

Report on a **GEO-ENVIRONMENTAL GROUND INVESTIGATION**

Ref: 23/36590 | Date: May 2023



For the site at:

**WE ROBERTS (PACKAGING SUPPLIES) LIMITED
UNIT J1, LOWER ROAD,
NORTHFLEET
DA11 9BL**

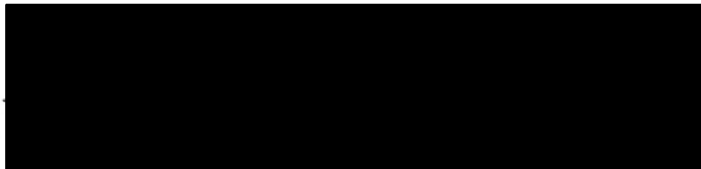
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EXECUTIVE SUMMARY

Site Location	WER Unit J1, Lower Road, Northfleet DA11 9BL
Proposed Development	Extension to the existing warehouse, with car park and soft landscaping.
Environmental Setting	The site is underlain by the superficial Alluvial deposits, Taplow Gravel Member with the Lewes Nodular Chalk Formation, Seaford Chalk Formation and Newhaven Chalk Formation at depth. Superficial Geology: Alluvium, Taplow Gravel Member (Secondary Undifferentiated Aquifer) Bedrock Geology: Lewes Nodular Chalk Formation, Seaford Chalk Formation and Newhaven Chalk Formation (Principal Aquifer) River Thames within 400m.

GEOTECHNICAL INVESTIGATION

Ground Conditions Encountered	The investigation revealed ground conditions that comprised Made Ground up to 2.20m in thickness underlain by Alluvium and the Taplow Gravel Member.
Groundwater	Groundwater was encountered in the boreholes during the investigation. Groundwater levels were monitored in a standpipe over a period of six weeks post installation. The groundwater level varied between 1.43m and 1.88m below ground level.
Engineering Observations	Based on the ground and groundwater conditions encountered in the boreholes, it will not be possible to support the proposed new development on conventional strip or isolated pad foundations. A piled foundation solution is recommended. The use of conventional spread foundations will be impracticable or uneconomical due to the size and depth of foundation required and a piled foundation should then be considered. In these ground conditions, it is considered that some form of bored and in-situ cast concrete piled foundation with reinforced concrete ground beams should prove satisfactory. A driven pile solution may also be possible due to the industrial nature of the surrounding land where the noise and vibration associated with driven piles may not be an issue, although due to the Alluvium vibrations may travel longer distances. Due to the thickness of Made Ground encountered and the underlying very soft Alluvial deposits, it is recommended that ground slabs should be fully suspended. Shallow excavations for foundations and services are likely to require nominal side support in the short term and groundwater is unlikely to be encountered in significant quantities once any accumulated surface water has been removed. Deeper and longer excavations below approximately 1.20m below existing ground level will require close side support and some seepages of groundwater could be encountered. Below approximately 1.50m groundwater may for significant inflows. Once groundwater has been encountered the Made Ground and Alluvial deposits may rapidly become unstable. Alluvial deposits may flow resulting in undermining of the ground surrounding the excavation unless suitable side wall support is installed. Normal safety precautions should be taken if shallow excavations are to be entered. Deeper excavations will require enhanced measures to reduce the risk to workers to acceptable levels.

ENVIRONMENTAL INVESTIGATION

Environmental Contamination

The findings of the site investigation have demonstrated that in the context of a proposed commercial use of the site, the contaminant of concern with respect to end-user protection was lead.

A potential risk to the potable water supply pipe from elevated TPH concentrations in groundwater was identified. This was not reflected within the soils.

Elevated ground gas in the form of methane and carbon dioxide has been detected on-site.

1.0 INTRODUCTION

1.1 Outline and Limitations of Report

At the request of Heath Projects Limited a supplementary ground investigation was carried out in connection with a proposed development at the above site.

The information was required for the design and construction of foundations and infrastructure for the proposed development, which includes the extension to the existing warehouse. Information was also required in order to assess whether any remediation was required for the protection of the end-user from the presence of potential contamination within the soils encountered.

The recommendations and comments given in this report are based on the ground conditions encountered in the exploratory holes made during the investigation and the results of the tests made in the field and the laboratory. It must be noted that there may be special conditions prevailing at the site remote from the exploratory hole locations which have not been disclosed by the investigation and which have not been taken into account in the report. No liability can be accepted for any such conditions.

1.2 Report Objectives

This report comprises an Intrusive Investigation Report to the geotechnical parameters of the ground and to assess potential contamination within the soils and waters encountered and assess potential risks to the end-user of the site from the presence of such contamination.

2.0 SITE DETAILS

National Grid Reference: TQ 613750

2.1 Site Location

The site is located on the northern side of Lower Road – 0.1 miles to the north-east of the A226 Stonebridge Road. The site is located in Northfleet, Gravesend, Kent, at approximate postcode DA11 9BL. The site forms the western side Unit J1 operated by W.E. Roberts packaging distribution. Additional warehouses associated with various commercial activities are located to the east and south of the site. The site is situated approximately 400m to the west of the River Thames.

The site is approximately triangular in shape and covers an approximate area of 0.1 Hectares with the general area being under the authority of the Gravesham Borough Council.

A site location plan is present below in Figure 1.



Figure 1: Site Location Map

3.0 SCOPE OF WORK

3.1 Site Works

The exploratory investigation included for an inspection of the site and near surface soils in order to: -

- Determine the presence, extent and significance of potential contaminants in the sub-surface strata associated with current and former activities at the site.
- Assess the significance of potential impacts on sensitive receptors at or adjacent to the site.
- Assess the potential environmental liabilities and consequences associated with the site.
- Identify requirements for further works, including the design of any additional investigative/monitoring works and remedial measures if deemed necessary.

The proposed scope of works was agreed by the client prior to the commencement of the investigations. To achieve this, the following works were undertaken: -

- The drilling of three rotary percussive boreholes to a maximum depth of 12.00m below ground level (Boreholes BH1, BH2 and BH3).
- The installation of a combined gas/groundwater monitoring standpipe to an approximate maximum depth of 8.00m in Borehole BH1, together with six return monitoring visits.
- Undisturbed samples were obtained within Borehole BH1 for archaeological assessment of the Alluvial deposits.
- Sampling and in-situ testing as appropriate to the ground conditions encountered in the boreholes.
- Laboratory testing to determine the engineering properties of the soils encountered in the exploratory holes.
- Interpretative reporting on foundation options for the proposed building and infrastructure.
- A study into the possibility of the presence of toxic substances in the soil, together with limited comment on any remediation required.

3.2 Ground Conditions

The locations of the exploratory holes are shown on the site sketch plan, Figure 3 below.

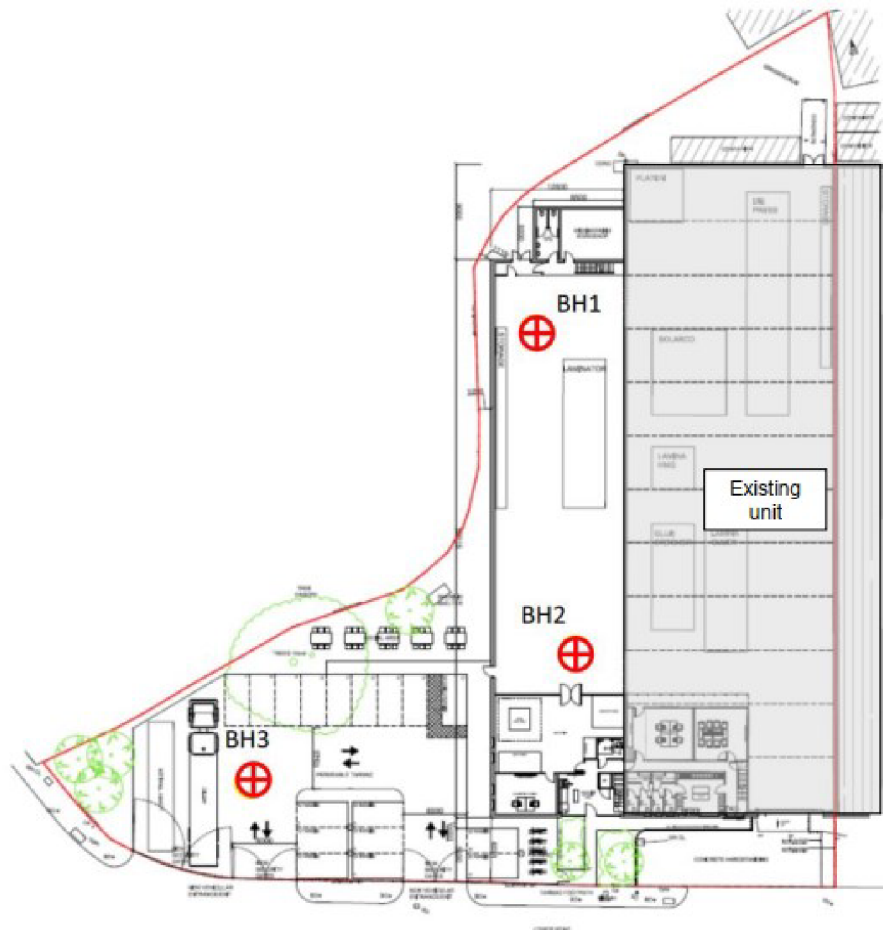


Figure 3: Site Investigation Plan

The boreholes revealed ground conditions that were generally consistent with the geological records and known history of the area and comprised Made Ground up to 2.20m in thickness underlain by Alluvium and then the Taplow Gravel Member. The Chalk bedrock stratum was not encountered within the depths investigated.

These ground conditions are summarised in the following table. For detailed information on the ground conditions encountered in the boreholes, reference should be made to the exploratory hole records presented in Appendix A.

Strata	Depth to top of strata (mbgl)	Depth to base of strata (mbgl)	Description
Made Ground	0.00	1.30 to 2.20	Hardcore over clayey sandy silt or silty sand with brick fragments. Gravelly silt with brick Clinker
Alluvium	1.30 to 2.20	7.80 to >10.00 (BH3)	Soft very silty chalky CLAY Very loose clayey SILT Soft clayey silty sandy amorphous PEAT
Taplow Gravel Member	7.80 to 8.80	>12.00 (max depth drilled)	Medium dense gravelly fine to coarse SAND with clay lenses, chalk nodules and shell fragments.

Summary of Ground Conditions in Exploratory Holes

3.3 Groundwater

Groundwater was encountered in all of the boreholes during the investigation and the material remained essentially dry throughout. A summary of the groundwater encountered during drilling is detailed in the table below.

Exploratory Hole	Depth (m)	Notes	Stratum
BH1	3.20	Water level dropped to 4.20m in 20 minutes	Alluvium
BH2	0.80	Water level rose to 0.60m in 20 minutes	Made Ground
BH2	9.60	Water Strike	Taplow Gravel Member
BH3	1.40	Water level rose to 1.20m in 20 minutes	Made Ground

Table 2: Groundwater Strike Summary

It must be noted that the speed of excavation is such that there may well be insufficient time for further light seepages of groundwater to enter the boreholes and hence be detected, particularly within more cohesive soils.

Isolated pockets of groundwater may also be present perched within any less permeable material found at shallower depth on other parts of the site especially within any Made Ground. It should be noted that the comments on groundwater conditions are based on observations made at the time of the investigation (March to May 2023) and that changes in the groundwater level could occur due to seasonal effects and also changes in drainage conditions.

4.0 IN-SITU AND LABORATORY TESTS

4.1 Standard Penetration Tests

The results of the Standard Penetration Tests carried out in the natural soils are shown on the exploratory hole records in Appendix A. SPT 'N' values range between 0 and 18.

The results of the tests are shown on the appropriate borehole records and summary sheets presented in Appendix A.

4.2 Classification Tests

Atterberg Limit tests were conducted on five selected samples taken from the cohesive portion of the natural soils in Boreholes 1, 2 and 3 showed the samples tested to fall into Classes MI, ME and CV according to the British Soil Classification System.

These are fine grained silts or clay soils of intermediate to extremely high plasticity and as such generally have a low permeability and a medium to high susceptibility to shrinkage and swelling movements with changes in moisture content, as defined by the NHBC Standards, Chapter 4.2. The results indicated Plasticity Index values of between 16% and 66%, with three samples being above the 40% boundary for soils assessed as being of high volume potential.

The results of the tests are presented on Table 1, contained in Appendix B.

Particle size distribution tests were conducted on three samples taken from the natural essentially granular soils present in Boreholes 1, 2 and 3 using wet sieving methods.

The test results are given in both tabular and graphical formats in Appendix B.

4.3 Chemical Attack on Buried Concrete

Using the results contained in Appendix B, the following table provides the highest values encountered for the BRE SD1 Suite D specification and the equivalent DS and ACEC classes, based on a static groundwater:

Strata	pH	2:1 Water Soluble SO ₄ (g/l)	2:1 Water Soluble Chloride (mg/l)	2:1 Water Soluble Nitrate (mg/l)	Total Sulphate (%)	Magnesium (mg/l)	DS Class	ACEC Class
Alluvium	7.1 to 8.9	1.2	6000	<2.0	0.428	510	DS-2	AC-2

Worst case DS and ACEC classes based on the BRE SD1 Suite D results

4.4 California Bearing Ratio Test

One Laboratory California Bearing Ratio test (CBR's) was conducted on a combined sample taken from Borehole 1 using the methods outlined in British Standard BS 1377: Part 9: 1990, Clause 4.3. The CBR method is essentially an empirical method of flexible pavement design in which a design curve is used to estimate pavement thickness appropriate to the CBR value of the soil.

The results of the tests are presented on the appropriate sheets, contained in Appendix B.

5.0 CONTAMINATION TESTING

5.1 Intended Future Uses of the Site

At the time of reporting (May 2023), it is proposed to extend the existing warehouse, with additional lorry and car parking and soft landscaping.

For the purposes of the assessment within this section of the report the site has been considered as 'Commercial' due to the proposed industrial development.

5.2 Made Ground Encountered

The investigation revealed the presence of Made Ground across the site to depths of up to 2.20m bgl.

The Made Ground typically consisted of clayey sandy silt or silty sand with brick and concrete fragments.

