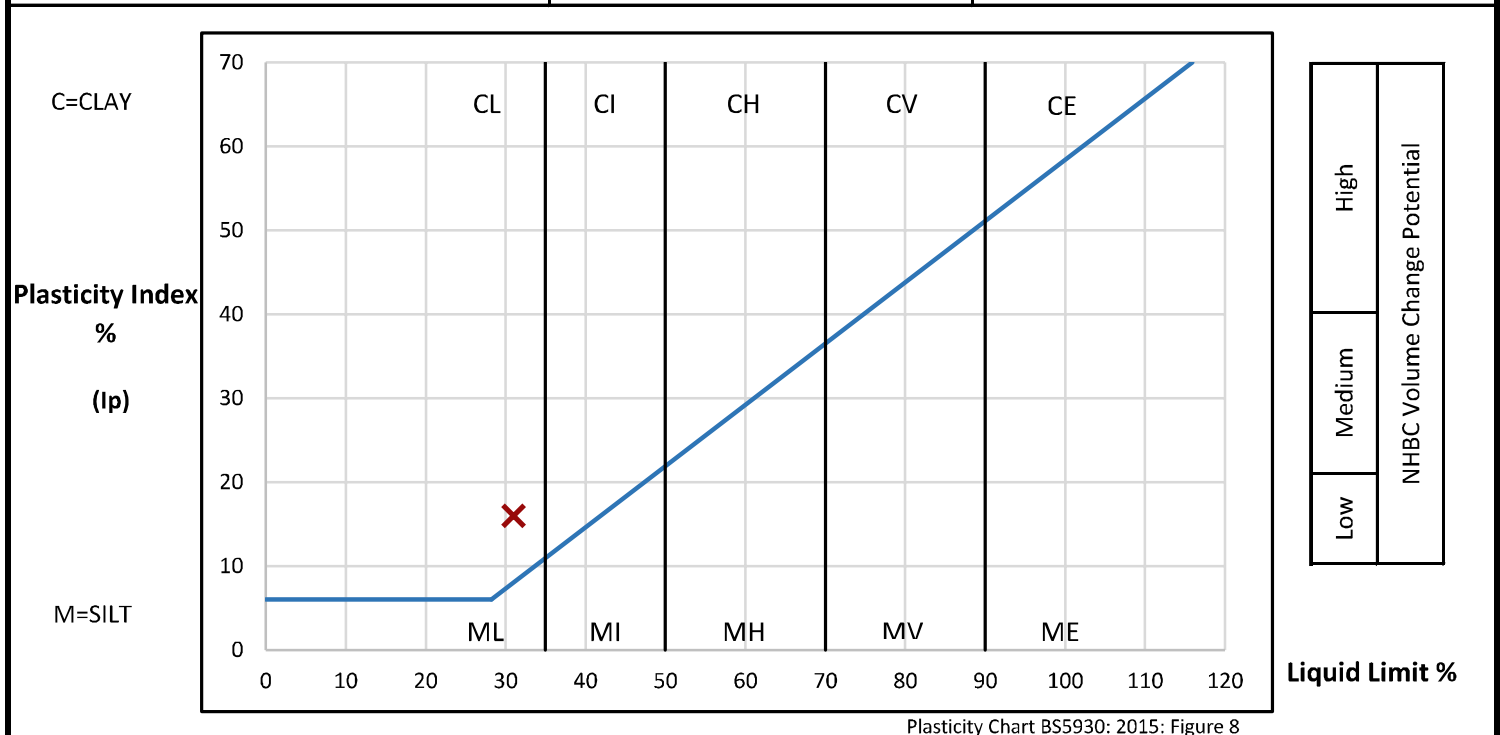
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DETERMINATION OF WATER CONTENT, LIQUID LIMIT AND PLASTIC LIMIT AND DERIVATION OF PLASTICITY INDEX AND LIQUIDITY INDEX

Borehole / Pit No.	Depth m	Sample Type	Reference	Water Content (W) %	Description	Remarks
TP03	2.20	D	3	15.8	Stiff light yellowish brown slightly gravelly slightly sandy silty CLAY. Gravel is white fine and medium angular to subrounded chalk and rare chert	

PREPARATION			Liquid Limit	31 %	
Method of preparation		Wet sieved over 0.425mm sieve	Plastic Limit	15 %	
Sample retained 0.425mm sieve	(Measured)	14 %	Plasticity Index	16 %	
Corrected water content for material passing 0.425mm			Liquidity Index	0.05	
Sample retained 2mm sieve	(Measured)	9 %	NHBC Modified (I'p)	14 %	
Curing time	24 hrs	Clay Content	Not analysed	Derived Activity	Not analysed



Method of Preparation:	BS EN ISO: 17892-1: 2014 & BS 1377: Part 2: 1990: 4.2
Method of Test:	BS EN ISO: 17892-1: 2014 & BS 1377: Part 2: 1990: 3.2, 4.4, 5.3, 5.4
Type of Sample Key:	U=Undisturbed, B=Bulk, D=Disturbed, J=Jar, W=Water, SPT=Split Spoon Sample, C=Core Cutter
Comments:	Corrected water content assume material greater than 0.425mm non-porous. See BS1377: Part2: 1990 Clause 3 Note 1 Volume Change Potential: NHBC Standards Chapter 4.2 Unmodified Plasticity Index Note: Modified Plasticity Index I'p = Ip x (% less than 425microns/100)



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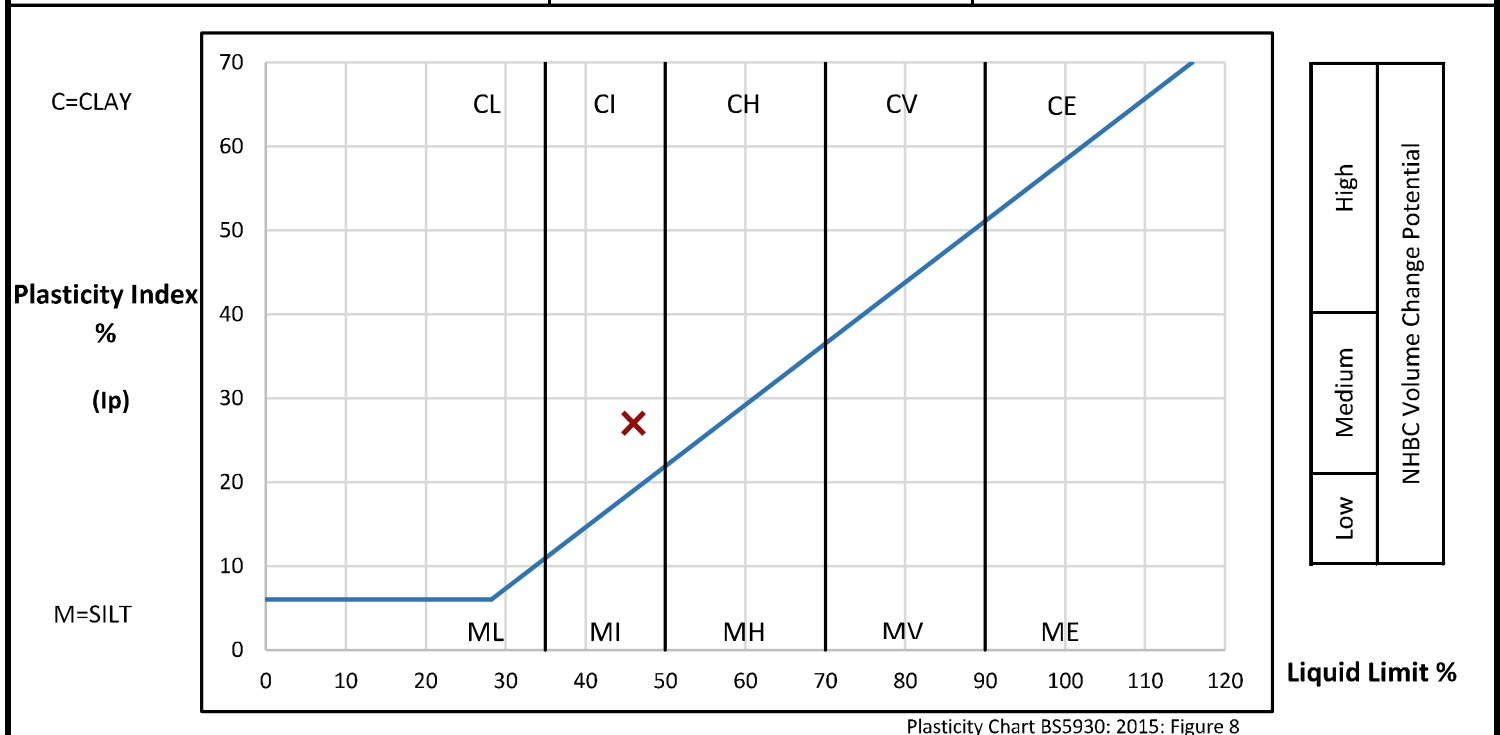
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DETERMINATION OF WATER CONTENT, LIQUID LIMIT AND PLASTIC LIMIT AND DERIVATION OF PLASTICITY INDEX AND LIQUIDITY INDEX

Borehole / Pit No.	Depth m	Sample Type	Sample Reference	Water Content (W) %	Description	Remarks
TP04	2.40	B	1	18.2	Very stiff dark grey slightly gravelly slightly sandy silty CLAY with a network of decayed roots. Gravel is white fine and medium angular to subrounded chalk	

PREPARATION				Liquid Limit 46 %	
Method of preparation Wet sieved over 0.425mm sieve				Plastic Limit 19 %	
Sample retained 0.425mm sieve (Measured) 10 %				Plasticity Index 27 %	
Corrected water content for material passing 0.425mm 20.3 %				Liquidity Index -0.03	
Sample retained 2mm sieve (Measured) 7 %				NHBC Modified (I'p) 24 %	
Curing time 25 hrs		Clay Content Not analysed		Derived Activity Not analysed	



Method of Preparation: BS EN ISO: 17892-1: 2014 & BS 1377: Part 2: 1990: 4.2
 Method of Test: BS EN ISO: 17892-1: 2014 & BS 1377: Part 2: 1990: 3.2, 4.4, 5.3, 5.4
 Type of Sample Key: U=Undisturbed, B=Bulk, D=Disturbed, J=Jar, W=Water, SPT=Split Spoon Sample, C=Core Cutter
 Comments: Corrected water content assume material greater than 0.425mm non-porous. See BS1377: Part2: 1990 Clause 3 Note 1
 Volume Change Potential: NHBC Standards Chapter 4.2 Unmodified Plasticity Index
 Note: Modified Plasticity Index I'p = Ip x (% less than 425microns/100)