Borehole	Depth
BH1	1.30m
BH2	2.20m
BH3	2.20m

Depth of Made Ground

5.3 Determination of Contaminants of Concern

Samples for a full contamination analysis were obtained from the following depths:

Trial Hole	Depth(s) of Sample for Contamination Analysis
BH1	0.50m
BH2	0.25m
BH2	0.50m
BH3	0.25m
BH3	0.50m

These exploratory holes were excavated at the locations indicated on the site investigation plan below (Figure 3).

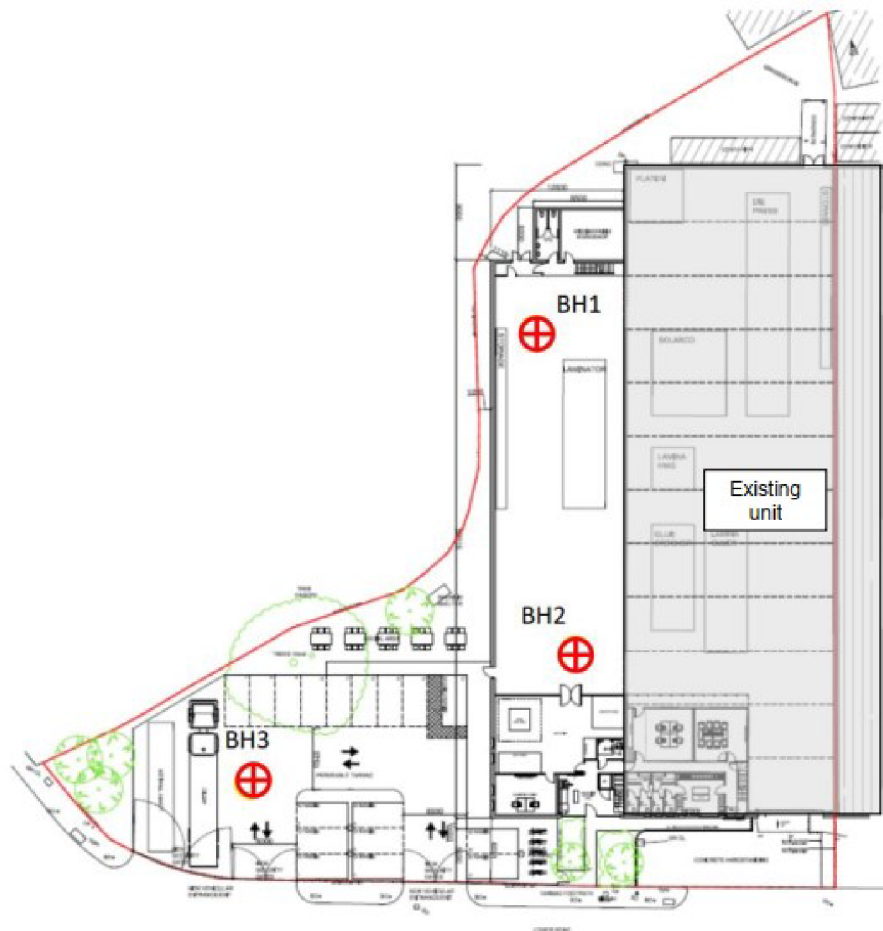


Figure 3: Site Investigation Plan

5.4 Discussion

5.4.1 Human Health Risk Assessment (On-Site Users, Workforce and Neighbouring Residents)

Comparison of the measured concentrations of the contaminants of concern to their respective screening values indicated that with one exception, none of the measured parameters exceeded the screening values.

The exception was the concentration of Lead at borehole BH2 at a depth of 0.50m.

5.4.2 Asbestos Containing Materials

The Made Ground at each exploratory location was screened for the presence of asbestos containing material. In all of the samples analysed, asbestos containing material was not observed during the investigation or identified during the laboratory analysis.

Further analysis of the soil sample results was conducted, and the summary of the statistical test is presented in the table below.

Statistical Comparison Test

Contaminant	Outliers	UCL ₉₅ (mg/kg)	Critical Concentration (Cc)	Result	Evidence Level (Against a null hypothesis)	Reject Null Hypothesis
Lead	NO	2173.16	2330	$\mu < Cc$	97%	YES

Notes: -

Null hypothesis: The true mean concentration is equal to or greater than the critical concentration: $\mu \geq Cc$

Alternative hypothesis: The true mean concentration is less than the critical concentration: $\mu < Cc$

Initial analysis of the soil sample datasets suggests that for the exceedances measured in Lead is not likely to be an outlier within the area. For the contaminants of concern, initial assessment of the contaminant datasets indicated that the true mean concentrations of the above contaminant were likely to be below the relevant critical concentration.

5.4.3 Assessment of Gas Hazard

Borehole BH1 was installed with a standpipe equipped with ground gas monitoring apparatus to a depth of approximately 8.0m below ground level.

The monitoring installation consisted of a 50mm diameter standpipe, which is in accordance with that prescribed to enable correlation with Gas Screening Values (GSVs) derived by CIRIA and the NHBC.

The installation consisted of 1m of plain pipe with a bentonite seal at the surface in order to prevent surface water ingress that could flood the response zone and to prevent atmospheric leakage/ingress. The standpipe was sealed with a bung and valve with a flush fitting stopcock cover.

The frequency of ground gas monitoring on-site was decided in line with recommendations by CIRIA to provide monitoring data sufficient to allow the prediction of worst-case conditions.

Based on a low generation potential and a low sensitivity development and monitoring which was undertaken during a range of climatic conditions, six monitoring visits at the site were considered appropriate.

Ground gas on-site was measured using Gas Data GFM Series infra-red analyser, with internal flow pod. The results are presented in the gas tables, contained in Appendix B.

Atmospheric conditions and the results of the ground gas monitoring (maximum values) from all visits are presented below.

Date	Weather Conditions	Temperature (°C)	Pressure (mb)	24hr Pressure Trend
22/03/2023	Cloudy	+10.0	1003	Falling
29/03/2023	High cloud	+8.0	1014	Falling
05/04/2023	Partially cloudy	+1.0	1023	Falling
14/04/2023	Cloudy	+5.0	1006	Rising
24/04/2023	Cloudy, occasional showers	+6.0	1010	Rising
02/05/2023	Cloudy	+10.0	1027	Rising

Atmospheric Weather Conditions

BH	Flow (l/h)	CH ₄ (%)	CO ₂ (%)	VOC (ppm)	H ₂ S (ppm)	CO (ppm)
BH1	0.6	25.3	7.9	0.196	<0.1	<0.1

Peak Gas Monitoring Results

Gas flow through soil occurs either by convection or by diffusion. Convection occurs when total gas pressure is not uniform throughout the system (i.e. when a total pressure gradient exists). Convective flow is in the direction in which total pressure decreases, because gases tend to move from regions of high pressure to regions of low pressure.

Diffusive flow of a gas is in the direction in which its concentration (partial pressure) decreases. The relative pressures recorded in the boreholes were generally negligible and therefore the potential for convective flow is considered to be low. Therefore, any gas flow would have to be via diffusion. This is corroborated by the trend of very low steady state flow rates (maximum of 0.6 l/hr), in many cases being below detection limits.

In general, high concentrations of methane and moderate concentrations of carbon dioxide were returned during the monitoring.

Hydrocarbon Vapours

The underlying made and natural ground across the site was found to be free from visual and olfactory indicators of volatile organic (e.g. hydrocarbon) contamination, which was corroborated by hydrocarbon analysis undertaken on each sample analysed.

As such, the probability for generation of VOC vapours from the underlying Made Ground and natural ground is considered to be low, which was verified by low VOC concentrations detected during gas monitoring.

CO and H₂S

There are currently no GSV for CO or H₂S. Thresholds are only available for occupational exposure limits (OEL). For H₂S, the OELST is 10ppm and OELLT is 5ppm. It should be noted that the OELLT is based upon an 8 hour exposure limit converted to an annual mean and the OELST is based upon 15 minute exposures converted to an annual mean. The concentrations of H₂S measured were below threshold values.

National Ambient Air Quality Standards (NAAQS) were developed by the US EPA under the Clean Air Act from 1990. The Clean Air Act primary standards to provide public health protection, including protecting the health of "sensitive" populations such as asthmatics, children, and the elderly. The EPA air quality standard is 9ppm CO average over 8 hours, not to be exceeded more than once a year. The concentrations of CO encountered did not exceed the EPA air quality standard.

CH₄ and CO₂ GSV

CIRIA (2007b) and NHBC (2007) provide assessments for CO₂ and CH₄ based upon GSV utilising flow rates and concentrations measured in appropriate standpipes. The GSVs within CIRIA (2007b) are based upon all buildings other than standard residential houses. The NHBC (2007) GSV are based upon standard residential houses with precast concrete floors (block and beam). As such, based upon the assumed end use of the site the GSV within the CIRIA guidance should be adopted. The thresholds for GSV based upon NHBC and CIRIA guidance are summarised below.

CIRIA		NHBC		
Classification	GSV (CH ₄ & CO ₂)	Classification	GSV (CH ₄)	GSV (CO ₂)
CS1	<0.07	Green	<0.13	<0.78
CS2	<0.70	Amber 1	<0.63	<1.60
CS3	<3.5	Amber 2	<1.60	<3.10
CS4	<15	Red	>1.60	>3.10
CS5	<70			
CS6	>70			

Thresholds for GSV

A summary of the monitoring results is provided below, which utilises the highest steady state concentration and highest flow rate at each location in order to adopt a worst-case scenario for the risk assessment.

BH	Flow (l/h)	CH ₄ (%)	CO ₂ (%)	VOC (ppm)	CH ₄ GSV (l/hr)	CO ₂ GSV (l/hr)	Characteristic Situation	NHBC Classification
BH1	0.6	25.3	7.9	0.196	0.1518	0.0474	CS2	Amber 1

Summary of Monitoring Results

On-site monitoring has shown emissions of methane in air up to 25.3% and carbon dioxide in air of up to 7.96% recorded during the monitoring visits. The maximum borehole flow rate was 0.6 l/h.

As such the maximum Gas Screening Value for methane is 0.1518 l/h and the maximum Gas Screening Value for carbon dioxide at site is 0.0474 l/h.

Based on these results the site would be classified as CS2 in accordance with CIRIA Report C665, Table 8.5 using the maximum gas concentration for methane and carbon dioxide. The following precaution options are recommended:

- Reinforced concrete cast in situ floor slab (suspended, non-suspended or raft) with at least 1200 g DPM2.
- Beam and block or precast concrete slab and minimum 2000 g DPM/reinforced gas membrane.
- Possibly underfloor venting or pressurisation in combination with a) and b) depending on use.
- All joints and penetrations sealed.

For further information on design and construction details, discussions should be sought with a specialist contractor. Guidance may also be obtained from the BRE Report BR212 'Construction of New Buildings on Gas-Contaminated Land' and CIRIA Report C665 (2007). It may also be prudent to contact the local Environmental Health Officer in order to comply with the Local Authority requirements.

5.4.4 Landscape Planting/Ecological Features

The concentrations of the phytotoxic substances Total Copper and Zinc encountered in the samples obtained were generally above the landscape planting generic assessment levels. This may be detrimental to sensitive plants.

5.4.5 Buildings and Construction Materials

Concrete Cast In-Situ

The concentrations of Total Sulphate encountered exceeded the BRE guidance level of 2400mg/kg in four of the five samples analysed for the contamination assessment. From the water-soluble sulphate concentrations BRE Special Digest 1: 2005, Tables C1 and C2 would classify the samples submitted as up to Class DS-2. This should be taken into account should any concrete structures be installed within the soils represented by these samples.

Potable Water Supply Pipes

If at any point in the future, it be intended to install new water supply pipes within the Made Ground then consideration to the pipe materials used and/or the trench construction in accordance with UKWIR (2010) and the WATER UK HBF guide. Based upon the concentrations of TPH returned by the samples of Made Ground and the analysis undertaken, the use of standard PE pipe materials at the site may be suitable.

5.4.6 Soil Disposal

The samples were analysed using the 'Hazardonline' assessment tool, which concluded that some of the samples contained hazardous properties:

Sample	Sample Depth	Strata	Hazardous Property
BH1	0.50m	Made Ground	HP7 (Zinc, Lead)
BH2	0.25m	Made Ground	HP7 (Lead)
BH2	0.50m	Made Ground	HP7 (Zinc, Lead) HP14 (Copper, Lead, Zinc)
BH3	0.25m	Made Ground	None
BH3	0.50m	Made Ground	None

HP7 – Carcinogenic

HP14 – Ecotoxic

5.5 Shallow and Deep Groundwater/Surface Water Risk

Controlled waters have been identified as a potential receptor at the site due to the designation of the underlying Alluvium and Taplow Gravel Member as Secondary Undifferentiated Aquifer. We have therefore assumed that any leachate generated from the Made Ground at the site would be high risk due to the high sensitivity of the receptors.

Groundwater samples were obtained from BH1 on-site on the 29th March 2023 in amber glass jars, stored at 4°C + 2°C during transit and returned to the laboratory for analysis under those parameters listed in the results. The groundwater well was developed and purged prior to sampling with disposal bailers.

The hazard caused by the presence of a substance or element is not absolute but depends on the water course in question.

This assessment is based on water assumed to be a threat to nearby ecosystems and the environment and has not been assessed with reference to potable water supplies.

The following exceedances were encountered within the sample:

Contaminant	Sample Location	Sample Result	Guideline Value	Evaluation
Aliphatic Petroleum Hydrocarbons >C16 – C21	BH1	1500 µg/l	600 µg/l	These are considered to be indicative of diesel fuel and lubricating oils. The site is used as a parking area for vehicles and some storage. Larger vehicles may also have been parked/stored in the same area. However, similar contaminants were not identified within the ground and therefore they are considered to represent the condition of the groundwater in the area as a whole due to the surrounding land uses rather than originating from the site.
Aliphatic Petroleum Hydrocarbons >C21 – C35	BH1	9400 µg/l	600 µg/l	
Aliphatic Petroleum Hydrocarbons C5 – C35	BH1	11000 µg/l	600 µg/l	

5.6 Conceptual Site Model and Conclusions

The findings of this site investigation have demonstrated that in the context of a proposed commercial use of the site, the contaminants of concern with respect to end-user protection was lead.