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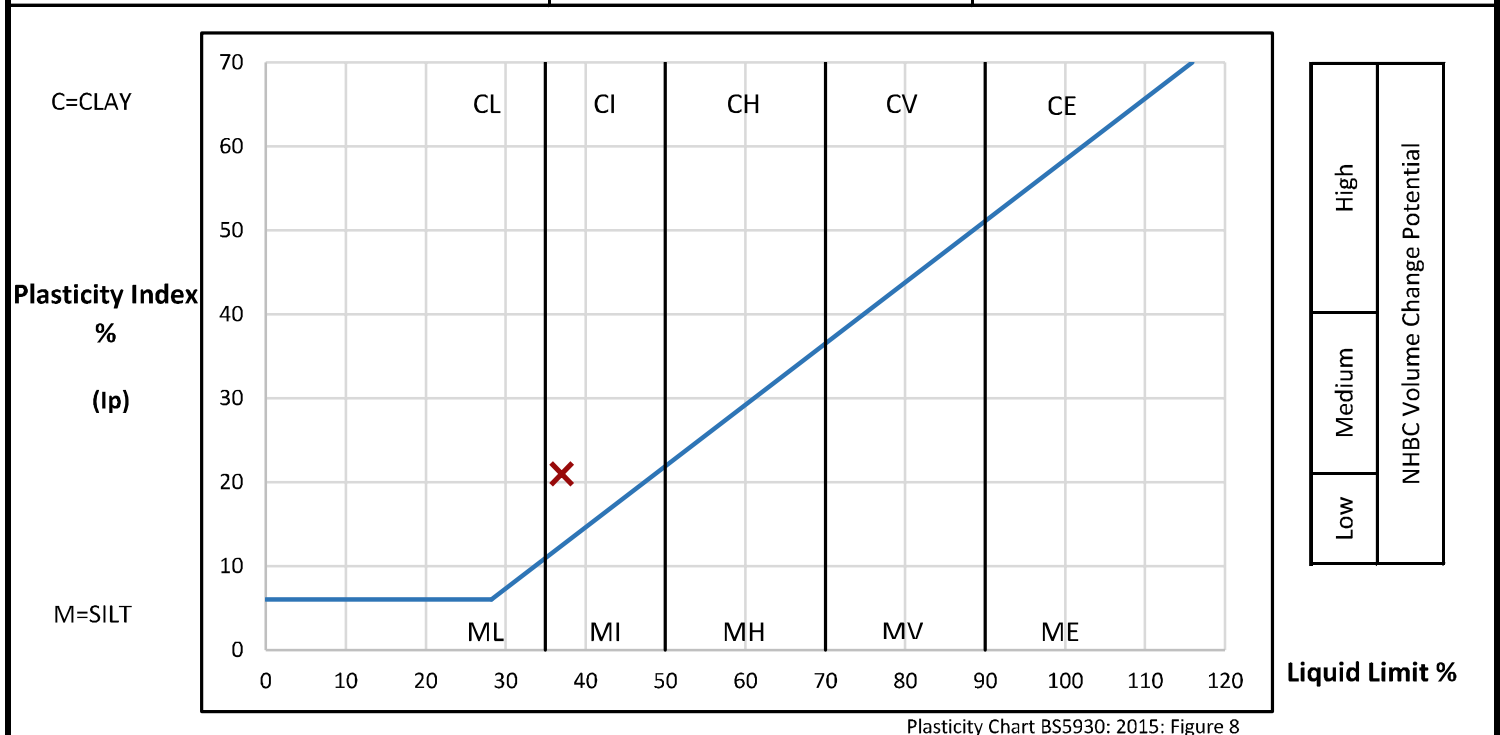
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DETERMINATION OF WATER CONTENT, LIQUID LIMIT AND PLASTIC LIMIT AND DERIVATION OF PLASTICITY INDEX AND LIQUIDITY INDEX

Borehole / Pit No.	Depth m	Sample Type	Sample Reference	Water Content (W) %	Description	Remarks
TP06	1.00	D	1	16.8	Stiff yellowish brown slightly gravelly slightly sandy silty CLAY. Gravel is black, brown and white fine and medium angular to subrounded chert	

PREPARATION				Liquid Limit 37 %	
Method of preparation Wet sieved over 0.425mm sieve				Plastic Limit 16 %	
Sample retained 0.425mm sieve (Measured) 21 %				Plasticity Index 21 %	
Corrected water content for material passing 0.425mm 21.3 %				Liquidity Index 0.04	
Sample retained 2mm sieve (Measured) 13 %				NHBC Modified (I'p) 17 %	
Curing time 25 hrs		Clay Content Not analysed		Derived Activity Not analysed	



Method of Preparation: BS EN ISO: 17892-1: 2014 & BS 1377: Part 2: 1990: 4.2
 Method of Test: BS EN ISO: 17892-1: 2014 & BS 1377: Part 2: 1990: 3.2, 4.4, 5.3, 5.4
 Type of Sample Key: U=Undisturbed, B=Bulk, D=Disturbed, J=Jar, W=Water, SPT=Split Spoon Sample, C=Core Cutter
 Comments: Corrected water content assume material greater than 0.425mm non-porous. See BS1377: Part2: 1990 Clause 3 Note 1
 Volume Change Potential: NHBC Standards Chapter 4.2 Unmodified Plasticity Index
 Note: Modified Plasticity Index I'p = Ip x (% less than 425microns/100)



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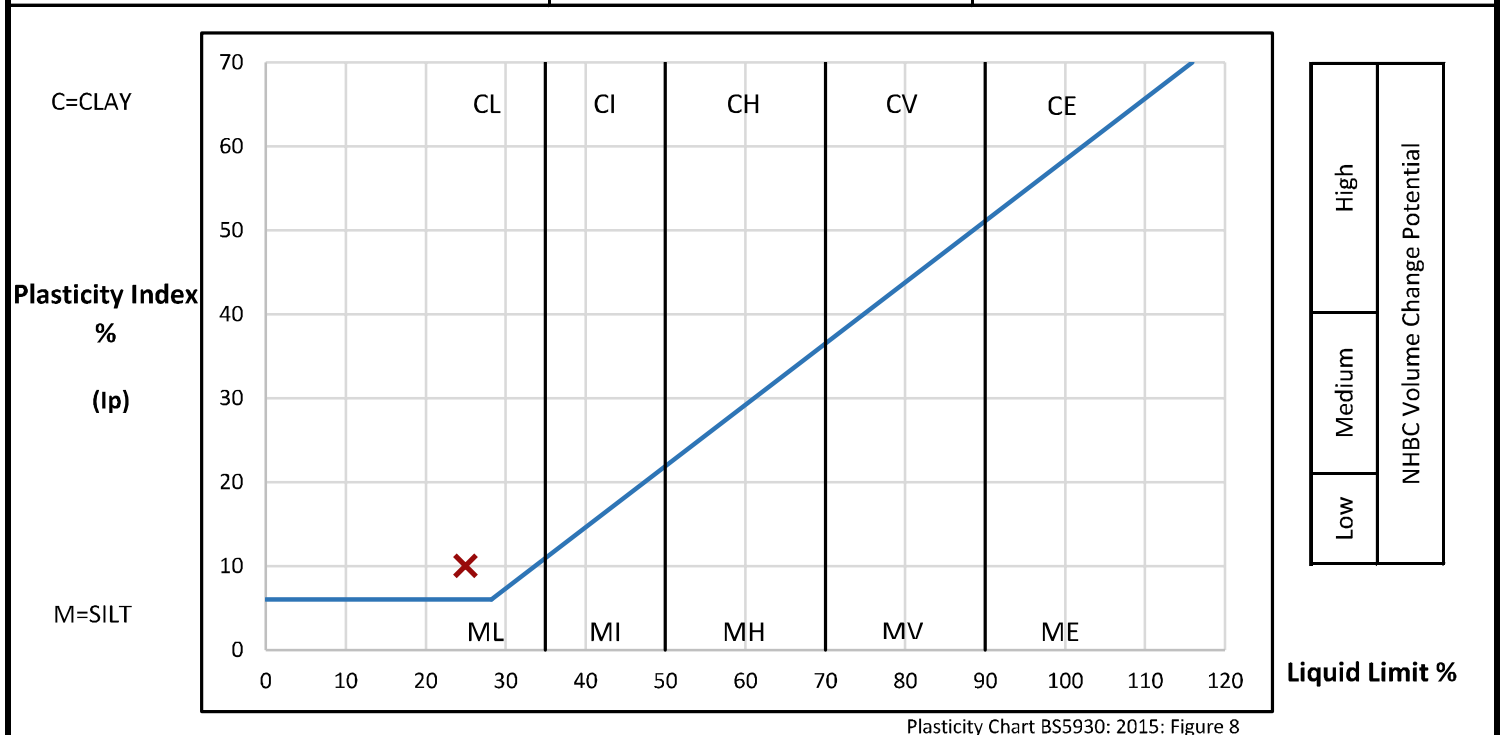
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DETERMINATION OF WATER CONTENT, LIQUID LIMIT AND PLASTIC LIMIT AND DERIVATION OF PLASTICITY INDEX AND LIQUIDITY INDEX

Borehole / Pit No.	Depth m	Sample Type	Sample Reference	Water Content (W) %	Description	Remarks
WS02	0.80	D	1	18.6	Soft dark yellowish brown slightly gravelly slightly sandy silty CLAY. Gravel is black, brown and white fine and medium angular and subangular chert	

PREPARATION				Liquid Limit 25 %	
Method of preparation Wet sieved over 0.425mm sieve				Plastic Limit 15 %	
Sample retained 0.425mm sieve (Measured) 11 %				Plasticity Index 10 %	
Corrected water content for material passing 0.425mm 20.9 %				Liquidity Index 0.36	
Sample retained 2mm sieve (Measured) 7 %				NHBC Modified (I'p) 9 %	
Curing time 26 hrs		Clay Content Not analysed		Derived Activity Not analysed	



Method of Preparation: BS EN ISO: 17892-1: 2014 & BS 1377: Part 2: 1990: 4.2
 Method of Test: BS EN ISO: 17892-1: 2014 & BS 1377: Part 2: 1990: 3.2, 4.4, 5.3, 5.4
 Type of Sample Key: U=Undisturbed, B=Bulk, D=Disturbed, J=Jar, W=Water, SPT=Split Spoon Sample, C=Core Cutter
 Comments: Corrected water content assume material greater than 0.425mm non-porous. See BS1377: Part2: 1990 Clause 3 Note 1
 Volume Change Potential: NHBC Standards Chapter 4.2 Unmodified Plasticity Index
 Note: Modified Plasticity Index I'p = Ip x (% less than 425microns/100)