A potential risk to the potable water supply pipe from elevated TPH concentrations in the soil was not identified, but was present in the groundwater.

Elevated ground gas in the form of methane and carbon dioxide has been detected on-site.

The Site Investigation has identified the following Source/Pathway/Receptor linkages present on-site or potentially present.

Potential Contaminants / Source	Pathway	Receptor	Site specific settings	Risk Classification: (Phase 2)	Action Required
Lead	Inhalation, ingestion and dermal contact.	Human Health Site Users	Commercial use	Low	Further action required
		Human Health Construction Workers	Workers should follow regulation on health and safety during development (HSE, 1991).	Medium	Further action required

Potential Contaminants / Source	Pathway	Receptor	Site specific settings	Risk Classification: (Phase 2)	Action Required
Methane & Carbon Dioxide	Through high permeability strata, cracks and ducts, and by Inhalation by humans	Human Health Inhalation of Gases	Elevated CH ₄ & CO ₂ encountered	Medium	Further action required
TPH	Permeation through PE pipes	Human Health	Limited to groundwater	Low	Further action required

Phase 2 Conceptual Site Model

5.7 Viable Risks Requiring Action

The following risks were identified in the original Phase 2 investigation. This supplementary investigation has not identified any further potential risks.

- There is a risk to end-users of the site from Lead encountered in the BH2 location on-site.
- There is a risk to the workforce on-site from Lead encountered in the BH2 location on-site.
- There is a risk to end-users of the site from the concentrations of ground gas encountered at the site.
- There is a risk to water pipes on-site from the concentrations of TPH encountered in the groundwater.

5.8 Discovery Strategy

The discovery strategy sets out the actions that must be taken if contamination is encountered during the course of a development.

The contractor should develop their discovery strategy as part of the construction management plan.

6.0 FOUNDATION DESIGN

6.1 General

It is proposed to construct extend the existing warehouse and in addition construct parking for cars and lorries plus some landscaping. Details of the structures, layouts etc. have been provided although details of the loadings were not available at the time of preparation of this report.

6.2 Site Preparation Works

The main contractor should be informed of the site conditions and risk assessments should be undertaken to comply with the Construction Design Management (CDM) regulations. Site personnel are to be made aware of the site conditions. It is recommended that extensive searches of existing man-made services are undertaken over the site prior to final design works.

6.3 Conventional Spread Foundations

A result of the inherent variability of uncontrolled fill, (Made Ground) is that it is usually unpredictable in terms of bearing capacity and settlement characteristics. Foundations should, therefore, be taken through any Made Ground and either into, or onto a suitable underlying natural stratum of adequate bearing characteristics.

Based on the ground and groundwater conditions encountered in the boreholes, it will not be possible to support the proposed new development on conventional strip or isolated pad foundations. A piled foundation solution is recommended.

6.4 Piled Foundations

The use of conventional spread foundations will be either impracticable or uneconomical due to the size and depth of foundation required, therefore a piled foundation will be required. In these ground conditions, it is considered that some form of bored and in-situ cast concrete piled foundation with reinforced concrete ground beams should prove satisfactory.

The construction of a piled foundation is a specialist activity and the advice of a reputable contractor, familiar with the type of soil and groundwater conditions encountered at this site should be sought prior to finalising the foundation design. The actual pile working load will depend on the particular type of pile chosen and method of installation adopted.

To achieve the full bearing value a pile should penetrate the bearing stratum by at least five times the pile diameter.

Where piles are to be constructed in groups the bearing value of each individual pile should be reduced by a factor of about 0.8 and a calculation made to check the factor of safety against block failure.

Driven piles could also be used and would develop much higher working loads approximately 2.5 to 3 times higher than bored piles of a similar diameter at the same depth. However, the close proximity of adjacent buildings will in all probability preclude their use due to noise and vibration.

The table below provides some indicative capacities for a single pile for the diameter and depths shown:

		Pile diameter (m)		
		0.3	0.45	0.6
Pile length (m)	9m	140kN	180kN	240kN
	12m	240kN	310kN	420kN

Indicative Pile Capacities for a Single Pile

6.5 Floor Slabs

Due to the thickness of Made Ground encountered and the underlying very soft Alluvial deposits, it is recommended that ground slabs should be fully suspended.

6.6 Excavations

Shallow excavations for foundations and services are likely to require nominal side support in the short term and groundwater is unlikely to be encountered in significant quantities once any accumulated surface water has been removed. Deeper and longer excavations below approximately 1.40m below existing ground level will require close side support and some seepages of groundwater could be encountered.

Once groundwater has been encountered the Made Ground and Alluvial deposits may rapidly become unstable. Alluvial deposits may flow resulting in undermining of the ground surrounding the excavation unless suitable side wall support is installed.

Normal safety precautions should be taken if shallow excavations are to be entered. Deeper excavations will require enhanced measures to reduce the risk to workers to acceptable levels.

6.7 Pavement Design

The results of California Bearing Ratio tests carried out in the laboratory on a sample of Made Ground indicate CBR values of between 14% and 20%.

The tests were undertaken on a sample described as predominantly gravelly sandy silty clay with clinker, ash and brick fragments, indicating there is variability in the nature of the material at formation level. Although a maximum CBR value of 20% is indicated, it is recommended that a precautionary lower value of 14% is used as indicated by the laboratory test results. Each area may need to be assessed separately on-site.

Any soft or loose layers encountered in otherwise competent formations should be removed and replaced with well compacted imported granular fill.

The engineering characteristics of any clayey and silty soils at shallow depth are particularly sensitive to changes in soil moisture content and will soften considerably when exposed to free water. It should therefore be prudent to programme pavement construction for the dry summer months.

7.0 LIST OF FIGURES / APPENDICES

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FIGURE 2 – PROPOSED SITE PLAN

FIGURE 3 – SITE INVESTIGATION PLAN

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APPENDIX B – LABORATORY TEST & GAS MONITORING DATA

APPENDIX C – STATISTICAL ANALYSIS

APPENDIX D – GENERIC VALUES USED IN THE RISK ASSESSMENT

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APPENDIX A

Borehole Logs

Site Analytical Services Ltd.							Site J1 EXTENSION, LOWER ROAD, NORTHFLEET, DA11 9BL		Borehole Number BH1	
Boring Method ROTARY PERCUSSIVE		Casing Diameter 128mm cased to 0.00m		Ground Level (mOD)		Client HEATH PROJECTS LIMITED		Job Number 2336590		
		Location TQ613750		Dates 13/03/2023		Engineer		Sheet 1/1		
Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	
0.25	D1					(0.20)	MADE GROUND: Hardcore			
0.50	D2					(0.60)	MADE GROUND: Dark brown clayey silty fine to coarse grained sand containing brick fragments			
0.75	D3					0.80	MADE GROUND: Soft, medium grey very silty clay containing occasional brick fragments			
1.00-1.45	SPT(C) N=1		DRY	0,0/0,0,1,0		(0.50)				
1.00	D4					1.30	Soft, grey slightly weathered very silty chalky CLAY			
1.50	D5									
2.00-2.45	SPT N=0		DRY	0,0/0,0,0,0		(2.10)				
2.00	D6									
2.50	D7									
3.00-3.45	SPT(C) N=0		DRY	0,0/0,0,0,0		3.40	Soft, light to medium grey clayey SILT			
3.00	D8			Water(1) at 3.20m, fell to 4.20m in 20 mins.						
3.50	D9									
4.00-4.45	SPT N=0		DRY	0,0/0,0,0,0		(1.70)				
4.00	D10									
4.50	D11									
5.00-5.45	SPT N=0		WET	0,0/0,0,0,0		5.10	Soft, dark brown clayey silty amorphous PEAT			
5.00	D12									
6.00-6.45	SPT(C) N=1		WET	0,0/1,0,0,0		(3.70)				
6.00	D13									
7.00	D14									
7.50-7.95	SPT N=2		WET	0,1/0,1,0,1		8.80	Medium dense, grey slightly gravelly fine to coarse grained SAND containing clay lenses, chalk nodules and shell fragments			
7.50	D15									
8.00	D16									
9.00-9.45	SPT(C) N=11		WET	1,1/2,3,2,4		(1.20)				
9.00	D17									
10.00	D18					10.00				
Remarks S= Standard Penetration Test - Cone C= Dynamic Penetration Test - Cone D= Disturbed Sample Excavating from 0.00m to 1.00m for 1 hour.								Scale (approx)	Logged By	
								1:50	EW	
								Figure No. 2336590.BH1		

Site Analytical Services Ltd.			Site J1 EXTENSION, LOWER ROAD, NORTHFLEET, DA11 9BL	Borehole Number BH1
Installation Type Single Installation	Dimensions Internal Diameter of Tube [A] = 50 mm Diameter of Filter Zone = 128 mm		Client HEATH PROJECTS LIMITED	Job Number 2336590
	Location TQ614750	Ground Level (mOD)	Engineer	Sheet 1/1

[illegible]

Remarks
Lockable cover set in cement

Site Analytical Services Ltd.							Site J1 EXTENSION, LOWER ROAD, NORTHFLEET, DA11 9BL		Borehole Number BH2	
Boring Method ROTARY PERCUSSIVE		Casing Diameter 128mm cased to 0.00m		Ground Level (mOD)		Client HEATH PROJECTS LIMITED		Job Number 2336590		
		Location TQ613750		Dates 13/03/2023		Engineer		Sheet 1/2		
Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	
0.25	D1	2.00	WET	Water Strike (1) at 0.80m, rose to 0.60m in 20 mins. 1,2/2,1,1,2		(0.30)	MADE GROUND: Hardcore		▽1	
0.50	D2					0.30	MADE GROUND: Brown clayey sandy silt containing brick and metal fragments			
0.75	D3					(0.45)	MADE GROUND: Soft, medium brown silty clay			
1.00	D4					0.75	MADE GROUND: Very loose, dark brown clayey sandy gravelly silt containing brick fragments			
1.00-1.45	SPT(C) N=6					(0.35)				
1.50	D5	3.00	WET	1,2/1,0,1,0		(1.10)				
2.00-2.45	SPT(C) N=2					2.20	Grey very silty CLAY containing decomposing roots			
2.00	D6									
2.50	D7									
3.00	U1					(1.80)				
4.00	U2	5.00		30 blows		4.00	Dark grey very silty CLAY containing decomposing roots			
						(1.50)				
5.00	U3					5.50	Soft, dark brown clayey silty amorphous PEAT			
6.00	U4					(2.30)				
7.00	U5					7.80	Medium dense, grey fine to coarse grained SAND containing clay lenses and chalk nodules			
8.00	U6	8.00	WET	110 blows		(2.60)			▽2	
9.00-9.45	SPT(C) N=11									
9.00	D9									
				Water Strike(2) at 9.60m.						
Remarks U= Undisturbed 100mm Diameter Sample C= Dynamic Penetration Test - Cone D= Disturbed Sample Excavating from 0.00m to 1.00m for 1 hour.								Scale (approx)	Logged By	
								1:50	EW	
								Figure No. 2336590.BH2		

Site Analytical Services Ltd. Site J1 EXTENSION, LOWER ROAD, NORTHFLEET, DA11 9BL Borehole Number BH2							Client HEATH PROJECTS LIMITED		Job Number 2336590
Boring Method ROTARY PERCUSSIVE		Casing Diameter 128mm cased to 0.00m		Ground Level (mOD)		Dates 13/03/2023		Engineer	Sheet 2/2
Location TQ613750									
Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
10.00	D10								
10.50-10.95 10.50	SPT(C) N=16 D11	10.00	WET	2,2/3,4,4,5		10.40	Medium dense, orange fine to coarse grained SAND		
11.00	D12					(1.60)			
12.00-12.45 12.00	SPT(C) N=18 D13	10.00	WET	2,3/4,4,5,5		12.00	Complete at 12.00m		
Remarks U= Undisturbed 100mm Diameter Sample C= Dynamic Penetration Test - Cone D= Disturbed Sample								Scale (approx) 1:50	Logged By EW
								Figure No. 2336590.BH2	

Site Analytical Services Ltd.							Site		Borehole Number	
							J1 EXTENSION, LOWER ROAD, NORTHFLEET, DA11 9BL		BH3	
Boring Method ROTARY PERCUSSIVE		Casing Diameter 128mm cased to 0.00m			Ground Level (mOD)		Client HEATH PROJECTS LIMITED		Job Number 2336590	
		Location TQ613750			Dates 14/03/2023		Engineer		Sheet 1/1	
Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	
0.25	D1					(0.30)	MADE GROUND: Hardcore			
0.50	D2					0.30 (0.20) 0.50	MADE GROUND: Brown sandy silt containing brick fragments			
0.75	D3					(0.60)	MADE GROUND: Clinker			
1.00-1.45	SPT(C) N=4 D4		DRY	0,1/1,1,1,1		1.10	MADE GROUND: Soft, medium brown silty clay containing brick fragments		▼1	
1.50	D5			Water(1) at 1.40m, rose to 1.20m in 20 mins.		(0.30) 1.40	MADE GROUND: Soft, dark brown clayey sandy gravelly silt containing brick fragments		▽1	
2.00-2.45	SPT(C) N=2 D6		WET	0,1/1,0,1,0		(0.80)				
2.50	D7					2.20	Soft, medium grey silty CLAY			
3.00-3.45	SPT N=2 D8		WET	0,1/1,0,1,0		(2.10)				
3.50	D9									
4.00-4.45	SPT N=1 D10		WET	0,0/0,0,1,0		4.30	Soft, dark brown clayey silty amorphous PEAT			
4.50	D11					(1.30)				
5.00-5.45	SPT N=1 D12		WET	0,1/0,0,1,0		5.60	Soft, grey very silty CLAY containing bands of fine grained sand, amorphous peat and chalk			
6.00-6.45	SPT N=6 D13		WET	1,1/1,2,1,2						
7.00	D14									
7.50-7.95	SPT N=9 D15		WET	1,2/2,2,2,3		(4.40)				
8.00	D16									
9.00-9.45	SPT N=10 D17		WET	2,2/2,3,2,3						
10.00	D18					10.00				
Remarks S= Standard Penetration Test - Cone C= Dynamic Penetration Test - Cone D= Disturbed Sample Excavating from 0.00m to 1.00m for 1 hour.								Scale (approx)	Logged By	
								1:50	EW	
								Figure No. 2336590.BH3		