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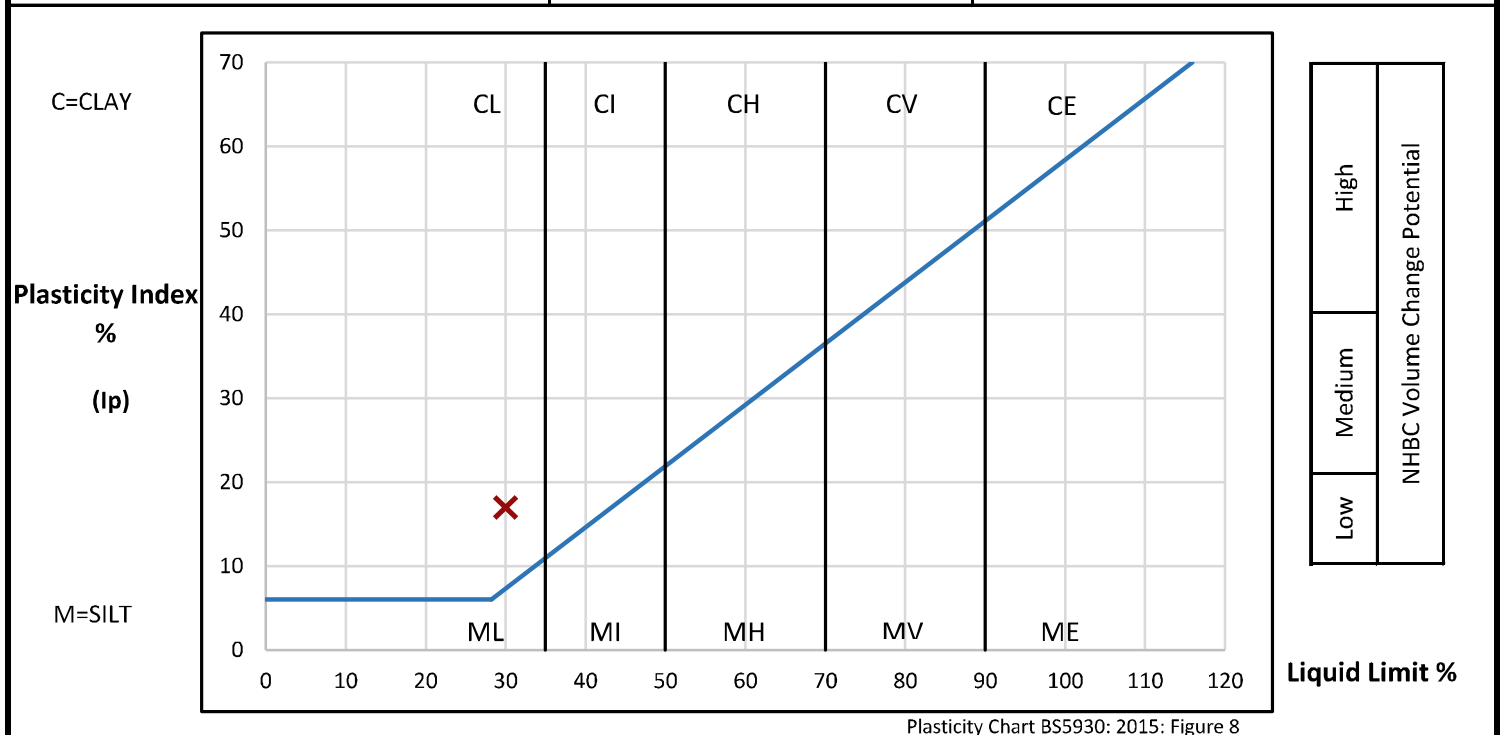
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DETERMINATION OF WATER CONTENT, LIQUID LIMIT AND PLASTIC LIMIT AND DERIVATION OF PLASTICITY INDEX AND LIQUIDITY INDEX

Borehole / Pit No.	Depth m	Sample Type	Sample Reference	Water Content (W) %	Description	Remarks
WS02	2.80	D	5	17.4	Stiff mottled light grey and yellowish brown slightly sandy silty CLAY.	

PREPARATION			Liquid Limit	30 %	
Method of preparation		From natural	Plastic Limit	13 %	
Sample retained 0.425mm sieve (Assumed)		0 %	Plasticity Index	17 %	
Corrected water content for material passing 0.425mm			Liquidity Index	0.26	
Sample retained 2mm sieve (Assumed)		0 %	NHBC Modified (I'p)	n/a	
Curing time	27 hrs	Clay Content	Not analysed	Derived Activity	Not analysed



Method of Preparation: BS EN ISO: 17892-1: 2014 & BS 1377: Part 2: 1990: 4.2
 Method of Test: BS EN ISO: 17892-1: 2014 & BS 1377: Part 2: 1990: 3.2, 4.4, 5.3, 5.4
 Type of Sample Key: U=Undisturbed, B=Bulk, D=Disturbed, J=Jar, W=Water, SPT=Split Spoon Sample, C=Core Cutter
 Comments:



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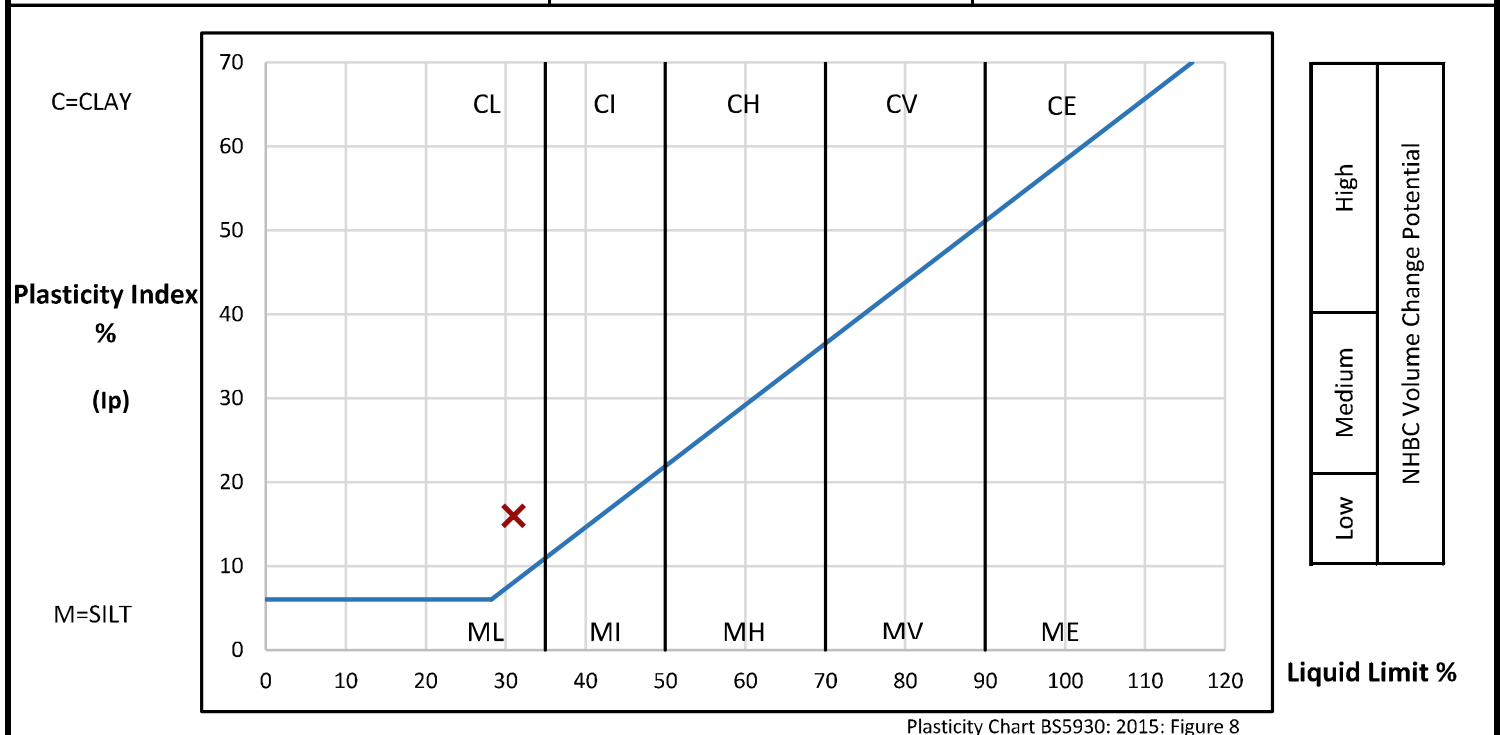
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DETERMINATION OF WATER CONTENT, LIQUID LIMIT AND PLASTIC LIMIT AND DERIVATION OF PLASTICITY INDEX AND LIQUIDITY INDEX

Borehole / Pit No.	Depth m	Sample Type	Sample Reference	Water Content (W) %	Description	Remarks
WS03	0.70	D	1	14.4	Very stiff yellowish brown slightly gravelly slightly sandy silty CLAY with rare recently active roots. Gravel is black, brown and white fine and medium angular to subrounded chert	

PREPARATION				Liquid Limit 31 %	
Method of preparation Wet sieved over 0.425mm sieve				Plastic Limit 15 %	
Sample retained 0.425mm sieve (Measured) 28 %				Plasticity Index 16 %	
Corrected water content for material passing 0.425mm 20.0 %				Liquidity Index -0.04	
Sample retained 2mm sieve (Measured) 21 %				NHBC Modified (I'p) 12 %	
Curing time 23 hrs		Clay Content Not analysed		Derived Activity Not analysed	



Method of Preparation: BS EN ISO: 17892-1: 2014 & BS 1377: Part 2: 1990: 4.2
 Method of Test: BS EN ISO: 17892-1: 2014 & BS 1377: Part 2: 1990: 3.2, 4.4, 5.3, 5.4
 Type of Sample Key: U=Undisturbed, B=Bulk, D=Disturbed, J=Jar, W=Water, SPT=Split Spoon Sample, C=Core Cutter
 Comments: Corrected water content assume material greater than 0.425mm non-porous. See BS1377: Part2: 1990 Clause 3 Note 1
 Volume Change Potential: NHBC Standards Chapter 4.2 Unmodified Plasticity Index
 Note: Modified Plasticity Index I'p = Ip x (% less than 425microns/100)



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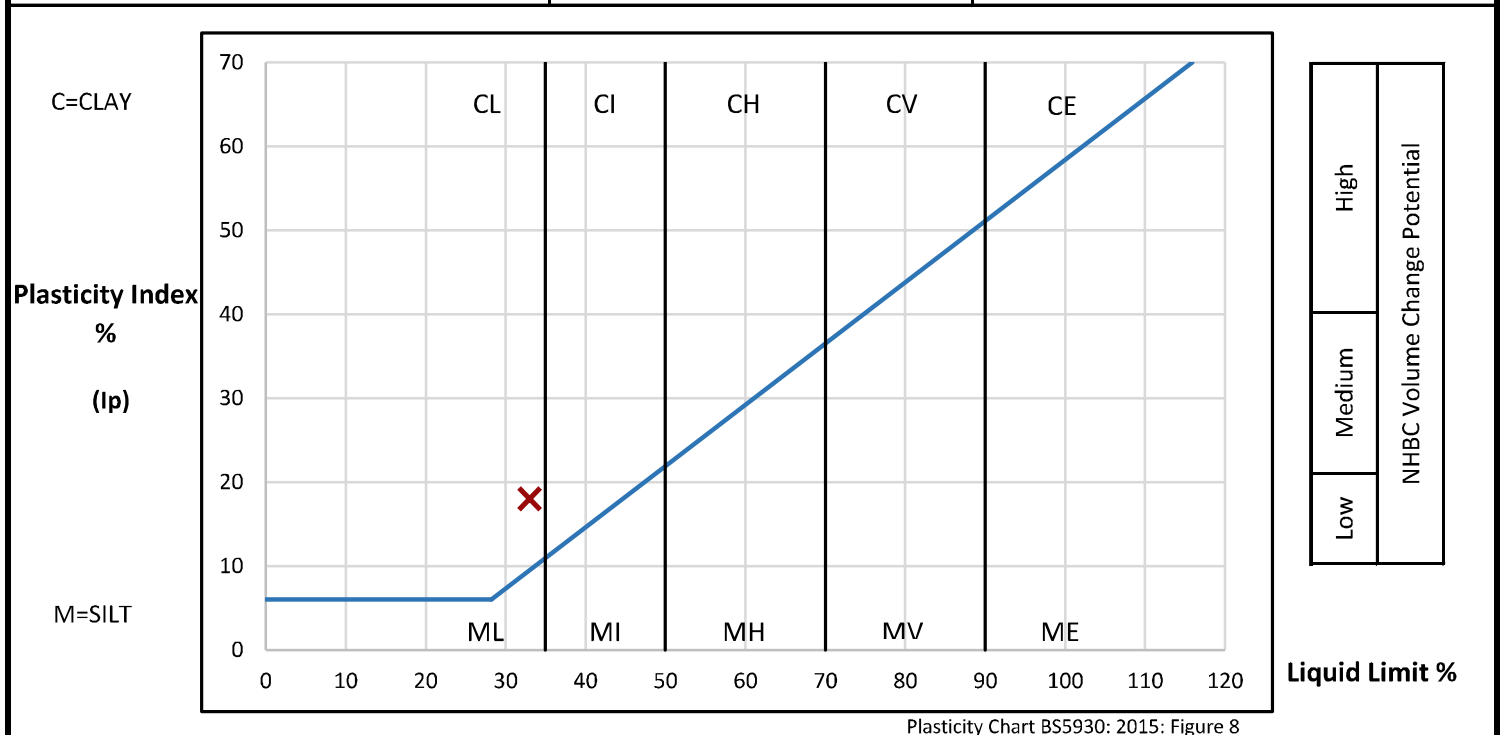
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DETERMINATION OF WATER CONTENT, LIQUID LIMIT AND PLASTIC LIMIT AND DERIVATION OF PLASTICITY INDEX AND LIQUIDITY INDEX