Site Analytical Services Ltd.							Standard Penetration Test Results					
Site : J1 EXTENSION, LOWER ROAD, NORTHFLEET, DA11 9BL											Job Number	
Client : HEATH PROJECTS LIMITED											2336590	
Engineer :											Sheet	
											1 / 1	
Borehole Number	Base of Borehole (m)	End of Seating Drive (m)	End of Test Drive (m)	Test Type	Seating Blows per 75mm		Blows for each 75mm penetration				Result	Comments
					1	2	1	2	3	4		
BH1	1.00	1.15	1.45	CPT	0	0	0	0	1	0	N=1	
BH1	2.00	2.15	2.45	SPT	0	0	0	0	0	0	N=0	
BH1	3.00	3.15	3.45	CPT	0	0	0	0	0	0	N=0	
BH1	4.00	4.15	4.45	SPT	0	0	0	0	0	0	N=0	
BH1	5.00	5.15	5.45	SPT	0	0	0	0	0	0	N=0	
BH1	6.00	6.15	6.45	CPT	0	0	1	0	0	0	N=1	
BH1	7.50	7.65	7.95	SPT	0	1	0	1	0	1	N=2	
BH1	9.00	9.15	9.45	CPT	1	1	2	3	2	4	N=11	
BH2	1.00	1.15	1.45	CPT	1	2	2	1	1	2	N=6	
BH2	2.00	2.15	2.45	CPT	1	2	1	0	1	0	N=2	
BH2	9.00	9.15	9.45	CPT	1	2	2	2	3	4	N=11	
BH2	10.50	10.65	10.95	CPT	2	2	3	4	4	5	N=16	
BH2	12.00	12.15	12.45	CPT	2	3	4	4	5	5	N=18	
BH3	1.00	1.15	1.45	CPT	0	1	1	1	1	1	N=4	
BH3	2.00	2.15	2.45	CPT	0	1	1	0	1	0	N=2	
BH3	3.00	3.15	3.45	SPT	0	1	1	0	1	0	N=2	
BH3	4.00	4.15	4.45	SPT	0	0	0	0	1	0	N=1	
BH3	5.00	5.15	5.45	SPT	0	1	0	0	1	0	N=1	
BH3	6.00	6.15	6.45	SPT	1	1	1	2	1	2	N=6	
BH3	7.50	7.65	7.95	SPT	1	2	2	2	2	3	N=9	
BH3	9.00	9.15	9.45	SPT	2	2	2	3	2	3	N=10	



APPENDIX B

Laboratory Test and Gas Monitoring Data

PLASTICITY INDEX & MOISTURE CONTENT DETERMINATIONS

BH/TP No.	Depth (m)	Natural Moisture (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Passing 425 µm (%)	Modified Plasticity Index (%)	Class
BH1	1.50	40	48	32	16	100	16	MI
	4.00	95	115	49	66	100	66	ME
BH2	2.50	47	74	33	41	100	41	CV
BH3	3.50	53	84	35	49	100	49	CV
	4.50	167		Non Plastic				

Table 1



GAS MONITORING 1/6

DATE: 22/03/2023

Weather Conditions:

Cloudy

Ground Conditions:

Damp

Temperature (°C):

10.0

Barometric Pressure (mbar):

1003

Barometric Pressure Trend (24hr):

Falling

Ambient O2:

20.3%

Monitoring Point Location	Flow	Atmospheric Pressure (mbar)	Methane %	Carbon Dioxide %	Oxygen %	VOC (ppm)	Hydrogen Sulphide (ppm)	Carbon Monoxide (ppm)	Depth to water (bgl)	Depth to Base of well (bgl)
BH1	<0.1	1003	8.2	7.7	9.7	0.105	<0.1	<0.1	1.60	7.85

Table 2

GAS MONITORING 2/6

DATE: 29/03/2023

Weather Conditions:			Ground Conditions:			Temperature (°C):				
High cloud			Damp			8.0				
Barometric Pressure (mbar):			Barometric Pressure Trend (24hr):			Ambient O2:				
1014			Falling			20.3%				
Monitoring Point Location	Flow	Atmospheric Pressure (mbar)	Methane %	Carbon Dioxide %	Oxygen %	VOC (ppm)	Hydrogen Sulphide (ppm)	Carbon Monoxide (ppm)	Depth to water (bgl)	Depth to Base of well (bgl)
BH1	0.6	1014	13.7	7.9	8.8	0.096	<0.1	<0.1	1.88	7.85

Table 2a

GAS MONITORING 3/6

DATE: 05/04/2023

Weather Conditions:			Ground Conditions:			Temperature (°C):				
Partial cloud cover			Dry			1.0				
Barometric Pressure (mbar):			Barometric Pressure Trend (24hr):			Ambient O2:				
1023			Falling			20.0%				
Monitoring Point Location	Flow	Atmospheric Pressure (mbar)	Methane %	Carbon Dioxide %	Oxygen %	VOC (ppm)	Hydrogen Sulphide (ppm)	Carbon Monoxide (ppm)	Depth to water (bgl)	Depth to Base of well (bgl)
BH1	<0.1	1023	19.4	7.4	9.1	0.196	<0.1	<0.1	1.58	7.85

Table 2b



GAS MONITORING 4/6

DATE: 14/04/2023

Weather Conditions:

Cloudy

Ground Conditions:

Dry

Temperature (°C):

5.0

Barometric Pressure (mbar):

1006

Barometric Pressure Trend (24hr):

Rising

Ambient O2:

20.1%

Monitoring Point Location	Flow	Atmospheric Pressure (mbar)	Methane %	Carbon Dioxide %	Oxygen %	VOC (ppm)	Hydrogen Sulphide (ppm)	Carbon Monoxide (ppm)	Depth to water (bgl)	Depth to Base of well (bgl)
BH1	<0.1	1006	25.3	7.9	8.7	0.153	<0.1	<0.1	1.63	7.85

Table 2c

GAS MONITORING 5/6

DATE: 24/04/2023

Weather Conditions:

Cloudy, occasional showers

Ground Conditions:

Wet

Temperature (°C):

6.0

Barometric Pressure (mbar):

1010

Barometric Pressure Trend (24hr):

Rising

Ambient O2:

21.0%

Monitoring Point Location	Flow	Atmospheric Pressure (mbar)	Methane %	Carbon Dioxide %	Oxygen %	VOC (ppm)	Hydrogen Sulphide (ppm)	Carbon Monoxide (ppm)	Depth to water (bgl)	Depth to Base of well (bgl)
BH1	<0.1	1010	14.1	5.2	12.7	0.090	<0.1	<0.1	1.59	7.85

Table 2d

GAS MONITORING 6/6

DATE: 02/05/2023

Weather Conditions:			Ground Conditions:			Temperature (°C):				
Cloudy			Dry			10.0				
Barometric Pressure (mbar):			Barometric Pressure Trend (24hr):			Ambient O2:				
1027			Rising			21.0%				
Monitoring Point Location	Flow	Atmospheric Pressure (mbar)	Methane %	Carbon Dioxide %	Oxygen %	VOC (ppm)	Hydrogen Sulphide (ppm)	Carbon Monoxide (ppm)	Depth to water (bgl)	Depth to Base of well (bgl)
BH1	<0.1	1027	8.8	4.2	14.8	0.167	<0.1	<0.1	1.43	7.85

Table 2e

Site : J1 EXTENSION, LOWER ROAD, NORTHFLEET, DA11 9BL

Client : HEATH PROJECTS LIMITED

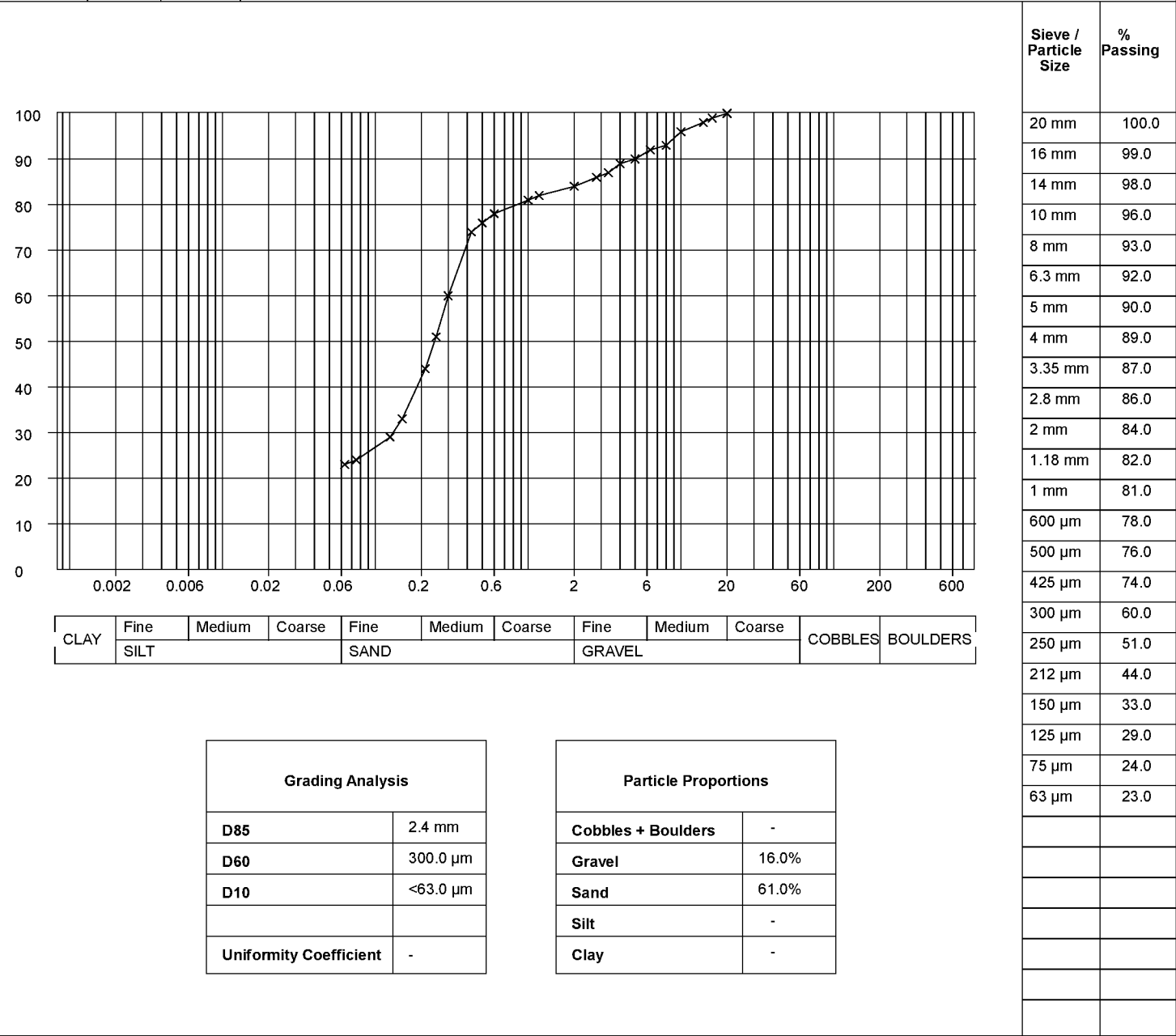
Engineer :

Job Number
2336590

Sheet
1/3

DETERMINATION OF PARTICLE SIZE DISTRIBUTION

Borehole / Trial Pit	Depth (m)	Sample	Laboratory Description
BH1	9.00	D17	



Method of Preparation : BS 1377:PART 1:1990:7.3 Initial preparation 1990:7.4.5 Particle size tests

Method of Test : BS 1377:PART 2:1990:9 Determination of particle size distribution

Remarks :

Site : J1 EXTENSION, LOWER ROAD, NORTHFLEET, DA11 9BL

Client : HEATH PROJECTS LIMITED

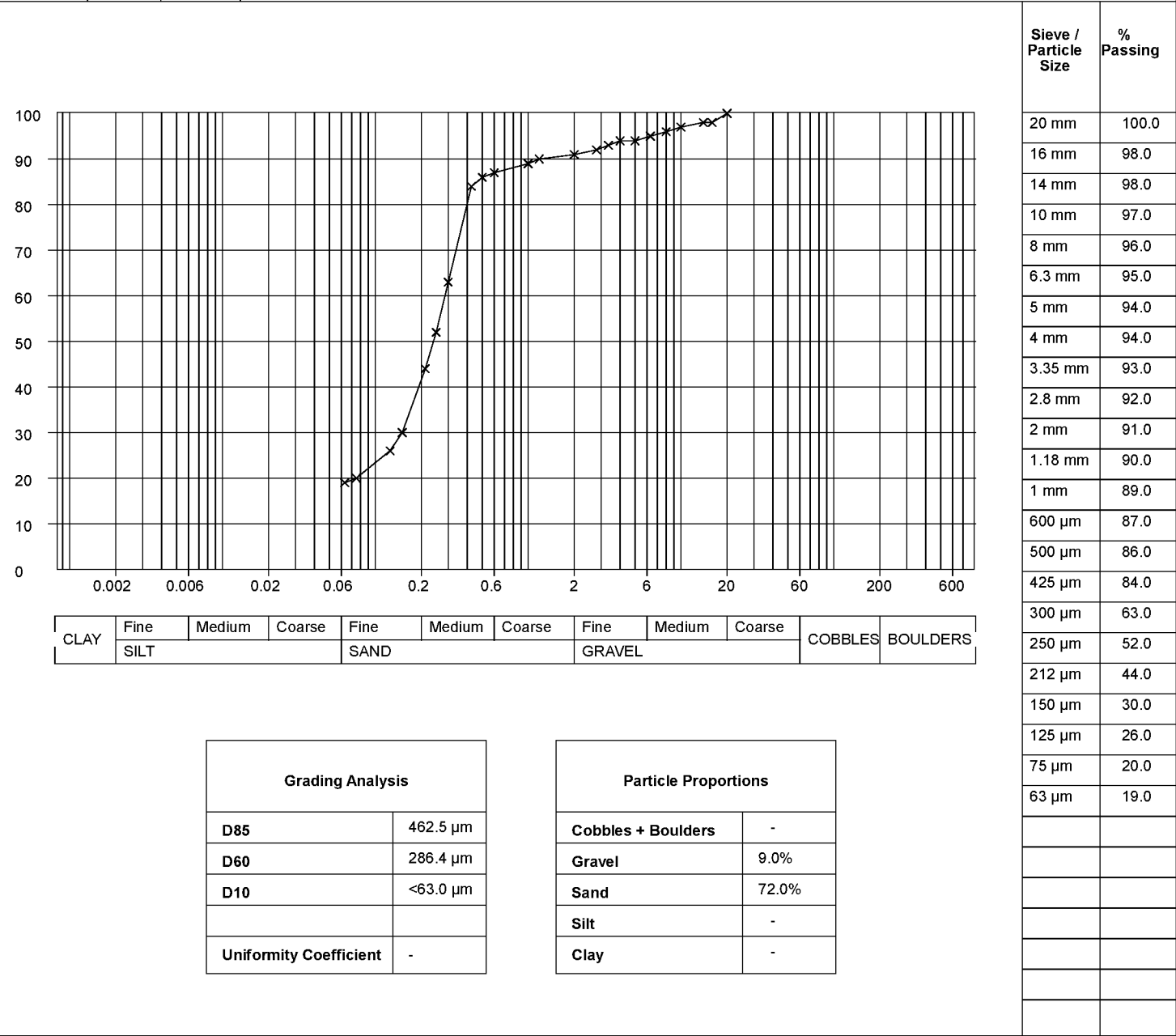
Engineer :