Borehole / Pit No.	Depth m	Sample Type	Sample Reference	Water Content (W) %	Description	Remarks
WS04	1.60	D	4	17.9	Firm yellowish brown slightly gravelly slightly sandy silty CLAY. Gravel is white fine and medium subangular to rounded chalk and rare chert	

PREPARATION			Liquid Limit	33 %	
Method of preparation		Wet sieved over 0.425mm sieve	Plastic Limit	15 %	
Sample retained 0.425mm sieve	(Measured)	12 %	Plasticity Index	18 %	
Corrected water content for material passing 0.425mm			Liquidity Index	0.16	
Sample retained 2mm sieve	(Measured)	8 %	NHBC Modified (I'p)	16 %	
Curing time	26 hrs	Clay Content	Not analysed	Derived Activity	Not analysed



Method of Preparation: BS EN ISO: 17892-1: 2014 & BS 1377: Part 2: 1990: 4.2

Method of Test: BS EN ISO: 17892-1: 2014 & BS 1377: Part 2: 1990: 3.2, 4.4, 5.3, 5.4

Type of Sample Key: U=Undisturbed, B=Bulk, D=Disturbed, J=Jar, W=Water, SPT=Split Spoon Sample, C=Core Cutter

Comments: Corrected water content assume material greater than 0.425mm non-porous. See BS1377: Part2: 1990 Clause 3 Note 1
Volume Change Potential: NHBC Standards Chapter 4.2 Unmodified Plasticity Index
Note: Modified Plasticity Index I'p = I_p x (% less than 425microns/100)



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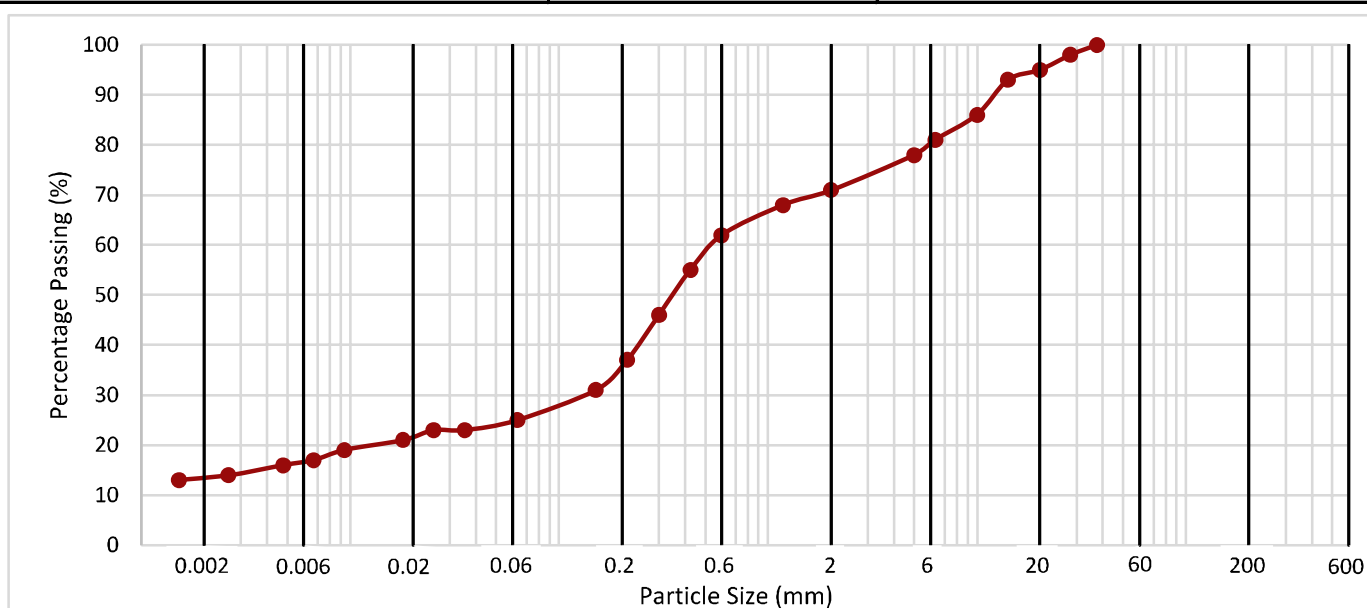
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Contract	Milksey Lane, Graveley
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DETERMINATION OF PARTICLE SIZE DISTRIBUTION

Borehole / Pit No.	Depth (m)	Sample		Description	Remarks
		Type	Reference		
TP01	1.60	B	2	Dark orangish brown slightly gravelly sandy silty CLAY. Gravel is black, brown and white angular to subrounded chert with rare brown and white quartzite and orangish brown ironstone and sandstone	Description based on possible engineering behaviour.