Job Number
2336590

Sheet
2/3

DETERMINATION OF PARTICLE SIZE DISTRIBUTION

Borehole / Trial Pit	Depth (m)	Sample	Laboratory Description
BH2	11.00	D12	



Method of Preparation : BS 1377:PART 1:1990:7.3 Initial preparation 1990:7.4.5 Particle size tests

Method of Test : BS 1377:PART 2:1990:9 Determination of particle size distribution

Remarks :

Site : J1 EXTENSION, LOWER ROAD, NORTHFLEET, DA11 9BL

Client : HEATH PROJECTS LIMITED

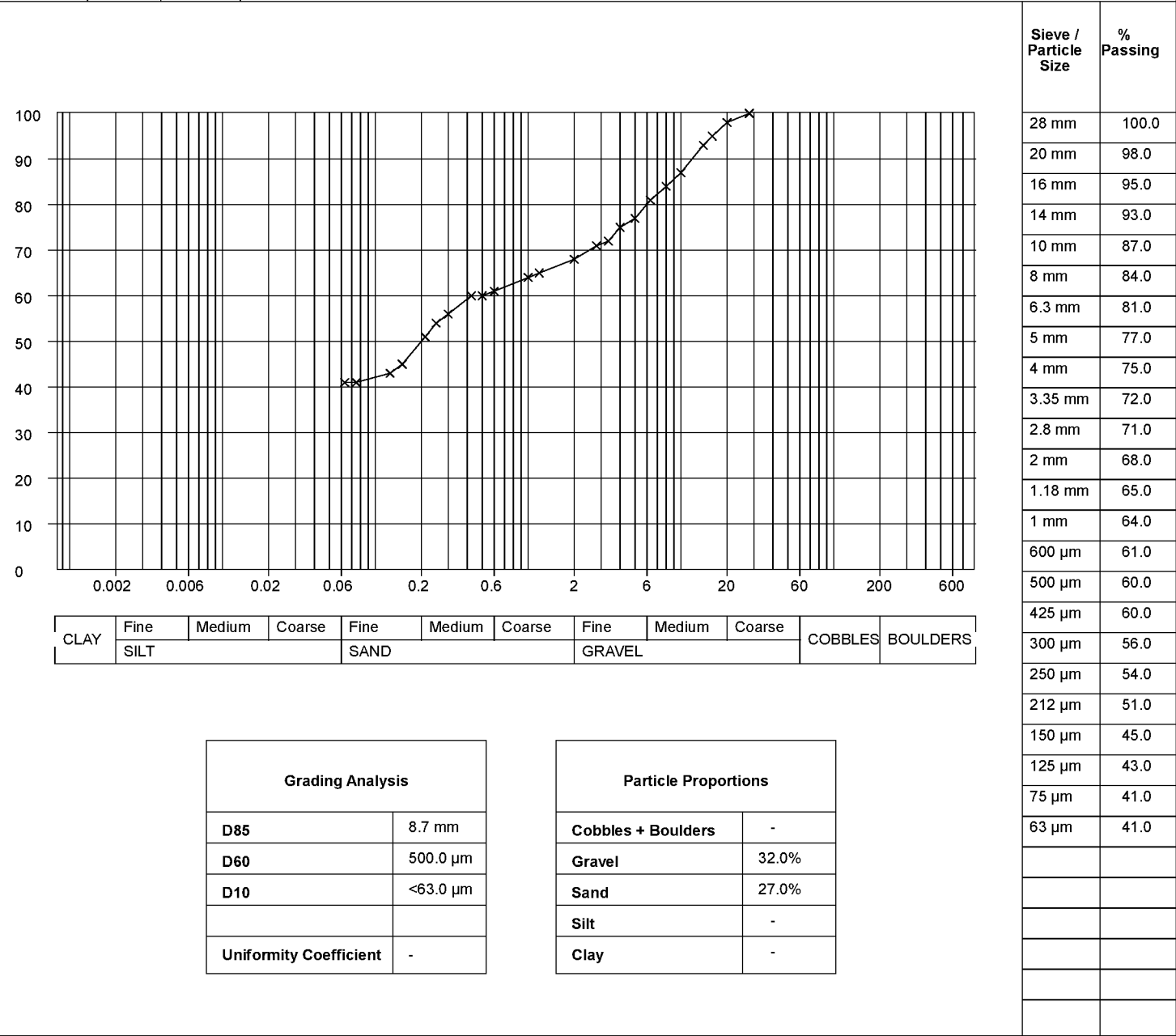
Engineer :

Job Number
2336590

Sheet
3/3

DETERMINATION OF PARTICLE SIZE DISTRIBUTION

Borehole / Trial Pit	Depth (m)	Sample	Laboratory Description
BH3	7.00	D14	



Method of Preparation : BS 1377:PART 1:1990:7.3 Initial preparation 1990:7.4.5 Particle size tests

Method of Test : BS 1377:PART 2:1990:9 Determination of particle size distribution

Remarks :



California Bearing Ratio (CBR)

Job Ref	33250		
	Borehole/Pit No.		
Site Name		J1 Extension, Lower Road, Northfleet DA11 9BL	
Sample No.		Combined	
Project No.	23/36590	Client	SAS
Soil Description	Dark grey gravelly sandy silty CLAY with clinker, ash and occasional brick fragments (gravel is fmc and angular to sub-angular)		
Test Method		BS1377 : Part 4 : 1990, clause 7	
Depth Top		0.25 m	
Depth Base		1.00 m	
Sample Type		B	
Samples received		31/03/2023	
Schedules received		31/03/2023	
Project Started		03/04/2023	
Date Tested		11/04/2023	

Specimen Preparation

Condition REMOULDED

Details Recompacted with specified standard effort using 2.5kg rammer

Soaking details

Not soaked

Period of soaking

- days

Time to surface

- days

Amount of swell recorded

- mm

Material retained on 20mm sieve removed 9.3 %

Initial Specimen details Bulk density 1.77 Mg/m³

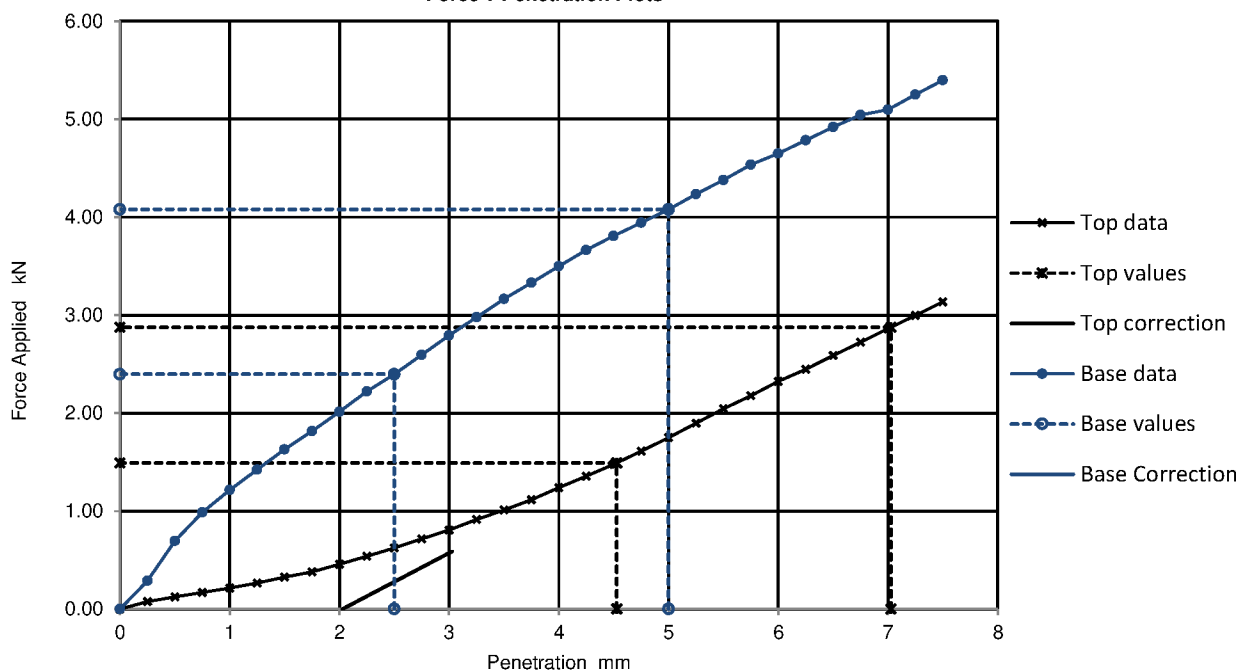
Surcharge applied 6 kg

Dry density 1.43 Mg/m³

4 kPa

Moisture content 24 %

Force v Penetration Plots



Results

TOP
BASE

Curve correction applied	CBR Values, %			
	2.5mm	5mm	Highest	Average
Yes	11	14	14	N/A
No	18	20	20	

Moisture Content
%
22
24

Remarks

1



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

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

Checked and Approved

Initials: J.P

Date: 14/04/2023

2519

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

MSF-5-R16



Steve Barratt
Site Analytical Services Ltd
Units 14 & 15
River Road Business Park
33 River Road
Barking
Essex
IG11 0EA

Derwentside Environmental Testing Services Ltd
Unit 1
Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Kent
ME17 2JN
t: 01622 850410

DETS Report No: 23-03953

Site Reference: J1 Extension, Lower Road, Northfleet DA11 9BL

Project / Job Ref: 23/36590

Order No: 11611

Sample Receipt Date: 21/03/2023

Sample Scheduled Date: 21/03/2023

Report Issue Number: 1

Reporting Date: 29/03/2023

Authorised by:

Kevin Old
Operations Director

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

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Soil Analysis Certificate						
DETS Report No: 23-03953	Date Sampled	14/03/23	14/03/23	14/03/23	14/03/23	14/03/23
Site Analytical Services Ltd	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: J1 Extension, Lower Road, Northfleet	TP / BH No	BH1	BH2	BH2	BH3	BH3
DA11 9BL	Additional Refs	D2	D1	D2	D1	D2
Project / Job Ref: 23/36590	Depth (m)	0.50	0.25	0.50	0.25	0.50
Order No: 11611	DETS Sample No	642145	642146	642147	642148	642149
Reporting Date: 29/03/2023						

Determinand	Unit	RL	Accreditation	(n)	(n)	(n)	(n)	(n)
Asbestos Screen ^(S)	N/a	N/a	ISO17025	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected
pH	pH Units	N/a	MCERTS	7.7	7.6	7.5	7.6	8.0
Total Cyanide	mg/kg	< 1	NONE	< 1	< 1	< 1	< 1	< 1
Complex Cyanide	mg/kg	< 1	NONE	< 1	< 1	< 1	< 1	< 1
Free Cyanide	mg/kg	< 1	NONE	< 1	< 1	< 1	< 1	< 1
Total Sulphate as SO ₄	mg/kg	< 200	MCERTS	1540	4714	6772	3974	2977
Total Sulphate as SO ₄	%	< 0.02	MCERTS	0.15	0.47	0.68	0.40	0.30
W/S Sulphate as SO ₄ (2:1)	mg/l	< 10	MCERTS	130	1060	1430	1160	987
W/S Sulphate as SO ₄ (2:1)	g/l	< 0.01	MCERTS	0.13	1.06	1.43	1.16	0.99
Sulphide	mg/kg	< 5	NONE	< 5	< 5	< 5	< 5	< 5
Organic Matter (SOM)	%	< 0.1	MCERTS	3.8	2	2.4	2.4	5.1
TOC (Total Organic Carbon)	%	< 0.1	MCERTS	2.2	1.2	1.4	1.4	3
Arsenic (As)	mg/kg	< 2	MCERTS	96	26	35	26	30
W/S Boron	mg/kg	< 1	NONE	1.9	1	< 1	< 1	2
Cadmium (Cd)	mg/kg	< 0.2	MCERTS	0.6	< 0.2	< 0.2	0.3	< 0.2
Chromium (Cr)	mg/kg	< 2	MCERTS	21	17	17	21	18
Chromium (hexavalent)	mg/kg	< 2	NONE	< 2	< 2	< 2	< 2	< 2
Copper (Cu)	mg/kg	< 4	MCERTS	653	490	1550	111	105
Lead (Pb)	mg/kg	< 3	MCERTS	1420	1820	2470	378	233
Mercury (Hg)	mg/kg	< 1	MCERTS	1.6	21.1	4.4	< 1	< 1
Nickel (Ni)	mg/kg	< 3	MCERTS	27	20	25	24	51
Selenium (Se)	mg/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	< 2
Zinc (Zn)	mg/kg	< 3	MCERTS	491	349	687	183	241
Total Phenols (monohydric)	mg/kg	< 2	NONE	< 2	< 2	< 2	< 2	< 2

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: 23-03953	Date Sampled	14/03/23	14/03/23	14/03/23	14/03/23	14/03/23
Site Analytical Services Ltd	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: J1 Extension, Lower Road, Northfleet DA11 9BL	TP / BH No	BH1	BH2	BH2	BH3	BH3
Project / Job Ref: 23/36590	Additional Refs	D2	D1	D2	D1	D2
Order No: 11611	Depth (m)	0.50	0.25	0.50	0.25	0.50
Reporting Date: 29/03/2023	DETS Sample No	642145	642146	642147	642148	642149

Determinand	Unit	RL	Accreditation	(n)	(n)	(n)
Naphthalene	mg/kg	< 0.1	MCERTS	< 0.1	0.35	1.11
Acenaphthylene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1
Acenaphthene	mg/kg	< 0.1	MCERTS	< 0.1	0.25	0.68
Fluorene	mg/kg	< 0.1	MCERTS	< 0.1	0.27	0.64
Phenanthrene	mg/kg	< 0.1	MCERTS	0.79	2.51	6.06
Anthracene	mg/kg	< 0.1	MCERTS	0.20	0.55	1.45
Fluoranthene	mg/kg	< 0.1	MCERTS	1.18	2.47	6.29
Pyrene	mg/kg	< 0.1	MCERTS	1.21	2.15	5.30
Benzo(a)anthracene	mg/kg	< 0.1	MCERTS	0.60	0.98	2.40
Chrysene	mg/kg	< 0.1	MCERTS	0.61	0.84	2.05
Benzo(b)fluoranthene	mg/kg	< 0.1	MCERTS	0.58	0.72	1.63
Benzo(k)fluoranthene	mg/kg	< 0.1	MCERTS	0.26	0.28	0.67
Benzo(a)pyrene	mg/kg	< 0.1	MCERTS	0.55	0.75	1.74
Indeno(1,2,3-cd)pyrene	mg/kg	< 0.1	MCERTS	0.29	0.31	0.81
Dibenz(a,h)anthracene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	0.18
Benzo(ghi)perylene	mg/kg	< 0.1	MCERTS	0.23	0.25	0.63
Coronene	mg/kg	< 0.1	NONE	< 0.1	< 0.1	0.14
Total Oily Waste PAHs	mg/kg	< 1	MCERTS	2.9	3.9	9.5
Total Dutch 10 PAHs	mg/kg	< 1	MCERTS	4.7	9.3	23.2
Total EPA-16 PAHs	mg/kg	< 1.6	MCERTS	6.5	12.7	31.6
Total WAC-17 PAHs	mg/kg	< 1.7	NONE	6.5	12.7	31.8

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Soil Analysis Certificate - TPH CWG Banded

DETS Report No: 23-03953	Date Sampled	14/03/23	14/03/23	14/03/23	14/03/23	14/03/23
Site Analytical Services Ltd	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: J1 Extension, Lower Road, Northfleet DA11 9BL	TP / BH No	BH1	BH2	BH2	BH3	BH3
Project / Job Ref: 23/36590	Additional Refs	D2	D1	D2	D1	D2
Order No: 11611	Depth (m)	0.50	0.25	0.50	0.25	0.50
Reporting Date: 29/03/2023	DETS Sample No	642145	642146	642147	642148	642149

Determinand	Unit	RL	Accreditation	(n)			(n)		
Aliphatic >C5 - C6 : HS_1D_MS_AL	mg/kg	< 0.01	NONE	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aliphatic >C6 - C8 : HS_1D_MS_AL	mg/kg	< 0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Aliphatic >C8 - C10 : EH_CU_1D_AL	mg/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	< 2	< 2
Aliphatic >C10 - C12 : EH_CU_1D_AL	mg/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	< 2	< 2
Aliphatic >C12 - C16 : EH_CU_1D_AL	mg/kg	< 3	MCERTS	< 3	< 3	< 3	< 3	< 3	< 3
Aliphatic >C16 - C21 : EH_CU_1D_AL	mg/kg	< 3	MCERTS	< 3	< 3	< 3	< 3	< 3	< 3
Aliphatic >C21 - C34 : EH_CU_1D_AL	mg/kg	< 10	MCERTS	< 10	< 10	< 10	< 10	< 10	< 10
Aliphatic (C5 - C34) : HS_1D_MS+EH_CU_1D_AL	mg/kg	< 21	NONE	< 21	< 21	< 21	< 21	< 21	< 21
Aromatic >C5 - C7 : HS_1D_MS_AR	mg/kg	< 0.01	NONE	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aromatic >C7 - C8 : HS_1D_MS_AR	mg/kg	< 0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Aromatic >C8 - C10 : EH_CU_1D_AR	mg/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	< 2	< 2
Aromatic >C10 - C12 : EH_CU_1D_AR	mg/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	< 2	< 2
Aromatic >C12 - C16 : EH_CU_1D_AR	mg/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	< 2	< 2
Aromatic >C16 - C21 : EH_CU_1D_AR	mg/kg	< 3	MCERTS	< 3	< 3	< 3	< 3	< 3	< 3
Aromatic >C21 - C35 : EH_CU_1D_AR	mg/kg	< 10	MCERTS	< 10	< 10	< 10	< 10	< 10	< 10
Aromatic (C5 - C35) : HS_1D_MS+EH_CU_1D_AR	mg/kg	< 21	NONE	< 21	< 21	< 21	< 21	< 21	< 21
Total >C5 - C35 : HS_1D_MS+EH_CU_1D_Tot al	mg/kg	< 42	NONE	< 42	< 42	< 42	< 42	< 42	< 42

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Soil Analysis Certificate - BTEX / MTBE						
DETS Report No: 23-03953	Date Sampled	14/03/23	14/03/23	14/03/23	14/03/23	14/03/23
Site Analytical Services Ltd	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: J1 Extension, Lower Road, Northfleet DA11 9BL	TP / BH No	BH1	BH2	BH2	BH3	BH3
Project / Job Ref: 23/36590	Additional Refs	D2	D1	D2	D1	D2
Order No: 11611	Depth (m)	0.50	0.25	0.50	0.25	0.50
Reporting Date: 29/03/2023	DETS Sample No	642145	642146	642147	642148	642149

Determinand	Unit	RL	Accreditation	(n)	(n)	(n)
Benzene : HS_1D_MS	ug/kg	< 2	MCERTS	< 2	< 2	< 2
Toluene : HS_1D_MS	ug/kg	< 5	MCERTS	< 5	< 5	20
Ethylbenzene : HS_1D_MS	ug/kg	< 2	MCERTS	25	< 2	146
p & m-xylene : HS_1D_MS	ug/kg	< 2	MCERTS	28	< 2	112
o-xylene : HS_1D_MS	ug/kg	< 2	MCERTS	< 2	< 2	35
MTBE : HS_1D_MS	ug/kg	< 5	MCERTS	< 5	< 5	< 5

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Soil Analysis Certificate - Sample Descriptions

DETS Report No: 23-03953	
Site Analytical Services Ltd	
Site Reference: J1 Extension, Lower Road, Northfleet DA11 9BL	
Project / Job Ref: 23/36590	
Order No: 11611	
Reporting Date: 29/03/2023	

DETS Sample No	TP / BH No	Additional Refs	Depth (m)	Moisture Content (%)	Sample Matrix Description
642145	BH1	D2	0.50	20.1	Black sandy clay with stones and concrete
642146	BH2	D1	0.25	12.1	Brown sandy gravel with stones and concrete
642147	BH2	D2	0.50	14.5	Brown sandy clay with stones and concrete
642148	BH3	D1	0.25	10.3	Brown sandy gravel with stones and concrete
642149	BH3	D2	0.50	15.7	Black sandy gravel with stones and concrete

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

Insufficient Sample ^{1/5}

Unsuitable Sample ^{1/5}



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Soil Analysis Certificate - Methodology & Miscellaneous Information

DETS Report No: 23-03953

Site Analytical Services Ltd

Site Reference: J1 Extension, Lower Road, Northfleet DA11 9BL

Project / Job Ref: 23/36590

Order No: 11611

Reporting Date: 29/03/2023

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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List of HWOL Acronyms and Operators
DETS Report No: 23-03953
Site Analytical Services Ltd
Site Reference: J1 Extension, Lower Road, Northfleet DA11 9BL
Project / Job Ref: 23/36590
Order No: 11611
Reporting Date: 29/03/2023

Acronym	Description
HS	Headspace analysis
EH	Extractable Hydrocarbons - i.e. everything extracted by the solvent
CU	Clean-up - e.g. by florisil, silica gel
1D	GC - Single coil gas chromatography
2D	GC-GC - Double coil gas chromatography
Total	Aliphatics & Aromatics
AL	Aliphatics only
AR	Aromatics only
#1	EH_2D_Total but with humics mathematically subtracted
#2	EH_2D_Total but with fatty acids mathematically subtracted
_	Operator - underscore to separate acronyms (exception for +)
+	Operator to indicate cumulative eg. EH+HS_Total or EH_CU+HS_Total

Det - Acronym
Benzene - HS_1D_MS
Ethylbenzene - HS_1D_MS
MTBE - HS_1D_MS
TPH CWG - Aliphatic >C10 - C12 - EH_CU_1D_AL
TPH CWG - Aliphatic >C12 - C16 - EH_CU_1D_AL
TPH CWG - Aliphatic >C16 - C21 - EH_CU_1D_AL
TPH CWG - Aliphatic >C21 - C34 - EH_CU_1D_AL
TPH CWG - Aliphatic >C5 - C6 - HS_1D_MS_AL
TPH CWG - Aliphatic >C6 - C8 - HS_1D_MS_AL
TPH CWG - Aliphatic >C8 - C10 - EH_CU_1D_AL
TPH CWG - Aliphatic C5 - C34 - HS_1D_MS+EH_CU_1D_AL
TPH CWG - Aromatic >C10 - C12 - EH_CU_1D_AR
TPH CWG - Aromatic >C12 - C16 - EH_CU_1D_AR
TPH CWG - Aromatic >C16 - C21 - EH_CU_1D_AR
TPH CWG - Aromatic >C21 - C35 - EH_CU_1D_AR
TPH CWG - Aromatic >C5 - C35 - HS_1D_MS+EH_CU_1D_AR
TPH CWG - Aromatic >C5 - C7 - HS_1D_MS_AR
TPH CWG - Aromatic >C7 - C8 - HS_1D_MS_AR
TPH CWG - Aromatic >C8 - C10 - EH_CU_1D_AR
TPH CWG - Total >C5 - C35 - HS_1D_MS+EH_CU_1D_Total
Toluene - HS_1D_MS
m & p-xylene - HS_1D_MS
o-Xylene - HS_1D_MS



4041



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Analytical Report Number : 23-25577

Project / Site name:	J1 Extention WER Northfleet DA11 9BL	Samples received on:	29/03/2023
Your job number:	23-36590	Samples instructed on/ Analysis started on:	29/03/2023
Your order number:	11688-AG	Analysis completed by:	05/04/2023
Report Issue Number:	1	Report issued on:	05/04/2023
Samples Analysed:	1 water sample		

Signed:

Dominika Warjan
Junior Reporting Specialist
For & on behalf of i2 Analytical Ltd.

Standard Geotechnical, Asbestos and Chemical Testing Laboratory located at: ul. Pionierów 39, 41-711 Ruda Śląska, Poland.

Accredited tests are defined within the report, opinions and interpretations expressed herein are outside the scope of accreditation.

Standard sample disposal times, unless otherwise agreed with the laboratory, are :

soils	- 4 weeks from reporting
leachates	- 2 weeks from reporting
waters	- 2 weeks from reporting
asbestos	- 6 months from reporting

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Any assessments of compliance with specifications are based on actual analytical results with no contribution from uncertainty of measurement.
Application of uncertainty of measurement would provide a range within which the true result lies.
An estimate of measurement uncertainty can be provided on request.

Analytical Report Number: 23-25577

Project / Site name: J1 Extention WER Northfleet DA11 9BL

Your Order No: 11688-AG

Lab Sample Number	2632924			
Sample Reference	BH1			
Sample Number	None Supplied			
Depth (m)	None Supplied			
Date Sampled	29/03/2023			
Time Taken	None Supplied			
Analytical Parameter (Water Analysis)	Units	Limit of detection	Accreditation Status	

General Inorganics

pH (L005B)	pH Units	N/A	ISO 17025	7.2
Total Cyanide	µg/l	10	ISO 17025	< 10
Complex Cyanide	µg/l	10	ISO 17025	< 10
Free Cyanide	µg/l	10	ISO 17025	< 10
Sulphate as SO ₄	µg/l	45	ISO 17025	69900
Sulphide	µg/l	5	NONE	< 5.0
Total Organic Carbon (TOC)	mg/l	0.1	ISO 17025	33.2

Total Phenols

Total Phenols (monohydric)	µg/l	10	ISO 17025	< 10
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Speciated PAHs

Naphthalene	µg/l	0.01	ISO 17025	< 0.01
Acenaphthylene	µg/l	0.01	ISO 17025	< 0.01
Acenaphthene	µg/l	0.01	ISO 17025	< 0.01
Fluorene	µg/l	0.01	ISO 17025	< 0.01
Phenanthrene	µg/l	0.01	ISO 17025	< 0.01
Anthracene	µg/l	0.01	ISO 17025	< 0.01
Fluoranthene	µg/l	0.01	ISO 17025	< 0.01
Pyrene	µg/l	0.01	ISO 17025	< 0.01
Benzo(a)anthracene	µg/l	0.01	ISO 17025	< 0.01
Chrysene	µg/l	0.01	ISO 17025	< 0.01
Benzo(b)fluoranthene	µg/l	0.01	ISO 17025	< 0.01
Benzo(k)fluoranthene	µg/l	0.01	ISO 17025	< 0.01
Benzo(a)pyrene	µg/l	0.01	ISO 17025	< 0.01
Indeno(1,2,3-cd)pyrene	µg/l	0.01	ISO 17025	< 0.01
Dibenzo(a,h)anthracene	µg/l	0.01	ISO 17025	< 0.01
Benzo(ghi)perylene	µg/l	0.01	ISO 17025	< 0.01

Total PAH

Total EPA-16 PAHs	µg/l	0.16	ISO 17025	< 0.16
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Heavy Metals / Metalloids

Boron (dissolved)	µg/l	10	ISO 17025	1200
Chromium (hexavalent)	µg/l	5	ISO 17025	< 5.0

Arsenic (dissolved)	µg/l	0.15	ISO 17025	8.92
Beryllium (dissolved)	µg/l	0.1	ISO 17025	< 0.1
Cadmium (dissolved)	µg/l	0.02	ISO 17025	< 0.02
Chromium (dissolved)	µg/l	0.2	ISO 17025	0.4
Copper (dissolved)	µg/l	0.5	ISO 17025	0.9
Lead (dissolved)	µg/l	0.2	ISO 17025	< 0.2
Mercury (dissolved)	µg/l	0.05	ISO 17025	< 0.05
Nickel (dissolved)	µg/l	0.5	ISO 17025	2.8
Selenium (dissolved)	µg/l	0.6	ISO 17025	5.9
Vanadium (dissolved)	µg/l	0.2	ISO 17025	2.2
Zinc (dissolved)	µg/l	0.5	ISO 17025	0.9



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Analytical Report Number: 23-25577

Project / Site name: J1 Extention WER Northfleet DA11 9BL

Your Order No: 11688-AG

Lab Sample Number				2632924
Sample Reference				BH1
Sample Number				None Supplied
Depth (m)				None Supplied
Date Sampled				29/03/2023
Time Taken				None Supplied
Analytical Parameter (Water Analysis)	Units	Limit of detection	Accreditation Status	

Monoaromatics & Oxygenates

Benzene	µg/l	3	ISO 17025	< 3.0
Toluene	µg/l	3	ISO 17025	< 3.0
Ethylbenzene	µg/l	3	ISO 17025	< 3.0
p & m-xylene	µg/l	3	ISO 17025	< 3.0
o-xylene	µg/l	3	ISO 17025	< 3.0
MTBE (Methyl Tertiary Butyl Ether)	µg/l	3	ISO 17025	< 3.0

Petroleum Hydrocarbons

TPH7 - Aliphatic >C5 - C6 _{HS, 1D, AL}	µg/l	1	ISO 17025	< 1.0
TPH7 - Aliphatic >C6 - C8 _{HS, 1D, AL}	µg/l	1	ISO 17025	< 1.0
TPH7 - Aliphatic >C8 - C10 _{HS, 1D, AL}	µg/l	1	ISO 17025	< 1.0
TPH7 - Aliphatic >C10 - C12 _{EH, 1D, AL, MS}	µg/l	10	NONE	< 10
TPH7 - Aliphatic >C12 - C16 _{EH, 1D, AL, MS}	µg/l	10	NONE	44
TPH7 - Aliphatic >C16 - C21 _{EH, 1D, AL, MS}	µg/l	10	NONE	1500
TPH7 - Aliphatic >C21 - C35 _{EH, 1D, AL, MS}	µg/l	10	NONE	9400
TPH-CWG - Aliphatic (C5 - C35) _{HS+EH, 1D, AL, MS}	µg/l	10	NONE	11000

TPH7 - Aromatic >C5 - C7 _{HS, 1D, AR}	µg/l	1	ISO 17025	< 1.0
TPH7 - Aromatic >C7 - C8 _{HS, 1D, AR}	µg/l	1	ISO 17025	< 1.0
TPH7 - Aromatic >C8 - C10 _{HS, 1D, AR}	µg/l	1	ISO 17025	< 1.0
TPH7 - Aromatic >C10 - C12 _{EH, 1D, AR, MS}	µg/l	10	NONE	< 10
TPH7 - Aromatic >C12 - C16 _{EH, 1D, AR, MS}	µg/l	10	NONE	< 10
TPH7 - Aromatic >C16 - C21 _{EH, 1D, AR, MS}	µg/l	10	NONE	< 10
TPH7 - Aromatic >C21 - C35 _{EH, 1D, AR, MS}	µg/l	10	NONE	< 10
TPH7 - Aromatic (C5 - C35) _{HS+EH, 1D, AR, MS}	µg/l	10	NONE	< 10

Analytical Report Number : 23-25577

Project / Site name: J1 Extention WER Northfleet DA11 9BL

Water matrix abbreviations:

Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters (PrW) Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Metals in water by ICP-MS (dissolved)	Determination of metals in water by acidification followed by ICP-MS. Accredited Matrices: SW, GW, PW except B=SW,GW, Hg=SW,PW, Al=SW,PW.	In-house method based on USEPA Method 6020 & 200.8 *for the determination of trace elements in water by ICP-MS.	L012-PL	W	ISO 17025
Boron in water	Determination of boron in water by acidification followed by ICP-OES. Accredited matrices: SW PW GW	In-house method based on MEWAM	L039-PL	W	ISO 17025
Complex cyanide in water	Determination of complex cyanide by calculation. Accredited matrices SW, PW, GW.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (Skalar)	L080-PL	W	ISO 17025
Hexavalent chromium in water	Determination of hexavalent chromium in water by acidification, addition of 1,5 diphenylcarbazide followed by colorimetry.	In-house method by continuous flow analyser. Accredited Matrices SW, GW, PW.	L080-PL	W	ISO 17025
Free cyanide in water	Determination of free cyanide by distillation followed by colorimetry. Accredited matrices SW, GW, PW.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (Skalar)	L080-PL	W	ISO 17025
Monohydric phenols in water	Determination of phenols in water by continuous flow analyser. Accredited matrices: SW PW GW	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (skalar)	L080-PL	W	ISO 17025
Speciated EPA-16 PAHs in water	Determination of PAH compounds in water by extraction in dichloromethane followed by GC-MS with the use of surrogate and internal standards. Accredited matrices: SW PW GW	In-house method based on USEPA 8270	L102B-PL	W	ISO 17025
Sulphide in water	Determination of sulphide in water by ion selective electrode.	In-house method	L029-PL	W	NONE
Sulphate in water	Determination of sulphate in water after filtration by acidification followed by ICP-OES. Accredited Matrices SW, GW, PW.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L039-PL	W	ISO 17025
TPHCWG (Waters)	Determination of dichloromethane extractable hydrocarbons in water by GC-MS, speciation by interpretation.	In-house method	L070-PL	W	ISO 17025
Total cyanide in water	Determination of total cyanide by distillation followed by colorimetry. Accredited matrices: SW PW GW	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (Skalar)	L080-PL	W	ISO 17025
Total organic carbon in water	Determination of dissolved organic carbon in water by TOC/DOC NDIR analyser. Accredited matrices: SW PW GW.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L037-PL	W	ISO 17025
BTEX and MTBE in water (Monoaromatics)	Determination of BTEX and MTBE in water by headspace GC-MS. Accredited matrices: SW PW GW	In-house method based on USEPA8260	L073B-PL	W	ISO 17025
pH at 20oC in water (automated)	Determination of pH in water by electrometric measurement. Accredited matrices: SW PW GW	In house method.	L099-PL	W	ISO 17025

For method numbers ending in 'UK or A' analysis have been carried out in our laboratory in the United Kingdom (WATFORD).

For method numbers ending in 'F' analysis have been carried out in our laboratory in the United Kingdom (East Kilbride).

For method numbers ending in 'PL or B' analysis have been carried out in our laboratory in Poland.

Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined aravimetrically using the moisture content which is carried out at a maximum of 30oC

Unless otherwise indicated, site information, order number, project number, sampling date, time, sample reference and depth are provided by the client. The instructed on date indicates the date on which this information was provided to the laboratory.

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Analytical Report Number : 23-24615

Project / Site name:	J1 Extension Lower Road, Northfleet DA11 9BL	Samples received on:	23/03/2023
Your job number:	23 36590	Samples instructed on/ Analysis started on:	23/03/2023
Your order number:	11647	Analysis completed by:	30/03/2023
Report Issue Number:	1	Report issued on:	30/03/2023
Samples Analysed:	9 soil samples		

Signed:

Dominika Warjan
 Junior Reporting Specialist
For & on behalf of i2 Analytical Ltd.

Standard Geotechnical, Asbestos and Chemical Testing Laboratory located at: ul. Pionierów 39, 41-711 Ruda Śląska, Poland.

Accredited tests are defined within the report, opinions and interpretations expressed herein are outside the scope of accreditation.

Standard sample disposal times, unless otherwise agreed with the laboratory, are :

soils	- 4 weeks from reporting
leachates	- 2 weeks from reporting
waters	- 2 weeks from reporting
asbestos	- 6 months from reporting

Excel copies of reports are only valid when accompanied by this PDF certificate.

Any assessments of compliance with specifications are based on actual analytical results with no contribution from uncertainty of measurement.
 Application of uncertainty of measurement would provide a range within which the true result lies.
 An estimate of measurement uncertainty can be provided on request.

Analytical Report Number: 23-24615

Project / Site name: J1 Extension Lower Road, Northfleet DA11 9BL

Your Order No: 11647

Lab Sample Number				2627386	2627387	2627388	2627389	2627390
Sample Reference				BH1	BH1	BH1	BH2	BH2
Sample Number				D7	D11	D14	D6	U6
Depth (m)				2.50	4.50	7.00	2.00	8.00
Date Sampled				14/03/2023	14/03/2023	14/03/2023	14/03/2023	14/03/2023
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Unit of detection	Accreditation Status					
Stone Content	%	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Moisture Content	%	0.01	NONE	41	41	63	26	10
Total mass of sample received	kg	0.001	NONE	2	2	1.8	2	1
Whole Sample Crushed								
		N/A	NONE	Crushed	Crushed	Crushed	Crushed	Crushed

General Inorganics

pH - Automated	pH Units	N/A	MCERTS	8.9	8.8	7.3	8.6	8.9
Total Sulphate as SO ₄	%	0.005	MCERTS	0.223	0.152	0.311	0.118	0.101
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.92	0.93	0.65	0.32	0.47
Water Soluble Chloride (2:1) (leachate equivalent)	mg/l	0.5	MCERTS	1200	2200	6000	250	350
Total Sulphur	%	0.005	MCERTS	1.08	1.55	1.82	0.128	0.436
Water Soluble Nitrate (2:1) as N (leachate equivalent)	mg/l	2	NONE	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0

Heavy Metals / Metalloids

Magnesium (water soluble)	mg/kg	5	NONE	66	250	230	20	31
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U/S = Unsuitable Sample I/S = Insufficient Sample

Analytical Report Number: 23-24615

Project / Site name: J1 Extension Lower Road, Northfleet DA11 9BL

Your Order No: 11647

Lab Sample Number				2627391	2627392	2627393	2627394
Sample Reference				BH3	BH3	BH3	BH3
Sample Number				D6	D10	D12	D15
Depth (m)				2.00	4.00	5.00	8.00
Date Sampled				14/03/2023	14/03/2023	14/03/2023	14/03/2023
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Unit of detection	Accreditation Status				
Stone Content	%	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1
Moisture Content	%	0.01	NONE	22	34	56	25
Total mass of sample received	kg	0.001	NONE	2	2	2	2
Whole Sample Crushed							
		N/A	NONE	Crushed	Crushed	Crushed	Crushed

General Inorganics

pH - Automated	pH Units	N/A	MCERTS	8.4	8.8	7.1	8.4
Total Sulphate as SO ₄	%	0.005	MCERTS	0.197	0.097	0.428	0.062
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.34	0.23	1.2	0.051
Water Soluble Chloride (2:1) (leachate equivalent)	mg/l	0.5	MCERTS	44	660	1800	19
Total Sulphur	%	0.005	MCERTS	0.225	1.45	3.05	0.033
Water Soluble Nitrate (2:1) as N (leachate equivalent)	mg/l	2	NONE	< 2.0	< 2.0	< 2.0	< 2.0

Heavy Metals / Metalloids

Magnesium (water soluble)	mg/kg	5	NONE	22	510	140	7.5
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U/S = Unsuitable Sample I/S = Insufficient Sample

Analytical Report Number : 23-24615

Project / Site name: J1 Extension Lower Road, Northfleet DA11 9BL

* These descriptions are only intended to act as a cross check if sample identities are questioned. The major constituent of the sample is intended to act with respect to MCERTS validation. The laboratory is accredited for sand, clay and loam (MCERTS) soil types. Data for unaccredited types of solid should be interpreted with care.

Stone content of a sample is calculated as the % weight of the stones not passing a 10 mm sieve. Results are not corrected for stone content.

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
2627386	BH1	D7	2.5	Brown clay and sand.
2627387	BH1	D11	4.5	Brown clay and sand.
2627388	BH1	D14	7	Brown clay and sand with gravel.
2627389	BH2	D6	2	Brown clay and sand with gravel.
2627390	BH2	U6	8	Brown sandy clay with gravel.
2627391	BH3	D6	2	Brown clay and sand with gravel.
2627392	BH3	D10	4	Brown clay and sand.
2627393	BH3	D12	5	Brown clay and loam with peat and vegetation
2627394	BH3	D15	8	Beige clay and sand with chalk.

Analytical Report Number : 23-24615

Project / Site name: J1 Extension Lower Road, Northfleet DA11 9BL

Water matrix abbreviations:

Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters (PrW) Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Magnesium, water soluble, in soil	Determination of water soluble magnesium by extraction with water followed by ICP-OES.	In-house method based on TRL 447	L038-PL	D	NONE
Moisture Content	Moisture content, determined gravimetrically. (30 °C)	In house method.	L019-UK/PL	W	NONE
pH in soil (automated)	Determination of pH in soil by addition of water followed by automated electrometric measurement.	In house method.	L099-PL	D	MCERTS
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight.	In-house method based on British Standard Methods and MCERTS requirements.	L019-UK/PL	D	NONE
Total Sulphate in soil as %	Determination of total sulphate in soil by extraction with 10% HCl followed by ICP-OES.	In house method.	L038-PL	D	MCERTS
Total Sulphur in soil as %	Determination of total sulphur in soil by extraction with aqua-regia, potassium bromide/bromate followed by ICP-OES.	In house method.	L038-PL	D	MCERTS
Crush Whole Sample	Either: Client specific preparation instructions - sample(s) crushed whole prior to analysis; OR Sample unsuitable for standard preparation and therefore crushed whole prior to analysis.	In house method, applicable to dry samples only.	L019-PL	D	NONE
Sulphate, water soluble, in soil (16hr extraction)	Determination of water soluble sulphate by ICP-OES. Results reported directly (leachate equivalent) and corrected for extraction ratio (soil equivalent).	In house method.	L038-PL	D	MCERTS
Water Soluble Nitrate (2:1) as N in soil	Determination of nitrate by reaction with sodium salicylate and colorimetry.	In-house method based on Examination of Water and Wastewater & Polish Standard Method PN-82/C-04579.08, 2:1 extraction.	L078-PL	W	NONE
Chloride, water soluble, in soil	Determination of Chloride colorimetrically by discrete analyser.	In house method.	L082-PL	D	MCERTS
Sulphate, water soluble, in soil	Determination of water soluble sulphate by ICP-OES. Results reported directly (leachate equivalent) and corrected for extraction ratio (soil equivalent).	In house method.	L038-PL	D	MCERTS

For method numbers ending in 'UK or A' analysis have been carried out in our laboratory in the United Kingdom (WATFORD).

For method numbers ending in 'F' analysis have been carried out in our laboratory in the United Kingdom (East Kilbride).

For method numbers ending in 'PL or B' analysis have been carried out in our laboratory in Poland.

Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30°C.

Unless otherwise indicated, site information, order number, project number, sampling date, time, sample reference and depth are provided by the client. The instructed on date indicates the date on which this information was provided to the laboratory.



APPENDIX C

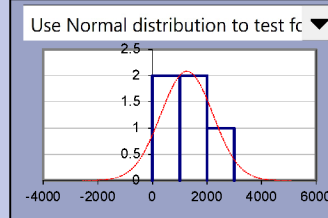
Statistical Analysis

Test Results

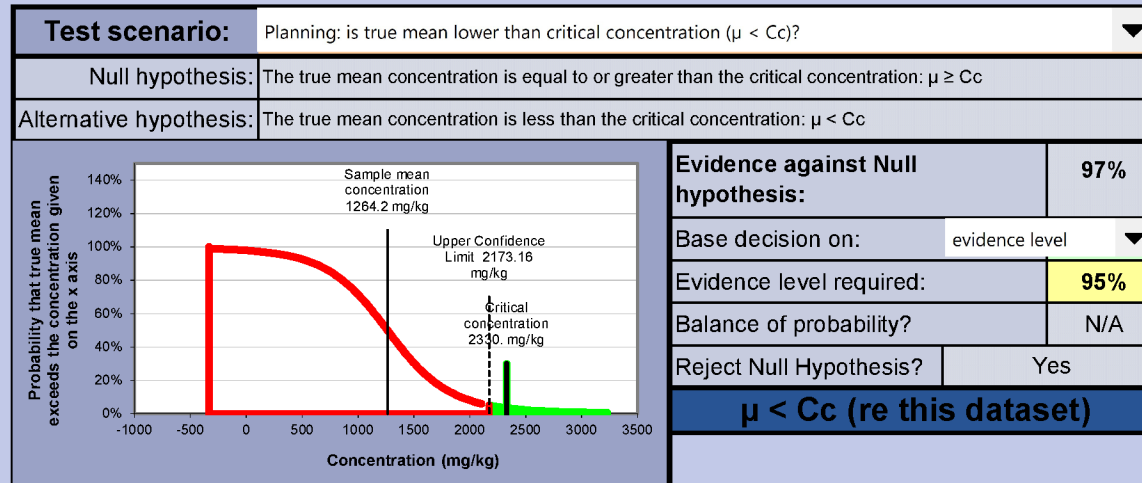
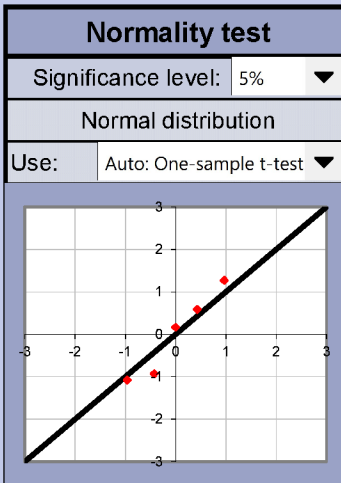
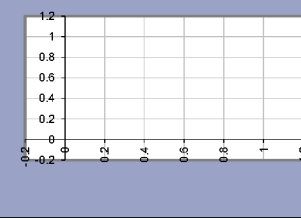
Client/client ref: Heath Projects Site ref: WE Roberts, Northfleet
Project ref: 23/36590 Data description:

Date: 02-May-2023
User details: A Garnham

Dataset:	Lead (mg/kg) ▼
Sample mean, $\bar{X}$ (mg/kg)	1264.2
Sample standard deviation, s	953.4
Sample size, n	5
Critical concentration, Cc (mg/kg)	2330



Outliers & non-detects	
Outliers present?	NO
Significance level	5% ▼
Outliers removed?	0
Non-detects	0



Back to data

Back to summary

Go to outlier test

Go to normality test

APPENDIX D

Generic Values used in the Risk Assessment

Qualitative Risk Assessment - Soils

The hazard caused by the presence of a substance or element is not absolute but depends on the proposed end use of the site.

It is understood that the site is to be developed for residential use with areas of private gardens. As such the S4UL screening levels for residential use with home-grown produce and Category 4 Screening Level for residential use have been used in the following soil assessment.

Site data has been assessed against current generic assessment criteria (GAC) / guideline values in accordance with current industry practice and statutory guidance; chemical toxicology (TOX), Soil Guideline Value (SGV) reports developed using the new Contaminated Land Exposure Assessment (CLEAv1.06) framework, CLR 11 (Environment Agency, 2009) and SP1010: Development of Category 4 screening levels for assessment of land affected by contamination (DEFRA, 2014).

However, it must be remembered that GAC are not binding standards but can be useful in forming judgements regarding the level of risk i.e. unacceptable or acceptable. Exceedance of GAC does not automatically result in the requirement for remedial / risk management work but would warrant further assessment.

Suitable 4 Use Levels, Category 4 Screening Levels, Soil Guideline Values, CLR Documents & Chartered Institute of Environmental Health Values

Under Part 2A of the Environmental Protection Act 1990, land is determined as contaminated if it is deemed to be causing significant harm, or where there is a Significant Possibility of Significant Harm to human health.

From January 2009 revised Soil Guidance Values for certain contaminants were issued in the Contaminated Land Reports (CLR) by the Environment Agency in conjunction with Department of the Environment, Food, Agriculture and Rural Affairs. These values and the CLEA methodology used to derive them have superseded CLEA and TOX reports for soil contaminants.

The CLR Documents are a series of contaminated land guidance documents developed by various past and present government agencies involved with protection of the environment.

These documents aim to provide a set of generic Soil Guideline Values and a site specific modelling programme based upon tolerable predicted uptakes from experimental data for a variety of common industrial toxic contaminants. In instances of carcinogenic and mutagenic substances the guideline values are set on the basis of "As Low As Reasonably Practicable" (ALARP), as theoretically mutation can occur on exposure to a single particle of the contaminant.

Revised Statutory Guidance to support Part 2A of the Environmental Protection Act 1990 was published in April 2012, which introduced a new four-category system for classifying land under Part 2A for cases of a Significant Possibility of Significant Harm to human health, 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.

'Category 4 Screening Levels' (C4SLs) have been introduced in March 2014 to provide a simple test for deciding when land is suitable for use and definitely not contaminated land. The Category 4 Screening Levels consist of estimates of contaminant concentrations in soil that are considered to present an 'acceptable' level of risk, within the context of Part 2A.

In response, in November 2014, The Chartered Institute of Environmental Health Generic Assessment Criteria for Human Health Risk Assessment adopt the Environment Agency's CLEA UK (Beta) Model and Category 4 Screening Levels and as such have derived guideline values that are compatible with current English legislation, policy and technical guidance in the form of LQM/CIEH S4UL's (Suitable 4 Use Levels).

The methodology for deriving both the previous Soil Guideline Values and the new Suitable 4 Use Levels is based on the Environment Agency's Contaminated Land Exposure Assessment (CLEA) methodology.

At the time of writing this report Suitable 4 Use Levels are in place for some heavy metals, BTEX Substances, Petroleum Hydrocarbons and Polycyclic Aromatic Hydrocarbons as well as a number of selected organic compounds.

Generic Assessment Criteria for Human Health Risk Assessment (S4UL's) have been produced by LQM / Chartered Institute of Environmental Health for the 'residential with home grown produce'. The table below summarized the relevant screening values for the contaminants of concern.

Commercial

		POS Res 1% SOM	POS Res 2.5% SOM	POS Res 6% SOM
Metals				
<i>Arsenic</i>	mg/kg	640	640	640
<i>Beryllium</i>	mg/kg	12	12	12
<i>Boron</i>	mg/kg	240000	240000	240000
<i>Cadmium</i>	mg/kg	190	190	190
<i>Chromium III</i>	mg/kg	8600	8600	8600
<i>Chromium VI</i>	mg/kg	33	33	33
<i>Copper</i>	mg/kg	68000	68000	68000
<i>Lead*</i>	mg/kg	2330	2330	2330
<i>Mercury</i>	mg/kg	58 (elemental 320 (Inorganic or methyl))	58 (elemental 320 (Inorganic or methyl))	58 (elemental 320 (Inorganic or methyl))
<i>Nickel</i>	mg/kg	980	980	980
<i>Selenium</i>	mg/kg	12000	12000	12000
<i>Vanadium</i>	mg/kg	9000	9000	9000
<i>Zinc</i>	mg/kg	730000	730000	730000
Total Phenols				
<i>Total Phenols (monohydric)</i>	mg/kg	440	690	1300
Speciated PAHs				
<i>Naphthalene</i>	mg/kg	190	460	1100
<i>Acenaphthylene</i>	mg/kg	83000	97000	100000
<i>Acenaphthene</i>	mg/kg	84000	68000	100000

Commercial

		POS Res 1% SOM	POS Res 2.5% SOM	POS Res 6% SOM
Fluorene	mg/kg	63000	68000	71000
Phenanthrene	mg/kg	22000	22000	23000
Anthracene	mg/kg	520000	540000	540000
Fluoranthene	mg/kg	23000	23000	23000
Pyrene	mg/kg	54000	54000	54000
Benzo(a)anthracene	mg/kg	170	170	180
Chrysene	mg/kg	350	350	350
Benzo(b)fluoranthene	mg/kg	44	44	45
Benzo(k)fluoranthene	mg/kg	1200	1200	1200
Benzo(a)pyrene	mg/kg	35	35	36
Indeno(1,2,3cd)pyrene	mg/kg	500	510	510
Dibenz(a,h)anthracene	mg/kg	3.5	3.6	3.6
Benzo(ghi)perylene	mg/kg	3900	4000	4000
Aliphatic hydrocarbons				
EC5 – C6	mg/kg	3200	5900	12000
EC6 - C8	mg/kg	7800	17000	40000
EC8 – C10	mg/kg	2000	4800	11000
EC10 – C12	mg/kg	9700	23000	47000
EC12 – C16	mg/kg	59000	82000	90000
EC16-C35	mg/kg	1600000	1700000	1800000
EC35-44	mg/kg	1600000	1700000	1800000
Aromatic hydrocarbons				
EC5 – C7	mg/kg	26000	46000	86000
EC7 – C8	mg/kg	56000	110000	180000
EC8 – C10	mg/kg	3500	8100	17000
EC10 – C12	mg/kg	16000	2800	34000
EC12 – C16	mg/kg	36000	37000	38000
EC16 – C21	mg/kg	28000	28000	28000
EC21 – C35	mg/kg	28000	28000	28000
EC35 – C44	mg/kg	28000	28000	28000
Benzene	mg/kg	27	47	90

**Commercial**

		POS Res 1% SOM	POS Res 2.5% SOM	POS Res 6% SOM
<i>Toluene</i>	mg/kg	56000	110000	180000
<i>Ethylbenzene</i>	mg/kg	57000	13000	27000
<i>Xylenes O</i>	mg/kg	6600	15000	14000
<i>Xylenes M</i>	mg/kg	6200	14000	31000
<i>Xylenes P</i>	mg/kg	5900	14000	30000
<i>Total PCBs</i>	mg/kg	0.24	0.24	0.24

Note:

** Based on C4SL values*

Qualitative Risk Assessment - Groundwater

The water has been assessed against current generic assessment criteria (GAC) / guideline values in accordance with current industry practice. Where available UK GAC has been used followed by European and American guidance. The Environmental Quality Standards (EQS) for Freshwaters (derived from the EC Dangerous Substances Directive), were selected as the most appropriate generic assessment criteria against which water quality can be compared with.

The EQS's have been generated for both List 1 and List 2 dangerous substances in controlled waters in England and Wales by the Environment Agency and are therefore considered to represent authoritative, relative and scientific guideline values. The concentrations stated by the EQS represent concentrations below which no detrimental effects to aquatic life should occur. It should be noted that the EQS's relate to the receiving water and not the discharge, therefore this method of assessment represents a very conservative approach.

Where no EQS's are available or no appropriate alternative conservative EQS for a similar chemical, the Dutch Intervention Values for groundwater have been used as preliminary screening tools.

Substance	Providence	Generic Guideline Value µg/l
Arsenic	EQS	50
Boron	EQS	2000
Cadmium	EQS	5
Chromium	EQS	5-250
Copper	EQS	1-28
Cyanide	DIV	1500
Lead	EQS	4-250
Mercury	EQS	1
Nickel	EQS	50-200
Phenol	EQS	30
Selenium	EQS	10
Sulphate	Not considered applicable	-
Sulphide	Not considered applicable	
Zinc	EQS	8-500
Mineral Oils (C10-C40)	DIV	600
PRO/VPH	EQS (Benzene)	30
Naphthalene	EQS	10
Acenaphthylene	EQS (Naphthalene)	10
Acenaphthene	EQS (Naphthalene)	10

Substance	Providence	Generic Guideline Value µg/l
Fluorene	DIV (Anthracene)	5
Phenanthrene	DIV (Anthracene)	5
Anthracene	DIV	5
Fluoranthene	DIV	10
Benzo(a) anthracene	DIV	0.5
Chrysene	DIV	0.2
Benzo(b)fluoranthene	DIV Benzo(k)fluoranthene	0.05
Benzo(k)fluoranthene	DIV	0.05
Benzo(a)pyrene	DIV	0.05
Indeno(1,2,3-cd)pyrene	DIV	0.05
Benzo(ghi)perylene	DIV (Benzo(a)pyrene)	0.05