Method of Test: **Wet Sieve + Hydrometer** Method of Pretreatment: **Not required**



CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

Hydrometer	Particle Size (mm)	Passing (%)	Silt by Dry Mass (%)
	0.0354	23	12
	0.0251	23	
	0.0179	21	
	0.0094	19	Clay by Dry Mass (%)
	0.0067	17	
	0.0048	16	
	0.0026	14	13
	0.0015	13	

Sieve Size (mm)	Passing (%)	Sand By Dry Mass (%)
2.00	71	46
1.18	68	
0.600	62	
0.425	55	
0.300	46	
0.212	37	
0.150	31	
0.063	25	

Fines By Dry Mass (%)	
<0.063mm	25

Sieve Size (mm)	Passing (%)	2mm+ By Dry Mass (%)
300		29
125		
90		
63		
50		
37.5	100	
28	98	
20	95	
14	93	
10	86	
6.3	81	
5	78	

Method of Preparation: BS1377: Part 1: 2016: 8.3 & 8.4.5
 Method of test: BS1377: Part 2: 1990: 9.2,9.5
 Type of Sample Key: U=Undisturbed, B=Bulk, D=Disturbed, J=Jar, W=Water, SPT=Split Spoon Sample, C=Core Cutter
 Comments:



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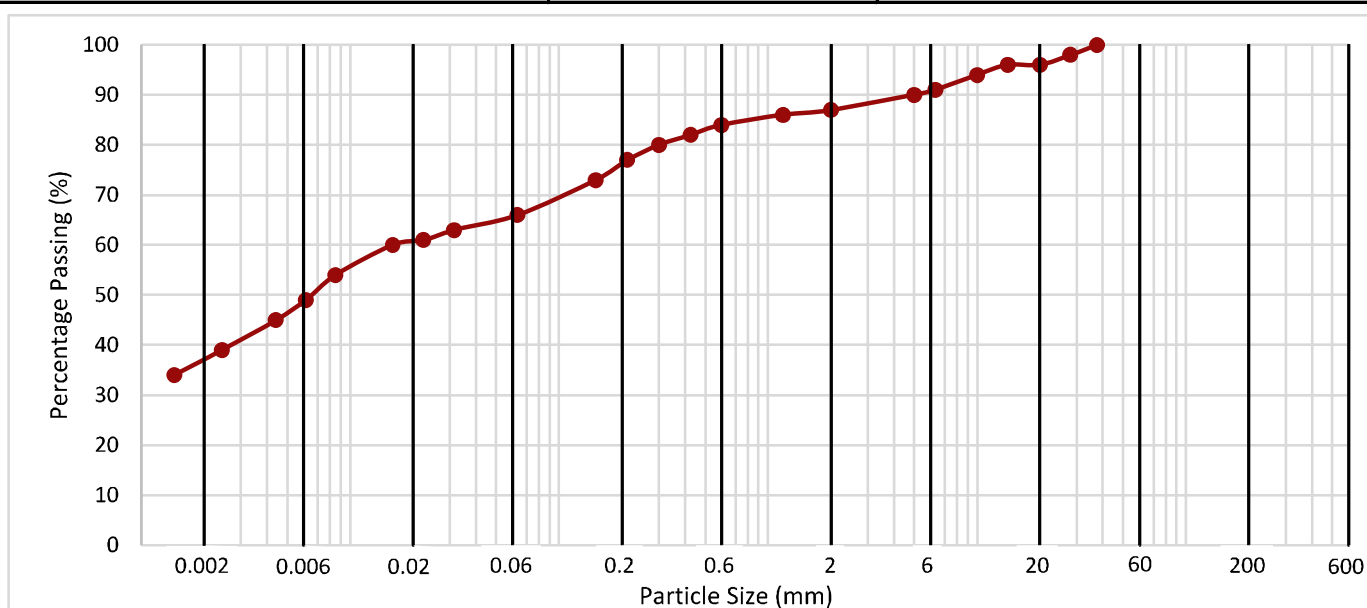
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Contract	Milksey Lane, Graveley
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DETERMINATION OF PARTICLE SIZE DISTRIBUTION

Borehole / Pit No.	Depth (m)	Sample		Description	Remarks
		Type	Reference		
TP02	1.20	B	1	Olive brown slightly gravelly slightly sandy silty CLAY. Gravel is black, brown and white subangular and subrounded chert and chalk	

Method of Test: **Wet Sieve + Hydrometer** Method of Pretreatment: **Not required**



CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

Hydrometer	Particle Size (mm)	Passing (%)	Silt by Dry Mass (%)
	0.0315	63	29
	0.0224	61	
	0.0160	60	
	0.0085	54	Clay by Dry Mass (%)
	0.0062	49	
	0.0044	45	
	0.0024	39	37
	0.0014	34	

Sieve Size (mm)	Passing (%)	Sand By Dry Mass (%)
2.00	87	21
1.18	86	
0.600	84	
0.425	82	
0.300	80	
0.212	77	
0.150	73	
0.063	66	

Fines By Dry Mass (%)	
<0.063mm	66

Sieve Size (mm)	Passing (%)	2mm+ By Dry Mass (%)
300		13
125		
90		
63		
50		
37.5	100	
28	98	
20	96	
14	96	
10	94	
6.3	91	
5	90	

Method of Preparation: BS1377: Part 1: 2016: 8.3 & 8.4.5
 Method of test: BS1377: Part 2: 1990: 9.2,9.5
 Type of Sample Key: U=Undisturbed, B=Bulk, D=Disturbed, J=Jar, W=Water, SPT=Split Spoon Sample, C=Core Cutter
 Comments: