

Gallery Gardens

Phase 2 Geo-Environmental Investigation, Risk Assessment and Remediation Strategy

Job Number: LKC241427

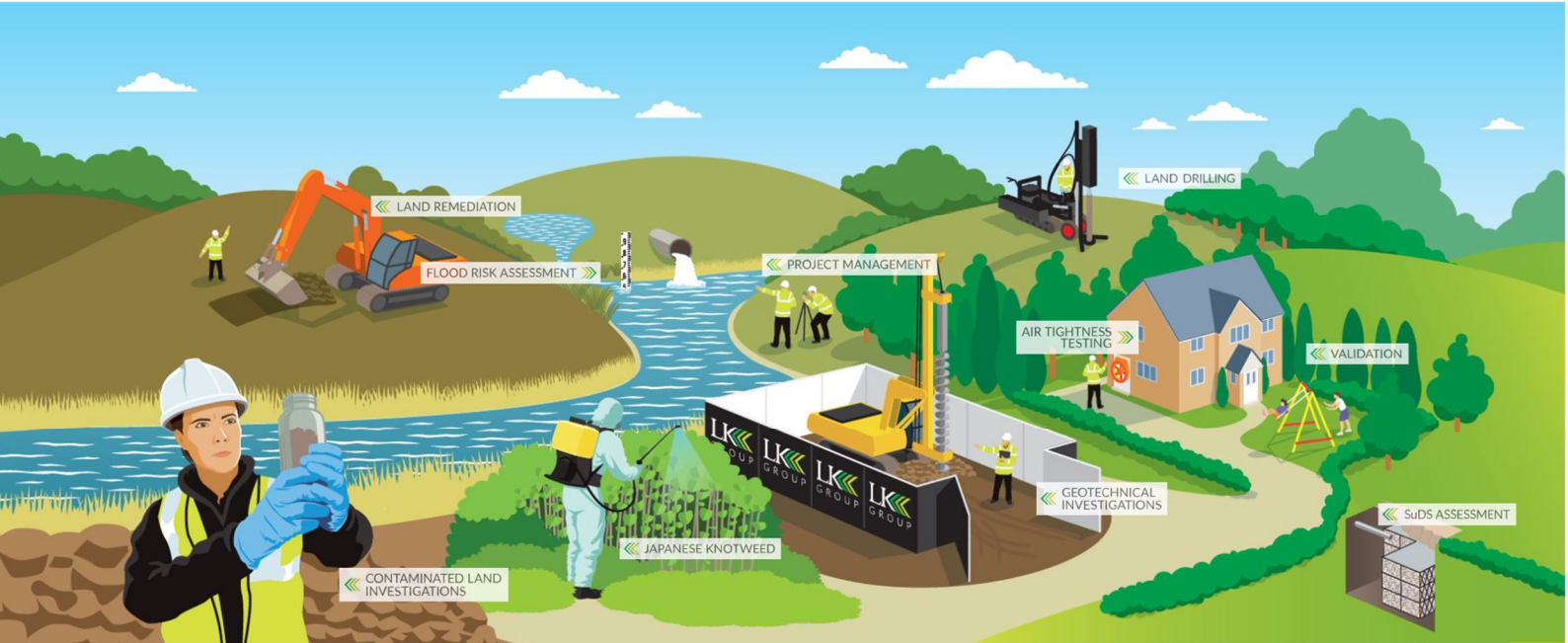
Date: July 2024

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Site Address	Gallery Gardens, Chester Road, Manchester, M15 4LQ
Report Title	Phase 2 Geo-Environmental Investigation, Risk Assessment and Remediation Strategy
Job Number	LK241427
Client	Drum Capital Projects Ltd

Revision	0	Date of Issue	19/7/24
Document Ref:	LKC241227-B1-GI-Gallery gardens_R0		
Status	Final		
Written By	CH		
Approved By	PD		

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1. Introduction

1.1. Background

LK Consult Ltd (LKC) has been commissioned to carry out a Phase 2 Geo-Environmental Investigation, Risk Assessment and Remediation Strategy for Gallery Gardens. The investigation was undertaken in support of a planning application to develop the site for residential use.

The following work has previously been undertaken:

- Preliminary Risk Assessment (PRA) report, undertaken by LKC (Ref: LKC241427-A1-PRA Gallery Gardens_R0, dated July 2024).

This report represents an update to current standards based on the original site investigation report undertaken by LKC (reference CL-602-LKC 17 1166-02_R1, dated February 2019). It is understood no significant changes in site use have occurred since the original report was undertaken.

This investigation has been undertaken to confirm the ground conditions below the site and to allow a contamination and geotechnical assessment to be undertaken.

The investigation will aim to confirm the risks of the potential pollutant linkages identified in the PRA and recommend further assessment / remediation, as required.

A summary of the site details is presented in Table 1-1. A summary of the site details is presented in Table 1-1. Figures 1 and 2 indicate the site location and boundary. Figure 3 indicates the proposed development.

Location	To the north of Chester Road approximately 1km to the south west of Manchester City Centre.
Area	Centred at approximate National Grid Reference 382649E 397171N.
Topography	4,500m ² .
Current Site Use	30 metres above ordnance datum (AOD).
Proposed Development	Residential apartments (maximum of 18 storeys) including small areas of soft landscaping and an underground basement car park.

Table 1-1: Summary of site details..

2. Summary of Preliminary Risk Assessment (PRA)

2.1. Phase 1 Preliminary Risk Assessment (PRA)

Pertinent information has been summarised from the PRA in Table 2-1.

Main Historical Features	The site was historically occupied by terraced housing between 1896 and 1965 mapping. A section of this terraced housing was noted to be absent by 1950 mapping and this may be related to the bombing of the area during the Second World War. More recently the site has been occupied by a warehouse and a public house.
Geology / Hydrogeology	Artificial: No BGS recorded artificial. Superficial: Glaciofluvial deposits (sand and gravel). Secondary A Aquifer. Bedrock: Chester Pebble Beds - Secondary A Aquifer.
Landfills / Infilled Ground	No recorded landfills.

Table 2-1: Summary of site details, historical review, environmental settings, and site reconnaissance.

Table 2-2 summarises the geotechnical constraints. This has been updated to consider the previous site investigation work.

Coal Mining	Site is not within a Development High Risk Area. No further assessment required.
Envirocheck Ground Stability Hazards	No to low hazard identified. No further action required.
Made Ground	Unknown depth and constituent of made ground across the site. Initial information indicates relatively deep made ground. Possible in-ground structures from previous developments. Unlikely to be a suitable founding stratum unless engineering work is undertaken.
Superficial	Unknown strength of soils for foundation design. Clay / sand anticipated below the site. Strata may be variable giving differential settlement.
Bedrock	Unknown depth to bedrock.
Groundwater	Unknown depth and variability of groundwater. Shallow / fluctuating groundwater can affect the strength of the soil, particularly in granular ground. Shallow groundwater can also affect construction works.
Plasticity	Plasticity of clay deposits should be confirmed, particularly where trees are present or proposed, to identify the shrink / swell risk.
Sulphate	Unknown sulphate content of the made ground and natural.
Road / Pavement Design	Unknown CBR values for footpath and road design.

Table 2-2: Summary of geotechnical constraints.

2.2. Previous Site Investigations

Previous investigation work has been undertaken by others on a small portion of the site and also on the adjacent land to the east. The relevant findings of this previous work are summarised below:

- Previous intrusive investigation work in the north west of the site identified made ground to depths of up to 5mbgl comprising gravels and clay with demolition rubble.
- Underlying the made ground was firm orange brown clay with varying amounts of silt, sand and gravel or loose to dense gravel with varying amounts of clay, silt and sand to depths between 4.5mbgl and 5.0mbgl.

- The bedrock, where encountered, at depths of 4.5m to 5.0mbgl was described as highly weathered weak friable sandstone, extremely weak in the uppermost weathered zone.
- No groundwater was encountered during investigation works in the north west corner but post investigation monitoring recorded groundwater at approximately 4.4mbgl within the natural superficial. Some perched water within the made ground was also identified.
- No significant groundwater or soil contamination was considered to be present in the north west corner of the site based on the site being completely covered by hardstanding.
- Gas monitoring undertaken did not record any significantly elevated concentrations of gas or flow rates.
- A geotechnical appraisal of the north west corner of the site concluded that shallow foundations would not be suitable and piled foundations into the weathered sandstone were recommended.

2.3. Conceptual Model

The preliminary contamination conceptual model using contaminant-pathway-receptor linkages based on guidance in LCRM¹ has been summarised in Table 2-3.

Each pollutant linkage is described along with an assessment of the risk based upon guidance on probabilities and consequences outlined in CIRIA C552². The risk matrix is provided in Appendix A.

PL	Pathway	Receptor	Contaminant (source)	Probability	Consequence	Risk
PL1	<ul style="list-style-type: none"> -Dermal contact. -Inhalation of soil, fibres and dust. -Ingestion of soils, dust, vegetables, soil attached to vegetables. -Windblown dust. 	<ul style="list-style-type: none"> -Future site users. -Offsite receptors. 	<ul style="list-style-type: none"> -Heavy metals -PAHs -ACM -Hydrocarbons (made ground, infilled basements, fuel storage, offsite former industries). 	Low Likelihood	Medium	Moderate / Low
PL2	<ul style="list-style-type: none"> -Inhalation of vapours. -Migration through permeable strata and preferential pathways. 	<ul style="list-style-type: none"> -Future site users. -Offsite receptors. 	<ul style="list-style-type: none"> -Volatile Contaminants such as hydrocarbons, (made ground, fuel storage, boiler). 	Low Likelihood	Medium	Moderate / Low
PL3	<ul style="list-style-type: none"> -Inhalation of gas. -Migration through permeable strata and preferential pathways. -Explosion in confined spaces. 	<ul style="list-style-type: none"> -Future site users. -Buildings. -Offsite land users. 	<ul style="list-style-type: none"> -Methane, carbon dioxide. (potentially infilled features 250m of the site, made ground onsite). 	Unlikely	Severe	Moderate / Low
PL4	<ul style="list-style-type: none"> -Surface Run-off. -Migration through permeable strata and preferential pathways -Perched waters migration. 	<ul style="list-style-type: none"> -Groundwater (Principal Aquifer). 	<ul style="list-style-type: none"> -Mobile contaminants such as metals, PAHs, hydrocarbons (made ground, fuel storage, boiler). 	Low Likelihood	Medium	Moderate / Low
		<ul style="list-style-type: none"> -Surface water (Bridgewater Canal). 		Unlikely	Medium	Low
PL5	<ul style="list-style-type: none"> -Ingestion of tainted water supply. 	<ul style="list-style-type: none"> -Future site users. -Water pipes. 	<ul style="list-style-type: none"> -Organic Contaminants such as hydrocarbons (made ground, fuel storage, boiler). 	Low Likelihood	Medium	Moderate / Low

Table 2-3: Preliminary Contamination Conceptual Model.

3. Ground Investigation

3.1. Site Investigation Design and Methodology

The investigation was carried out on 1st August 2018 and between 11th-14th December 2018 and comprised the following:

- 4no. window sample boreholes drilled to 3.44-5.86 metres below ground level (mbgl) (ref. WS101 to WS104).
- 2no. rotary boreholes drilled to 20mbgl (ref. BH1 & BH2).
- 8no. trial pits (using JCB) excavated to 0.9-1.2mbgl (ref. TP101 to TP108).

All site investigation locations are shown in **Figure 4**.

The window sample boreholes were undertaken to assess made ground and superficial deposits and to allow the installation of gas monitoring wells.

The rotary boreholes were drilled to assess the depth to bedrock and to obtain rock core samples of the underlying sandstone for testing.

Trial pits were excavated to assess made ground and superficial deposits while obtaining samples for chemical and geotechnical testing. In addition, some trial pits targeted potential below ground obstructions identified during a previous GPR survey.

The exploratory locations were chosen in consultation with the structural engineers to ensure sufficient information was obtained to allow foundation design and contaminated land risk assessment to be undertaken. At the time of the investigation work, the site was in use and some of the locations were relocated due to access restrictions.

All site investigation locations are shown in Figure 4.

All profile logs are provided in Appendix B and are in line with BS14688-1³ and BS5930⁴.

3.2. Well Installations

The window sample boreholes were installed with monitoring wells for gas and groundwater monitoring and groundwater. Deeper monitoring wells were installed in the rotary boreholes to assess groundwater within the bedrock. Monitoring wells were installed in accordance with BS10175 and CIRIA C665 .

Well installation details are provided in profile logs in Appendix B. Well installation details are provided in Profile Logs in Appendix B.

3.3. Sampling Protocol

3.3.1. Soil Sampling (Contamination)

Standard sampling protocol and preservation of samples was undertaken as described in the EA guidance on site investigation⁵.

Soil was collected for onsite testing for total volatile organic compounds (TVOCs) using a photoionisation detector (PID) fitted with a 10.6eV lamp and moisture trap. A plastic zip bag was half filled with soil allowing a suitably sized headspace. The bag was sealed and stored for at least 20 minutes before being tested. Results of the PID readings are

presented on the profile logs (Appendix B). The onsite monitoring was carried out in line CIRIA C665⁶ to aid in screening samples for volatile analysis.

Soil samples of approximately 500g were recovered in amber jars and plastic tubs. All the samples were sent to DETS laboratory for chemical testing.

Many of the contamination tests are UKAS or MCERTS accredited and further details are given in the Certificate of Analysis presented in Appendix C. Table 3-1 shows the soil testing undertaken.

Testing	No. Samples	Justification
Metals / metalloids, pH, water soluble sulphate, speciated PAHs, SOM and asbestos screen.	8	A basic suite with a broad selection of contaminants tested on samples across the site where no significant evidence of contamination was identified (with the exception of ash, clinker and coal) and no TVOCs identified from the PID tests.
Metals / metalloids, pH, water soluble sulphate, cyanide suite, phenol, TPHCWG, BTEX, MTBE, speciated PAHs, SOM and asbestos screen.	3	Although no visual/olfactory evidence of contamination was identified (with the exception of some ash), comprehensive suite of contaminants tested for including hydrocarbons to confirm the absence of significant mobile contamination and allow waste soil classification to be undertaken.

Table 3-1: Summary of Soil Testing.

Notes:

If asbestos present during screen identification and quantification will be undertaken.

Metal/metalloids=arsenic, cadmium, chromium, (total and hexavalent), copper, lead, mercury, nickel, selenium, vanadium, zinc, and boron; TPHCWG=carbon banded and aromatic/aliphatic split petroleum hydrocarbons; PAH=polycyclic aromatic hydrocarbons, BTEX=benzene, toluene, ethylbenzene, and xylenes; MTBE=Methyl tert-butyl ether, SOM=Soil Organic Matter.

3.3.2. Soil Sampling (Geotechnical)

Soil samples taken during the investigation were collected in tubs, bulk bags and sealed U100 tubes for testing and sent to Murray Rix Laboratories / Chemtest for geotechnical testing.

Further details are given in the laboratory report presented in Appendix D. Table 3-2 shows the geotechnical testing undertaken.

Testing	No. Samples
pH and water-soluble sulphate	2
Atterberg Limits (plasticity testing)	1
Single Stage Triaxial	1
Particle Size Distribution (PSD)	4
BRE Suite Short / Full	1
Uniaxial Compressive Strength (UCS)	10
Point Load Tests	40

Table 3-2: Summary of Geotechnical Testing Undertaken.

3.3.3. Water Sampling / Leaching Testing

To establish the condition of deeper groundwater LKC collected two groundwater samples. Sampling was carried out in accordance with BS5930⁷ and BS5667-11⁸.

The groundwater samples were collected a minimum of 1 week after drilling had finished. Sample collection was undertaken using a low flow sampling pump. The sample was collected in glass and plastic bottles and a glass vial. A water meter was used to test the pH, temperature, and conductivity before sampling until equilibrium conditions were met, as per BS10175⁹ guidelines.

The samples were sent to DETS laboratory for analysis. The sampling suite is presented in Table 3-3.

Many of the tests are UKAS or MCERTS accredited and further details are given in the Certificate of Analysis presented in Appendix E. Table 3-3 shows the groundwater testing undertaken.

Testing	No. Samples	Justification
Metals / metalloids, pH, sulphate, cyanide suite, TPHCWG, BTEX, MTBE, speciated PAHs, phenol, and hardness.	2	Detailed suite undertaken in groundwater samples installed in the underlying bedrock to confirm the absence of contamination.

Table 3-1: Summary of Groundwater/Leachate Tests Undertaken.

Notes:

Metal/metalloids=arsenic, cadmium, chromium, (total and hexavalent), copper, lead, mercury, nickel, selenium, vanadium, zinc, and boron; TPHCWG=carbon banded and aromatic/aliphatic split petroleum hydrocarbons; PAH=polycyclic aromatic hydrocarbons, BTEX=benzene, toluene, ethylbenzene, and xylenes; MTBE=Methyl tert-butyl ether.

3.4. In-situ Testing

3.4.1. Geotechnical Testing

In-situ geotechnical tests were performed in the boreholes to further characterise the sub-soil conditions. The following tests were undertaken:

- Standard Penetration Tests (SPTs) were performed in the window sample boreholes at approximately 1m intervals.
- Shear vane tests (giving undrained shear strength) were performed in the window sample boreholes and trial pits within cohesive strata.

Shear vanes tests /pocket penetrometer tests were not always possible due to the friable or gravel rich nature of some of the clay deposits. The results are provided within Appendix D.

3.5. Gas Monitoring

3-month period (August 2018 to November 2018) in monitoring wells installed in the window sample boreholes. In addition, two monitoring visits were undertaken in late January and early February 2019 to include the deeper boreholes.

Monitoring was undertaken using a Geotechnical Instruments GA2000 plus / GA5000 in accordance with the monitoring protocol outlined in CIRIA C665 (flow rate measured first). The monitoring was undertaken over a range of weather conditions (including low and falling barometric pressure and heavy rain) to demonstrate worst-case conditions.

The gas monitoring results (including PID results), are reproduced in full in Appendix F.

4. Ground Conditions

4.1. Geology

The ground conditions beneath the site are summarised below. Logs are provided in Appendix B.

4.1.1. *Made Ground*

Made ground was recorded to a thickness of between 0.9-5.05mbgl and generally comprised dark brown gravelly sandy clay with quantities of concrete, brick, glass, ash, clinker, ceramic, pottery, timber and metals. The deeper thicknesses of made ground are considered likely to be associated with former infilled basements.

No visual or olfactory evidence of significant hydrocarbon contamination was encountered.

4.1.2. *Natural Strata*

Drift deposits were encountered in all exploratory locations to a maximum proven depth of 4.2mbgl within the window sample boreholes. Generally, the drift comprises firm gravelly sandy and silty CLAY. However, slightly gravelly very silty SAND was also encountered in localised areas.

Due to the weathered nature of shallow underlying sandstone, it was often difficult to determine the boundary between the drift deposits and solid geology. In a majority of window sample boreholes, clayey SAND was encountered at the base of the drift deposits, but this is likely to represent extremely weathered sandstone.

Weathered sandstone was encountered from 4.2mbgl in the window sample boreholes and refusal on more competent bedrock at 5.8-6.0mbgl. Bedrock was cored to a maximum depth of 20mbgl, coring was carried out from 8mbgl in RBH101 and 6.5mbgl in RBH102. The recovered rock was logged as weak red with grey/yellow banding coarse grained micaceous SANDSTONE with occasional rounded quartz gravel inclusions which is consistent with the Chester Pebble Beds (Sherwood Sandstone).

4.1.3. *Contamination*

Except for the anthropogenic material encountered in the made ground (as described above), no further contamination was identified.

4.1.4. *Obstructions*

Trial pits were undertaken in a number of locations to assess unidentified below ground structures detected by a previous ground penetrating radar (GPR) survey. The following below ground structures or previously unidentified services were identified:

- TP101 – Brick wall encountered in the southeastern wall of the trial pit to a depth of 2.5mbgl.
- TP107 – Previously unidentified water pipe encountered at 0.55m corresponding with the GPR trace.

No other below ground structures were encountered but it is likely that further obstructions such as former footings and walls are present given the history of the site.

The other unidentified features from the GPR survey are considered likely to be denser made ground and brick rubble encountered in the trial pits.

It should be noted that a potential significant constraint to development is the below ground United Utilities Pumping Station located beneath Hulme Hall Road to the west of the site.

4.2. Groundwater

4.2.1. Groundwater Levels

No groundwater strikes were encountered in the trial pits or window sample boreholes. During subsequent monitoring of the window sample boreholes, all monitoring wells were found to be dry on every visit.

Groundwater levels in the monitoring wells installed within the underlying bedrock recorded groundwater levels between 4.9-4.95mbgl. This is general agreement with the findings of previous investigations on the adjacent site to the east where groundwater levels have been recorded between 5.4-5.8mbgl and strikes recorded as shallow as 4.5mbgl.

4.3. In-Situ Geotechnical Testing

4.3.1. Standard Penetration Tests

In-situ standard penetration tests (SPTs) were undertaken, predominantly in the natural ground. The results are summarised in Table 4-1 and provided within the profile logs in Appendix B.

Depth (m)	WS101	WS102	WS103	WS104
1-2	13 (C)	5 (MG)	8 (MG)	19 (MG)
2-3	8 (C)	6 (C)	4 (MG)	12 (MG)
3-4	13 (C)	26 (C)	5 (MG)	>50 (S/S)
4-5	19 (C/S)	21 (C) >50 (S/S)	14 (MG)	-
5-6	35 (S)	-	>50 (S/S)	-
GW Level	Dry	Dry	Dry	Dry

Table 4-1: Summary of SPT (N) values.

Notes:

S/S = Sandstone; S=Sand; C=Clay; MG=Made Ground.

Groundwater level based on strikes during investigation and monitoring data.

4.4. Geotechnical Laboratory Testing

4.4.1. Single Stage Triaxial Test

Single stage triaxial testing was undertaken on one sample of the natural clay strata. The results are presented in Appendix D and summarised in Table 4.2.

Location	Depth (mbgl)	Material Description	Undrained Shear strength (kPa)
WS102	1.3-2.0m	Soft brown silty very sandy CLAY	23

Table 4-2: Summary of multi/single stage triaxial results.

4.4.2. Particle Size Distribution

Particle size distribution (PSDs) tests were carried out on granular strata to confirm the material type. Full results are presented in Appendix D and summarised below in Table 4-3.

Location	Depth (mbgl)	Material	Percent passing through sieve		
			63mm	2mm	0.063mm
WS101	4.2-5.0m	Brown silty SAND with rare gravel.	100%	99%	19%
WS104	3.2-3.44m	Brown silty SAND and GRAVEL.	100%	53%	12%
TP101	1.5-2.1m	Brown clayey silty SAND with frequent gravel.	100%	76%	22%
TP102	2.7-3.0m	Brown slightly clayey silty SAND with occasional gravel.	100%	80%	14%

Table 4-3: Summary of particle size distribution results.

Notes:

% passing: 63mm = cobble / gravel boundary; 2mm = gravel / sand boundary; 0.063mm = sand / silt boundary

4.4.3. Atterberg Limits

A representative sample of suspected cohesive material (WS101 2.0-3.0m) was subjected to Atterberg Limits (plasticity) testing. However, due to the non-plastic nature of the material no determination on the plasticity or shrinkability could be undertaken.

4.4.4. Compressive Strength Testing

Uniaxial Compressive Strength (UCS) tests have been undertaken on ten samples of the competent sandstone strata. In addition, a total of forty point load tests were undertaken on rock core samples recovered. The results are presented in Appendix D and summarised in Tables 4-4 and 4-5.

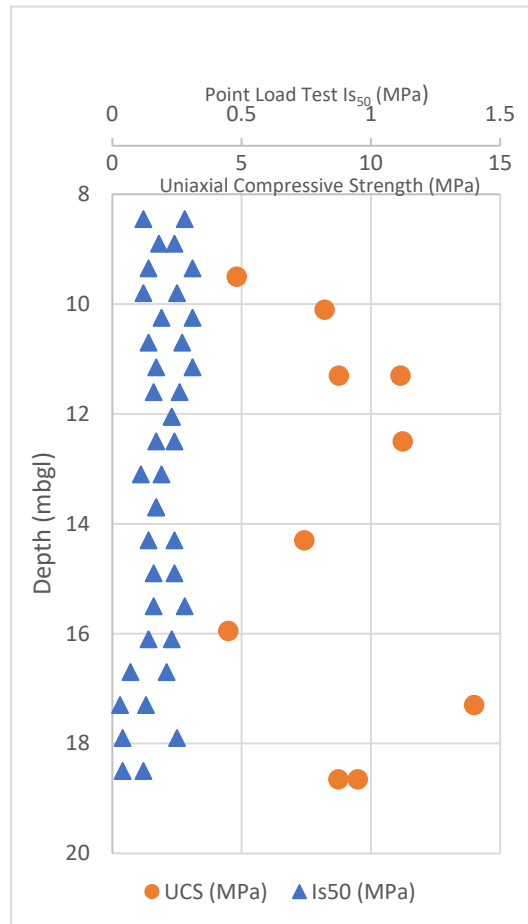
Location	Depth (mbgl)	UCS (MPa)	Rock Strength Classification
BH1	9.5-11.0	8.21	Weak
	11.0-12.5	8.76	Weak
	14.0-15.5	7.42	Weak
	15.5-17.0	4.48	Very Weak
	18.5-20.0	9.49	Weak
BH2	9.5-11.0	4.81	Very Weak
	11.0-12.5	11.14	Weak
	12.5-14.0	11.23	Weak
	17.0-18.5	13.99	Weak
	18.5-20.0	8.74	Weak

Table 4-4: Summary of UCS results.

Location	Depth (mbgl)	Is (MPa) range	Is ₍₅₀₎ (MPa) range	Mean Is ₍₅₀₎ MPa
BH1	9.5-15.5	0.03-0.19	0.04-0.24	0.11
	15.5-20	0.09-0.18	0.12-0.23	0.16
BH2	9.5-15.5	0.1-0.22	0.12-0.28	0.2
	15.5-20	0.18-0.24	0.23-0.31	0.27

Table 4-5: Summary of Point Load Test results.

Graph 4-1 shows the point load results and laboratory UCS test results against depth below ground level.



Graph 4-1: UCS and Point Load Results against depth.

UCS laboratory data ranged between 4.48 and 13.99MPa, which would classify the rock as predominantly 'weak' based on BS5930:2015 rock strength classifications. Higher UCS results were generally recorded in the rock cores taken from BH2 compared to the results from BH1. A significantly lower UCS value was recorded in BH1 at 15.5-17.0m (4.48MPa) and the rock quality parameters and description of the rock in this location and depth suggests a zone of weaker rock with increased fracturing.

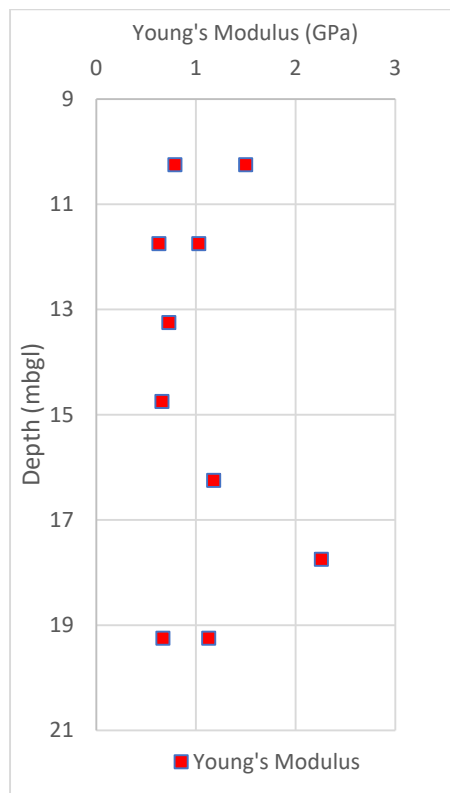
Referring to Graph 4-1, the mean point load $I_s(50)$ value is c.0.2 MPa and the mean UCS is c.8.0 MPa giving a correlation factor of 40 which is an indication of the general weak nature of the bedrock consistent with the poorly cemented sandstones of the Sherwood Sandstone Group.

4.4.5. Deformability of Rock

Ten samples of competent rock were subjected to deformability tests to obtain Young's modulus. The results are presented in Appendix D and summarised in Table 4-6 and plotted with depth in Graph 4-2.

Location	Depth (mbgl)	Youngs Modulus (GPa)	
		Average	Secant
BH1	9.5-11.0	1.20	0.79
	11.0-12.5	1.02	0.63
	14.0-15.5	1.31	0.66
	15.5-17.0	0.93	1.18
	18.5-20.0	0.89	1.13
BH2	9.5-11.0	4.81	1.50
	11.0-12.5	11.14	1.03
	12.5-14.0	11.23	0.73
	17.0-18.5	13.99	2.26
	18.5-20.0	8.74	0.67

Table 4-6: Summary of Youngs Modulus results.



Graph 4-2: Young's Modulus against depth.

Young's moduli values range between 0.63 and 2.26 GPa which is consistent with typical values for weak sandstone. For example, published values of Young's Modulus for Sherwood Sandstone are generally between 0.35 and 3.5 GPa.

5. Geotechnical Assessment

Proposed Development	Construction of two residential apartment blocks (maximum 18 storey) with a single storey basement level in one building.
General Ground conditions / Geotechnical Testing	<p>Maximum investigation depth 20mbgl.</p> <p>Made Ground to 0.9-5.05mbgl. SPT N=4-12 at 1-3mbgl.</p> <p>Drift deposits predominately gravelly sandy or silty CLAY to a maximum proven depth of 4.2mbgl. SPTs N=13 at 1mbgl, N=6-8 at 2m, N=13-26 at 3-4mbgl.</p> <p>Weathered sandstone recovered as clayey SAND encountered below drift deposits to refusal on more competent bedrock at 5.8-6.0mbgl.</p> <p>Bedrock of weak, red with grey/yellow banding coarse grained micaceous SANDSTONE with occasional rounded quartz gravel inclusions encountered from 6.5mbgl.</p> <p>Plasticity tests not possible on superficial clay due to non-plastic nature of the material.</p> <p>Laboratory UCS results on rock cores were between 4.48 and 13.99MPa characterising the bedrock as predominately weak.</p> <p>Young's Modulus between 0.63 and 2.26GPa.</p>
Basement Floor Slab: Allowable Bearing Pressure	-Ground bearing floor slabs are acceptable founded on firm clay or medium dense sands or on weathered bedrock. It is recommended to install underdrainage underneath the floor slab connected to a pumpable sump to minimise buoyancy uplift risk during construction and for the long term in the advent of raised groundwater conditions or incoming surface waters.
Basement Retaining Walls	-Trial pit sides became unstable below 1.2mbgl due to loose made ground. Retaining walls will be required for the excavation of the basement. A contiguous (or secant) piled wall will be required prior to excavations. The local authority (highways) may require the design life to be 120 years. Deep embedment and/or reinforcing with whaling and anchors and/or internal braces may be required. It is recommended that advice from a suitably qualified and experienced piling contractor be sought at the earliest juncture.
Piles and Piling Estimates	<p>Bored piles are recommended.</p> <p>Assuming 5270kN load and 2no. 600mm diameter piles per pile cap, it is estimated that a rock socket of between 5m to 7m in length will be required. Total pile length below basement floor level will be circa 8m to 10m depending on thickness of made ground and drift deposits and top of competent bedrock.</p> <p>Piles may require lengthening or larger diameters depending on groundwater depths.</p> <p>Due to the inherent strength variability of the Sherwood Sandstone, it is recommended to carry out a comprehensive pile load testing programme.</p> <p>-The appointed specialist piling contractor will be able to optimise pile design such as pile grouping per pile cap, pile diameter & pile spacing, installation methodology, pile cap settlement, and socket lengths to suit from the SI data.</p>
Concrete Requirements	Based on BRE Digest 2005 ¹⁰ – DS-2 AC-2 recommended.
Services	Services – consideration to the presence of services running through the site. Services may need to re-routed.
Coal Mining	The site is not within a Coal Mining Development High Risk Area.
Temporary support of excavation	May be required; however, trial pits were generally recorded as stable.

Table 5-1: Geotechnical assessment.

6. Generic Risk Assessment

6.1. Introduction

Current good practice requires that the findings from a site investigation should be evaluated on a site-specific basis, using a risk-based approach. Risk assessment involves identification and evaluation of the hazards presented by the concentrations of contaminants measured followed by an evaluation of the risks which are associated with these hazards (LCRM¹¹). Information gathered from the risk assessment has been collated in the revised contamination conceptual model in Section 6.6.

6.2. Soil Risk Assessment

6.2.1. Methodology

With regards to the soil risk assessment LKC will use the following hierarchy:

- Category 4 Screening Levels (C4SLs) ^{12, 13}.
- LQM Suitable 4 Use Levels (S4ULs) ^{14, 15, 16, 17}.

The proposed development is for residential apartments with limited shared soft landscaping, therefore the assessment criteria for residential without plant uptake has been used.

All criteria have been generated using the CLEA V1.06 model¹⁸ based either on 1%, 2.5% and 6% Soil Organic matter (SOM). Results will be compared to the nearest appropriate SOM.

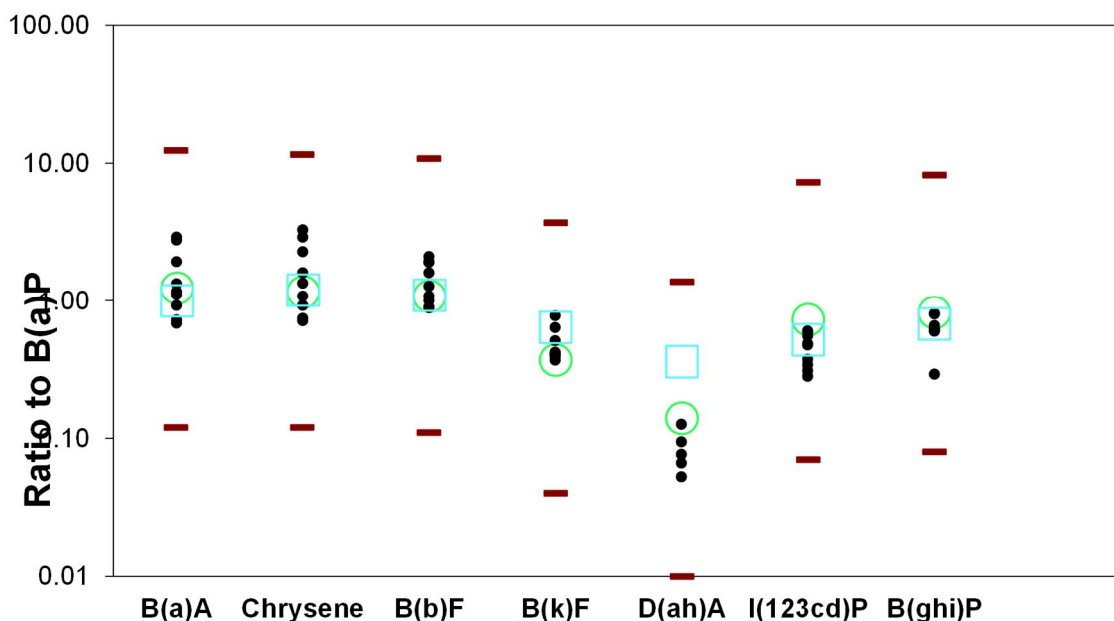
A summary of the generic assessment criteria used in this assessment is provided in Appendix H.

B(a)P as Surrogate Marker

LKC consider the main risk drivers for PAHs are benzo(a)pyrene (B(a)P) and naphthalene. This is due to B(a)P possibly being a carcinogen and most toxic of the PAHs^{19,20} and naphthalene the most volatile and soluble²¹. The C4SLs indicate B(a)P as a surrogate marker for carcinogenic PAHs, if it falls within appropriate limits, since the risk from other non-carcinogenic PAHs are considered negligible²². For B(a)P to be used as a surrogate marker it should follow the profile described by the HPA (2008)²³ and CL:AIRE (2013). Naphthalene will be treated separately using the LQM S4ULs.

LKC undertook an assessment of the PAH data for the site with regards to using B(a)P as a surrogate marker for carcinogenic PAHs as per HPA and CL:AIRE guidelines. The primary toxicological study related to Culp *et al.*²⁴, which was based on coal tar mixtures (>80,000mg/kg of total PAHs) fed in food to mice over a two-year carcinogenicity study.

Graph 6-1 summarises the study site data with respect to how the ratios of carcinogenic PAHs relate to B(a)P, within the confidence limits provided in the HPA document.



Graph 6-1: The ratio of PAH to B(a)P in soil for all available data at the site based on 5 samples (where values were >LOD to allow the calculation of a ratio).

Notes:

B(a)P = Benzo(a)pyrene; D(ah)A = Dibenzo(ah)anthracene; B(a)A = Benzo(a)anthracene; B(b)F = Benzo(b)fluoranthene;

B(k)F = benzo(k)fluoranthene; I(123cd)P = Indeno(123cd)pyrene; B(ghi)P = Benzo(ghi)perylene

● = Ratio to B(a)P for all data ○ = Mean ratio to B(a)P for Culp data △ = Mean ratio to B(a)P from all data at the site

□ = Mean ratio to B(a)P for UK data presented by HPA — = Upper and Lower limits (order of magnitude from Culp data)

All the data points that could be used to calculate ratios fall inside the upper or lower limits.

Based on this distribution of data LKC considers B(a)P can be used as a surrogate marker for carcinogenic PAHs and the C4SL criteria is suitable for this dataset.

6.2.2. Soil Results Comparison against Assessment Criteria

All analysis sheets are presented in Appendix C. Elevated results are presented in Table 6-1.

Contaminant	Units	No. of samples	Elevated Results	Sample Location	Criteria	Source of Criteria
Metals						
Arsenic	mg/kg	11	42	WS101 0.2-0.9m	40	C4SL
			41	WS102 0.2-0.6m		
			52	TP101 0.5-1.4m		
Lead	mg/kg	11	1,000	WS102 0.2-0.6m	310	C4SL
			330	WS103 0.3-1.2m		
			520	TP105 0.5-1.5m		
			410	TP106 0.1-0.55m		
			480	TP108 0.1-1.0m		
PAHs						
Benzo(a)pyrene	mg/kg	11	35	TP105 0.1-0.7m	5.3	C4SL
			13	TP105 0.5-1.5m		
			87	TP106 0.1-0.55m		
			12	TP108 0.1-1.0m		
GENERAL						

Contaminant	Units	No. of samples	Elevated Results	Sample Location	Criteria	Source of Criteria
pH	pH	11	Range 6 to 11.6			
SOM	%	6	Range 2.8 to 12			
Asbestos	N/A	6	Detected (see Table 6-2)			

Table 6-1: Summary of Elevated Results.

Notes:

All units in mg/kg.

Only results that exceeded assessment criteria have been shown and results from all depths are noted.

Results have been compared to the nearest appropriate SOM for the assessment criteria hierarchy described in Section 6.2.

Asbestos was identified, as detailed in Table 6-2.

Sample Location	ID	Type	Total Asbestos (%)
WS101 (0.2-0.9m)	Chrysotile	Fibres/Clumps	0.001

Table 6-2: Details of Asbestos Identified.

6.2.3. Direct Contact Risk – Pollutant Linkage 1

Metals, PAHs, Asbestos

Elevated PAHs and metals (arsenic and lead) have been identified on site, given the number and location of elevated samples, the contamination is considered to be site wide.

The source of the contamination is expected to the ash and clinker noted in the made ground.

Asbestos was only detected in one made ground sample out of eleven tested. The source of the asbestos is likely to be from demolition rubble from former buildings present in made ground.

At the concentrations identified, the contaminants are considered to pose a potential risk to future site users (residents) in the small areas of soft landscaping only, where made ground may be exposed. The principal pathways are the ingestion pathways (soil and dust) and dermal contact.

The probability of PAH, metal and asbestos contamination affecting site users is low given the size of the soft landscaped areas. With a medium consequence, the risk is considered to be moderate/low and remediation is recommended in any proposed soft landscaping.

Additional consideration should also be given to the risk to workers and offsite receptors during groundworks and construction. This is discussed further in Section 7.3.

Petroleum hydrocarbons

No elevated concentrations of hydrocarbons were identified, therefore the probability of these contaminants posing a risk to site users is considered unlikely. With a medium consequence, the risk is considered to be low and no remediation is recommended.

6.2.4. Risk from Inhalation of Vapours – Pollutant Linkage 2

No visual / olfactory evidence of volatile contaminants was identified during the investigation. The PID did not detect any TVOCs above instrument detection limits.

LKC therefore consider the probability of volatile contaminants affecting site users as unlikely. The consequence is expected to be medium, giving a low risk and no remediation is required with respect to pollutant linkage 2.

6.3. Gas Risk Assessment

Six gas monitoring visits have been undertaken on the study site at request of the client. Gas monitoring results in full are presented in Appendix F. Following guidance set out in CIRIA C665²⁵ and BS8485²⁶ peak methane and carbon dioxide concentrations have been used in the gas risk assessment. In addition, and as per guidance, flow rates were measured first.

All gas concentrations, flow, pressure and groundwater levels are shown on Table 6-2.

	Visit	CH ₄ (%v/v)	CO ₂ (%v/v)	O ₂ (%v/v)	H ₂ S (ppm)	CO (ppm)	Flow (l/h)	Ground water (mbgl)	Pressure (mb)
WS101	1	<0.1	4.4	6.6	<0.1	4	<0.1	Dry	1006 (r)
	2	<0.1	4.3	6.4	<0.1	2	<0.1	Dry	1020 (s)
	3	<0.1	4.5	8.0	<0.1	<0.1	<0.1	Dry	1029 (r)
	4	0.1	5.1	7.5	<0.1	1	<0.1	Dry	1007 (f)
	5	Unable to access							
	6	0.2	8.9	9.8	<0.1	<0.1	<0.1	Dry	984 (f)
	7	0.1	3.8	12.3	<0.1	<0.1	0.1	Dry	1007 (r)
	8	0.1	1.9	17.8	<0.1	1	<0.1	Dry	1012 (s)
WS102	1	<0.1	8.4	11.0	<0.1	8	<0.1	Dry	1007 (r)
	2	<0.1	7.9	10.7	<0.1	1	<0.1	Dry	1020 (s)
	3	<0.1	6.1	13.0	<0.1	<0.1	<0.1	Dry	1029 (r)
	4	0.1	4.8	15.5	<0.1	1	<0.1	Dry	1008 (f)
	5	Unable to access							
	6	0.2	7.4	10.7	<0.1	<0.1	<0.1	Dry	985 (f)
	7	0.1	4.6	16.1	<0.1	<0.1	0.2	Dry	1007 (r)
	8	0.1	4.2	15.8	<0.1	<0.1	<0.1	Dry	1012 (s)
WS103	1	<0.1	1.8	19.0	<0.1	20	<0.1	Dry	1006 (r)
	2	<0.1	1.7	19.0	<0.1	<0.1	<0.1	Dry	1020 (s)
	3	<0.1	1.2	19.3	<0.1	<0.1	<0.1	Dry	1029 (r)
	4	0.2	1.4	19.4	<0.1	1	<0.1	Damp	1009 (f)
	5	<0.1	1.3	19.2	<0.1	<0.1	<0.1	Dry	1027 (r)
	6	0.2	0.9	20.8	<0.1	<0.1	<0.1	Dry	985 (f)
	7	0.1	1.3	20.0	<0.1	<0.1	0.2	Dry	1007 (r)
	8	0.1	1.6	18.9	<0.1	<0.1	<0.1	Dry	1012 (s)
WS104	1	<0.1	1.0	20.1	<0.1	4	<0.1	Dry	1005 (r)
	2	<0.1	0.5	19.7	<0.1	1	<0.1	Dry	1020 (s)
	3	<0.1	0.4	19.3	<0.1	<0.1	<0.1	Dry	1029 (r)
	4	0.2	0.6(0.2)	20.6	<0.1	1	<0.1	Dry	1008 (f)
	5	<0.1	1.4	18.0	<0.1	<0.1	<0.1	Dry	1027 (r)
	6	0.2	0.8 (0.1)	21.1	<0.1	<0.1	<0.1	Dry	984 (f)
	7	0.1	0.1	20.9	<0.1	<0.1	0.1	Dry	1007 (r)
	8	0.1	0.1	20.5	<0.1	<0.1	<0.1	Dry	1012 (s)
BH1	7	Unable to monitoring due to standing water on surface.							4.9
	8	Unable to monitoring due to standing water on surface.							1007 (r)
BH2	7	0.1	3.8	16.7	<0.1	<0.1	0.1	4.95	1007 (r)
	8	0.1	4.5	15.5	<0.1	<0.1	<0.1	4.93	1012 (s)

Table 6-2: Gas Monitoring Assessment.

The gas concentrations and flow rates were generally consistent in each monitoring location throughout the monitoring period and, as anticipated, the highest gas concentration was recorded during low and falling barometric pressure.

Low oxygen (minimum of 6.6%v/v) was recorded in WS101 and WS102 over the monitoring period. The lower oxygen detected in these wells is likely to be due to biological oxygen demand from organic material in the made ground in these locations. Due to the heterogeneity of made ground, the lower oxygen was not detected in the other monitoring locations.

Carbon monoxide was >1ppm in all boreholes during the first monitoring visit with the maximum concentration being 20ppm in WS102.

Only workplace exposure limits defined by the HSE are available for carbon monoxide and are not fully applicable to a residential setting. A Short-Term Exposure Limit of 200ppm (15-minute period) and Long-Term Exposure Limit of 30ppm have been defined (8-hour period).

Based on the above exposure limits, carbon monoxide is not expected to pose a significant risk to the proposed site receptors.

Gas Screening Value

In accordance with CIRIA C665²⁷, a Gas Screening Value (GSV) may be calculated. Assuming worst-case scenario maximum gas concentrations and flow for each borehole have been used to calculate the GSV. The GSV can be used to determine the characteristic situation (CS).

Table 6-3 shows the maximum GSV for each borehole and the appropriate characteristic situation (based on GSV only). An overall site assessment (WS101-WS104) has also been included (worst case values across the site).

Boreholes	Max GSV (l/hr)	CS
WS101	0.0089	CS1
WS102	0.017	CS1
WS103	0.0036	CS1
WS104	0.001	CS1
BH2	0.0045	CS1
All boreholes	0.0089	CS1

Table 6-3: Summary of Worst-Case Gas Screening Values (GSV).

Notes:

CS = Characteristic Situation.

In addition, in accordance with CIRIA C665, if carbon dioxide and methane are recorded above 5%v/v and 1%v/v respectively, you should consider upgrading the characteristic situation from CS1 to CS2.

The proposed development includes one apartment block (Block A) with a basement car park and therefore, a significant quantity of the underlying made ground, seen as the most probable source of the elevated gas concentrations, will be removed. In addition, the basement car park which will be well ventilated to avoid the build up of exhaust fumes, will provide adequate protection from the ingress of any hazardous gas to this apartment block (Block A).

The second building in the south of the site (Block B) does not have a basement car park but it is understood that this building will include a suspended reinforced concrete ground floor slab. Although, carbon dioxide concentrations have been recorded above 5%, flow rates have been very low or negligible. This suggests that, although small quantities of gas are being generated in the made ground, there is insufficient driving force to allow them to penetrate the proposed reinforced floor slab based on flow rates recorded.

LKC consider the probability of carbon dioxide and methane gas affecting site users and buildings as unlikely. Assuming a severe consequence, there is a moderate/low risk but, given the proposed basement level, a low risk is assumed, and no formal gas protection measures are required.

6.4. Controlled Water Assessment

LKC considers the Principal Aquifer as the primary receptor.

LKC have compared results above Limits of Detection (LOD). Where relevant the review of priority substances takes precedence considering threshold values for groundwater cannot be used 'as part of site specific investigations'. The hierarchy is as follows:

- River Basin District Standards and updated Water Framework Directive for Annual Average / Maximum Allowable Concentration Environmental Quality Standards (AA-MAC-EQS) for priority substances (surface water risk).
- 2001 Environment Agency Values for Environmental Quality Standards (EQS) .
- 2001 Environment Agency Values for UK Drinking Water Standard (UKDWS)
- Surface Water Abstraction Directive (SWAD) based on A2 treatment (TPH only).
- Resource Protection Values (RPVs) .
- Minimal Reporting Values (MRVs).

The risk from List 2 compound (EC Dangerous Substance Directive 76/464/EEC) in a freshwater ecosystem is governed by the hardness of the water. Where applicable the hardness was taken into account for these contaminants. Additionally, to run the M-BAT model to take into account bioaccessibility of copper, zinc and nickel the Dissolved Oxygen Concentration (DOC), pH and calcium concentrations will be used.

No elevated contaminants above detection limits were identified in any water sample.

Based on the above, LKC considers the probability of contaminants on site affecting the Principal Aquifer as unlikely. Given the medium consequence, a low risk is anticipated (Pollutant Linkage 4) and no remediation is required.

6.5. Potable Water Supply (Pollutant Linkage 5)

Soil results were compared to United Utilities (UU) guidelines for the selection of potable water pipes in land potentially affected by contamination . Only contaminants of concern, based on the preliminary conceptual model and ground conditions encountered, were analysed. The following contaminants were not considered to be a risk and therefore not included in the analysis suites: chlorinated compounds, cresols, ethers, nitrobenzene, ketones, aldehydes and amines.

The following elevated contaminants were identified:

- Elevated petroleum hydrocarbons in shallow made ground in one location, TP101.
- Elevated TVOCs (inc. naphthalene) in made ground across the site.

If new potable water pipes are laid in made ground onsite, it is likely that barrier pipe will be required to protect future site users.

Once details of the pipeline location and depths are known a UU Risk Assessment should be undertaken.

At this stage, the probability of organic contaminants affecting potable water pipes is a low likelihood. Given the consequence is considered to be medium, the risk (pollutant linkage 6) is anticipated to be moderate/low risk and remediation (i.e. barrier pipe) is likely to be required (subject to further risk assessment).

6.6. Revised Contamination Conceptual Model

The preliminary contamination conceptual model has been revised following the risk assessments undertaken in Sections 6.1-6.4. The revised contamination conceptual model follows the same methodology and guidance used in the preliminary contamination conceptual model. The risk matrix is provided in Appendix A.

The revised contamination conceptual model is presented in Table 6-4.

Where a very low risk or low risk is identified no specific remediation is required.

Where there is a moderate / low risk is identified, some form of remediation may be required depending on the pollutant linkage, the type and concentration of contaminants present and the proposed development.

Where LKC identifies a moderate or higher risk, remediation or further investigation work is recommended.

PL	Pathway	Receptor	Contaminant	Probability	Consequence	Risk	Recommendation
PL1	<ul style="list-style-type: none"> -Dermal contact. -Inhalation of soil, fibres and dust. -Ingestion of soils, dust, vegetables, soil attached to vegetables. -Windblown dust. 	<ul style="list-style-type: none"> - Future site users. - Offsite receptors. 	<ul style="list-style-type: none"> - Heavy metals - PAHs - ACM 	Low Likelihood	Medium	Moderate / Low	Remediation recommended
			<ul style="list-style-type: none"> - Hydrocarbons 	Unlikely	Medium	Low	No remediation recommended
PL2	<ul style="list-style-type: none"> -Inhalation of vapours. -Migration through permeable strata and preferential pathways. 	<ul style="list-style-type: none"> - Future site users. - Offsite receptors. 	<ul style="list-style-type: none"> - Volatile Contaminants such as hydrocarbons 	Unlikely	Medium	Low	No remediation recommended
PL3	<ul style="list-style-type: none"> -Inhalation of gas. -Migration through permeable strata and preferential pathways. -Explosion in confined spaces. 	<ul style="list-style-type: none"> - Future site users. - Buildings. - Offsite land users. 	<ul style="list-style-type: none"> -Methane, carbon dioxide. 	Unlikely	Severe	Moderate / Low	No remediation recommended
PL4	<ul style="list-style-type: none"> -Surface Run-off. -Migration through permeable strata and preferential pathways -Perched waters migration. 	<ul style="list-style-type: none"> - Groundwater (Principal Aquifer). 	<ul style="list-style-type: none"> - Mobile contaminants such as metals, PAHs, hydrocarbons 	Unlikely	Medium	Low	No remediation recommended
PL5	<ul style="list-style-type: none"> -Ingestion of tainted water supply. 	<ul style="list-style-type: none"> - Future site users. - Water pipes. 	<ul style="list-style-type: none"> - Organic Contaminants such as hydrocarbons 	Low Likelihood	Medium	Moderate / Low	Utility provider risk assessment to be completed. The site will likely require barrier piping.

Table 6-4: Revised Contamination Conceptual Model.

7. Summary Conclusions

7.1. Ground Conditions

Ground conditions are summarised in Table 7-1 below.

Made Ground	Made ground was recorded to a thickness of between 0.9-5.05mbgl and generally comprised dark brown gravelly sandy clay with quantities of concrete, brick, glass, ash, clinker, ceramic, pottery, timber and metals. The deeper thicknesses of made ground are considered likely to be associated with former infilled basements. No visual or olfactory evidence of significant hydrocarbon contamination was encountered.
Superficial	Drift deposits were encountered in all exploratory locations to a maximum proven depth of 4.2mbgl within the window sample boreholes. Generally, the drift comprises firm gravelly sandy and silty CLAY. However, slightly gravelly very silty SAND was also encountered in localised areas. Due to the weathered nature of shallow underlying sandstone, it was often difficult to determine the boundary between the drift deposits and solid geology. In a majority of window sample boreholes, clayey SAND was encountered at the base of the drift deposits, but this is likely to represent extremely weathered sandstone.
Bedrock	Weathered sandstone was encountered from 4.2mbgl in the window sample boreholes and refusal on more competent bedrock at 5.8-6.0mbgl. Bedrock was cored to a maximum depth of 20mbgl, coring was carried out from 8mbgl in RBH101 and 6.5mbgl in RBH102. The recovered rock was logged as weak red with grey/yellow banding coarse grained micaceous SANDSTONE with occasional rounded quartz gravel inclusions which is consistent with the Chester Pebble Beds (Sherwood Sandstone).
Groundwater	No groundwater strikes were encountered in the trial pits or window sample boreholes. During subsequent monitoring of the window sample boreholes, all monitoring wells were found to be dry on every visit. Groundwater levels in the monitoring wells installed within the underlying bedrock recorded groundwater levels between 4.9-4.95mbgl. This is general agreement with the findings of previous investigations on the adjacent site to the east where groundwater levels have been recorded between 5.4-5.8mbgl and strikes recorded as shallow as 4.5mbgl.
Obstructions	TP101 – Brick wall encountered in the southeastern wall of the trial pit to a depth of 2.5mbgl. TP107 – Previously unidentified water pipe encountered at 0.55m corresponding with the GPR trace.

Table 7-1: Summary of Ground Conditions.

7.2. Geotechnical

Geotechnical observations and conclusions are contained in Table 7-2 below, more detailed discussions are contained within Section 5.

Proposed Development	Construction of two residential apartment blocks (maximum 18 storey) with a single storey basement level in one building.
Basement Floor Slab: Allowable Bearing Pressure	-Ground bearing floor slabs are acceptable founded on firm clay or medium dense sands or on weathered bedrock. It is recommended to install underdrainage underneath the floor slab connected to a pumpable sump to minimise buoyancy uplift risk during construction and for the long term in the advent of raised groundwater conditions or incoming surface waters.
Basement Retaining Walls	-Trial pit sides became unstable below 1.2mbgl due to loose made ground. Retaining walls will be required for the excavation of the basement. A contiguous (or secant) piled wall will be required prior to excavations. The local authority (highways) may require the design life to be 120 years. Deep embedment and/or reinforcing with whaling and anchors and/or internal braces may be required. It is recommended that advice from a suitably qualified and experienced piling contractor be sought at the earliest juncture.
Piles and Piling Estimates	Bored piles are recommended. Assuming 5270kN load and 2no. 600mm diameter piles per pile cap, it is estimated that a rock socket of between 5m to 7m in length will be required. Total pile length below basement floor level will be circa 8m to 10m depending on thickness of made ground and drift deposits and top of competent bedrock. Piles may require lengthening or larger diameters depending on groundwater depths. Due to the inherent strength variability of the Sherwood Sandstone, it is recommended to carry out a comprehensive pile load testing programme. The appointed specialist piling contractor will be able to optimise pile design such as pile grouping per pile cap, pile diameter & pile spacing, installation methodology, pile cap settlement, and socket lengths to suit from the SI data.
Concrete Requirements	Based on BRE Digest 2005 ²⁸ – DS-2 AC-2 recommended.
Services	Services – consideration to the presence of services running through the site. Services may need to re-routed.
Coal Mining	The site is not within a Coal Mining Development High Risk Area.
Temporary support of excavation	May be required; however, trial pits were generally recorded as stable.

Table 7-2: Geotechnical Conclusions Table.

7.3. Contamination Assessment

A revised contamination conceptual model has been produced by LKC which is summarised in Table 7-3 below (more detailed model provided in Section 6).

PL	Contaminant	Risk	Recommendations
1	Asbestos PAHs Metals	Moderate / Low	Remediation required.
	Petroleum hydrocarbons	Low	No remediation required
2	Volatile contaminants	Low	No remediation required
2	Other volatile contaminants	Moderate / Low	No remediation required.
3	Carbon dioxide, methane	Moderate / Low	No remediation required.
4	Groundwater (mobile contaminants)	Low	No remediation required.
5	Organic contaminants.	Moderate / Low	Utility provider risk assessment to be completed. The site will likely require barrier piping.

Table 7-3: Summary Risk Table.

PL=Pollutant Linkage, see Table 6-4 for details.

8. Recommendations

The recommendations provided below are considered appropriate for the site based on the site investigation work undertaken. LKC should stress that no remediation, enabling works or designing works should take place until Regulatory approval has been obtained.

A summary of remediation requirements is included in Table 8-1.

PL	Recommendation
1	Environmental cover system required in soft landscaping areas.
2	No remediation required.
3	No remediation required.
4	No remediation required.
5	Potable water pipe assessment required.

Table 8-1: Remediation Summary.

The local authority is likely to require a standalone Build-Phase Remediation Strategy and Verification Plan in accordance with LCRM Stage 3 remediation and verification²⁹. This should be produced once details of design, contractors and installation are known.

8.1.1. Further Investigation Works

Access to the southern third of the site was limited during the investigation works and additional exploratory works are proposed for this area at a later date. An updated risk assessment along with a detailed remediation strategy and verification plan is likely to be required.

8.1.2. Environmental Cover System (PL1)

In soft landscaping areas, an environmental cover system will be required and should comprise 450mm in private front gardens / soft landscaping. The environmental cover system should constructed be as shown in Plate 8-1.

Either (physical break layer)		Or (geotextile membrane)	
450mm front gardens & shared landscaping (minimum)	Chemically validated TOPSOIL ¹	450mm front gardens & shared landscaping (minimum)	Chemically validated TOPSOIL ¹
	Chemically validated SUBSOIL		Chemically validated SUBSOIL GEOTEXTILE MEMBRANE (at base of subsoil)
	100mm (minimum) PHYSICAL BREAK LAYER ²		
Existing MADE GROUND			

Plate 8-1: Typical Environmental Cover System Construction.

Notes:

Hardstood Areas – No Remediation Required.

¹NHBC recommend 100mm minimum topsoil depth.

²Gravel break layer, minimal fines.

Where there are TPO's in influencing distance of environmental cover systems it is likely the arboriculture officer may only allow a 100mm clean cover system over a geotextile membrane.

Validation of environmental cover soils will be required and should include measuring depth using a staff and providing photographic evidence. Photographic evidence of the granular physical break or geotextile layer should also be collected.

Chemical validation of imported soils is required, details are included in Section 8.3.

8.1.3. *Potable Water Pipe Remediation (PL5)*

It is recommended that a Water Pipeline Assessment³⁰ is undertaken once the location and depth of potable water pipes are known. It is likely that barrier pipe will be required.

Validation of pipeline installation should include delivery notes of pipe materials, photographs of installed pipe and confirmation of connections.

8.2. **Other Considerations**

8.2.1. *Unexpected Contamination*

The relevant contractors should be briefed that during development works at the site should any unusual ground conditions and / or visual or olfactory evidence of contamination (including asbestos containing material) be encountered at the site, LKC and the Local Authority should be informed, and further assessment of the material may be required.

8.2.2. *Decommissioning of Boreholes*

Decommission all existing groundwater sampling, ground gas monitoring and groundwater level monitoring wells by grouting should be undertaken to ensure no contamination of aquifers. Any other boreholes or borehole installations encountered during groundworks should also to be decommissioned.

All borehole and borehole installation decommissioning is to be undertaken in accordance with current EA guidelines³¹.

8.2.3. *Grubbing Out of In-ground Structures*

Surface hard standing and relict features including former foundations and current foundation can be expected across the site wide. It is recommended that in-ground structures are grubbed out as part of the groundworks.

Hard materials can be used to generate suitable aggregates for re-use on site as part of engineered made ground and/ or construction platforms (subject to geo-environmental testing and client design specifications). Suitable materials derived from grubbing-up should be stored in a location on site, to be agreed with the Engineer, prior to crushing. Any unsuitable materials should be removed to a suitably licensed landfill site.

8.2.4. *Re-use of Site Generated Material*

To ensure material is compliant with appropriate waste regulations, any site won material re-used onsite should be in recourse to appropriate exemptions. A U1 and T5 exemption should be registered. This will allow the following to be used onsite or brought in for use onsite (refer to guidance for types of waste that can be used³²):

- 5,000 tonnes (c. 2,500m³) treatment of crushed concrete / stone.
- 1,000 tonnes (c. 500m³) use of non-hazardous soil.
- 5,000 tonnes (c. 2,500m³) use of clays, sand, gravel, brick, concrete, stone etc.
- 50,000 tonnes (c. 25,000m³) use of bituminous material to be used in roadways.

A Materials Management Plan (MMP) with recourse to the CL:AIRE Code of Practice³³ may be required if volumes exceed exemption limits. This must be registered before material movement starts onsite.

If an MMP is required, this needs to be registered by a Qualified Person (QP) and there must be 'certainty of use' for any material re-used onsite or exported to site to ensure there is no 'sham recovery'.

For all the above material will need to be tested at the rate and analytical suites presented in the following sections.

8.2.5. *Stockpile Management*

Stockpiled material should be suitably managed. Material should be segregated by type and source. For example, construction / demolition arisings, site won subsoil. Stockpiles may also require covering to minimise the generation of vapours, fibres, dust, and possible nuisance to adjacent receptors, and to prevent rainwater ingress. The source of each stockpile should be recorded and appropriate validation testing for re-use or potential offsite disposal should be undertaken as required.

8.2.6. *Disposal*

Material required to be removed from site should be undertaken under an appropriate duty of care and the results of chemical analysis should be provided to a licensed landfill for confirmation of waste classification.

Waste records such as disposal tickets and waste carrier licences should be provided in the Site Completion Report. Photographic evidence of removal and waste removal tickets should be retained and included in the validation report.

8.2.7. *Health and Safety Considerations*

In working with, removing, or treating any contaminating material it is important that any potential risks associated with the actual site works are mitigated by good environmental management of the site during the remedial phases. Standard health and safety precautions (as per HSE guidance³⁴) should be adopted by all workers involved with site enabling and construction works.

8.2.8. *Piling in Contaminated Land*

If a piled foundation is being considered this may provide a preferential pathway for contaminants to the underlying aquifer. A piling risk assessment may be required. Good practice for the drilling of piles on contaminated sites should be adhered to, such as guidance provided by the Environment Agency³⁵.

8.2.9. *Asbestos in Soils Management Plan*

Due to the presence of asbestos containing material, it is recommended that additional precautions are taken during site clearance, earthworks, and construction in the area of concern. The presence of asbestos in the made ground at the site presents a potential risk of generation of airborne fibres if this material is disturbed, such as for excavations to construct new foundations.

LKC recommend that an appropriate 'Asbestos Management Strategy' is developed in line with CIRIA C733³⁶.

8.3. Validation of Imported / Site Won Soils

Chemical validation of all imported and site-won soils to be used on site soft landscaping areas should be undertaken. Imported soils should be accompanied by a certificate of analysis and source details.

A summary of the required imported material sampling requirements is presented in Table 8-2, based on MCC 'Guidelines to Developer' (2021) ³⁷. LKC consider no testing, but proof of provenance is sufficient for natural, virgin, quarried material.

Ideally, the material should be sampled at source to prevent double handling if soil fails, with confirmatory sampling undertaken on importation to site. Where this is not possible then material imported should be segregated based on source and soil type. Validation samples should be taken prior to placement in gardens / soft landscaping to ensure suitability for use.

Material Type	Source	Suite of Analysis	Sampling Rate (min. 3 per source)		
			Garden	Landscape	Other *
Topsoil / subsoil / Fill material	Greenfield	Suite A	200m ³	200m ³	200m ³
	Remediated / Site-won	Suite A / B dependent upon original SI	100m ³	150m ³	200m ³
	Brownfield / Unknown	Suite B	50m ³	150m ³	200m ³
Quarried Fill	First Generation i.e., quarried sand (subsoil) or stone (break layer)	No testing is required.	Certification of material provenance is required.		

Table 8-2: Sampling Requirements for Imported and Site Won Soils.

Notes:

Suite A - Heavy metals, pH, water soluble sulphate, speciated PAH, soil organic matter and asbestos screen.

Suite B - Heavy metals, pH, water soluble sulphate, speciated PAH, phenol, total and free cyanide, soil organic matter, asbestos screen, banded petroleum hydrocarbons (TPH CWG), BTEX, MTBE.

*Other assumed to be stone / 6F2 / mass fill etc.

Any soil with visual or olfactory evidence of hydrocarbons should be rejected.

In addition, it should be ensured that the matrix of the topsoil is suitable as a growing medium and no undesirable material is present (in line with BS3882³⁸). LKC advise this information is provided by the supplier before material is imported onto site.

Imported material to be used in gardens will be compared against residential with plant uptake criteria (as used in the contamination risk assessment in Section 6).

8.4. Site Completion Report

All remediation and validation work should be documented in a Site Completion Report. The Site Completion Report will allow discharge of relevant planning conditions.

The following Completion Reports should be provided to satisfy the outstanding contaminated land planning conditions:

- **Pre-construction Phase Completion Report:** Site level reduction details, offsite disposal information, validation testing of site won material to be used in gardens, findings of the watching brief including details of any unexpected contamination and verification testing.

- **Build-phase Construction Completion Report:** Validation testing of any imported subsoil and topsoil, completion of UU potable water supply document and/or discussion with UU and details of installation.

Figures

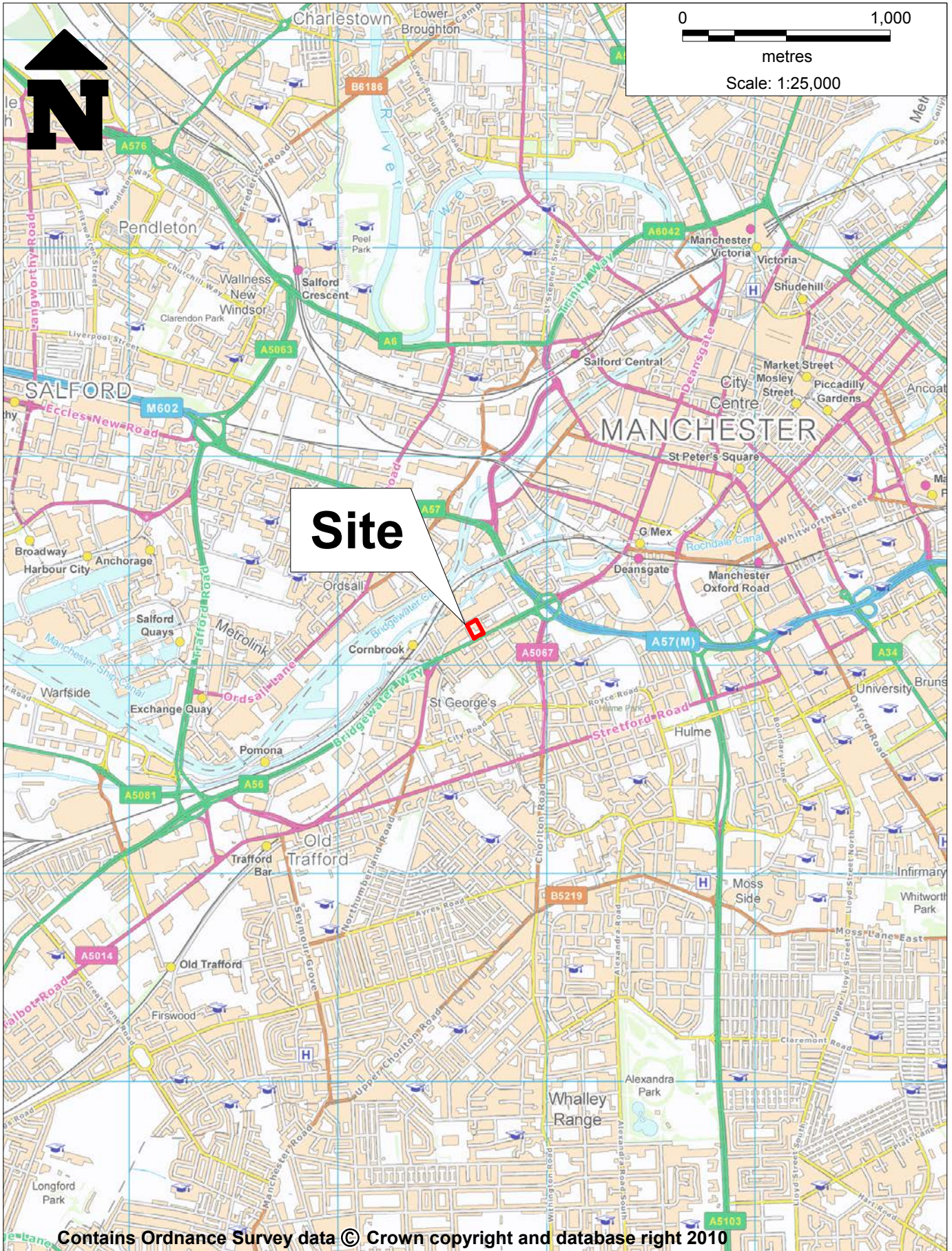
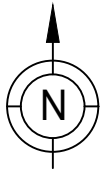


Figure 1: Site Location Plan, Gallery Gardens, Manchester

Drawn: July 2024 Scale: 1:25,000 @ A4 (see scale bar)



KEY



Site Boundary

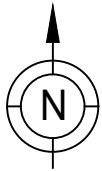
Sampling Locations and features annotated by LK Consult Ltd are approximate and are based upon observed measurements unless otherwise stated. Do not scale from this drawing and work from marked dimensions only. All dimensions and features should be confirmed on site by the Contractor. Where this drawing includes information provided to LK Consult Ltd by others, LK Consult Ltd gives no warranty, representation or assurance as to the accuracy of such information.



Client: Drum Capital Projects Ltd			
Site: Gallery Gardens, Manchester			
Title: Site Boundary Plan			
Job No.: LKC241427	Scale (See Scale Bar): 1:1000 @ A4	Figure: 2	Revision:
Drawn By: AC	Checked By: CH	Drawn: Jul 2024	

Extract from: Civic Engineers
Drawing Ref: Site Location Plan, No.(SK)003, Rev:P01

SCALE (Metres)



KEY



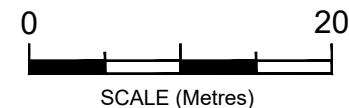
Site Boundary

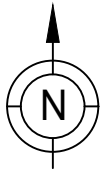
Sampling Locations and features annotated by LK Consult Ltd are approximate and are based upon observed measurements unless otherwise stated. Do not scale from this drawing and work from marked dimensions only. All dimensions and features should be confirmed on site by the Contractor. Where this drawing includes information provided to LK Consult Ltd by others, LK Consult Ltd gives no warranty, representation or assurance as to the accuracy of such information.



Client: Drum Capital Projects Ltd			
Site: Gallery Gardens, Manchester			
Title: Proposed Development Plan			
Job No.: LKC241427	Scale (See Scale Bar): 1:500 @ A4		Figure: 3
Drawn By: AC	Checked By: CH	Drawn: Jul 2024	Revision:

Extract from: DEP Landscape Architecture Ltd
Drawing Ref: Landscape Layout, No.3736 01 (May 2018)





KEY

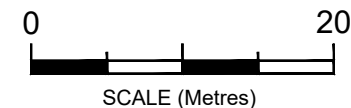
-  Site Boundary
-  Window Sample Borehole (WS)
-  Trial Pit (TP)
-  Borehole (BH)

Sampling Locations and features annotated by LK Consult Ltd are approximate and are based upon observed measurements unless otherwise stated. Do not scale from this drawing and work from marked dimensions only. All dimensions and features should be confirmed on site by the Contractor. Where this drawing includes information provided to LK Consult Ltd by others, LK Consult Ltd gives no warranty, representation or assurance as to the accuracy of such information.



Client: Drum Capital Projects Ltd			
Site: Gallery Gardens, Manchester			
Title: Sampling Location Plan			
Job No.: LKC241427	Scale (See Scale Bar): 1:500 @ A4	Figure: 4	Revision:
Drawn By: AC	Checked By: CH	Drawn: Jul 2024	

Extract from: DEP Landscape Architecture Ltd
Drawing Ref: Landscape Layout, No.3736 01 (May 2018)



Appendix A – Risk Matrix

RISK EVALUATION

The method for risk evaluation is a qualitative method of interpreting the output from the risk estimation stage of the assessment, based on CIRIA 552³⁹. It involves the classification of the:

- Magnitude of the potential consequence (severity) of the risk occurring (Table A).
- Magnitude of the probability (likelihood) of the risk occurring (Table B).

Consequence (Severity)		
Classification	Definition	Example
Severe	Short term (acute) risk to human health likely to result in 'significant harm' as defined by the Environment Protection Act 1990, Part IIA. Short term risk of pollution (note: water Resources Act contains no scope for considering significance of pollution) of sensitive water resource. Catastrophic damage to buildings/properties. A short-term risk to a particular ecosystem, or organism forming part of such ecosystem (note: the definition of ecological systems within the Draft Circular on Contaminated Land, DETR, 2000).	High Concentrations of cyanide on the surface of an informal recreation area. Major spillage of contaminants from site into controlled waters. Explosion, causing building collapse (can also equate to short term human health risk if buildings are occupied).
Medium	Chronic damage to Human Health ('significant harm' as defined in DETR, 2000). Pollution of sensitive water resources (note Water Resources Act contains no scope for considering significance of pollution). A significant change in a particular ecosystem, or organism forming part of such ecosystem.	Concentrations of a contaminant from site exceed generic, or site-specific assessment criteria. Leaching of contaminants from a site to a major or minor aquifer (Principal and Secondary). Death of a species within a designated nature reserve.
Mild	Pollution of non-sensitive water resources. Significant damage to crops, buildings, structures, and services ('significant harm' as defined in DETR, 2000). Damage to sensitive buildings/structures/services or the environment.	Pollution of non-classified groundwater. Damage to building rendering it unsafe to occupy (e.g., foundation damage resulting in instability).
Minor	Harm, although not necessarily significant harm, which may result in a financial loss, or expenditure to resolve. Non-permanent health effects to human health (easily prevented by means such as personal protective clothing etc). Easily repairable damage to buildings, structures, and services.	The presence of contaminants at such concentrations that protective equipment is required during site works. The loss of plants in a landscaping scheme. Discoloration of concrete.

Table A. Classification of Consequence

Probability (Likelihood)	
Classification	Definition
High Likelihood	There is a pollutant linkage and an event that either appears very likely in the short term and almost inevitable over the long term, or there is evidence at the receptor of harm or pollution.
Likely	There is a pollutant linkage, and all the elements are present and in the right place, which means that it is probable that an event will occur. Circumstances are such that an event is not inevitable, but possible in the short term and likely over the long term.
Low Likelihood	There is a pollutant linkage and circumstances are possible under which an event could occur. However, it is by no means certain that even over a longer period such event would take place and is less likely in the shorter term.
Unlikely	There is a pollutant linkage, but circumstances are such that it is improbable that an event would occur in the very long term.

Table B. Classification of Probability.

These classifications are then compared to indicate the risk presented by each pollutant linkage (Table C). It is important that this classification is only applied where there is a possibility (which can range from high likelihood to unlikely) of a pollutant linkage existing.

		Consequence			
		Severe	Medium	Mild	Minor
Probability	High Likelihood	Very High Risk	High Risk	Moderate Risk	Moderate / Low Risk
	Likely	High Risk	Moderate Risk	Moderate / Low Risk	Low Risk
	Low Likelihood	Moderate Risk	Moderate / Low Risk	Low Risk	Very Low Risk
	Unlikely	Moderate / Low Risk	Low Risk	Very Low Risk	Very Low Risk

Table C. Comparison of Consequence against Probability

Once the risk has been determined the corresponding action can be assessed (Table D).

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

Table D. Description of the Classification and Likely Action Required.

Where a very low risk is identified no specific remediation is required.

Where a low risk is identified, some form of remediation may be required depending on the pollutant linkage, the type and concentration of contaminants present and the proposed development.

Where there is a moderate/low risk identified, an assessment will be undertaken to establish what category the pollutant linkage will fall into.

Where LKC identifies a moderate or higher risk, remediation or further investigation work is recommended.

Appendix B – Profile Logs

Excavation Method

Drive-in Windowless Sampler

Dimensions
Ground Level (mOD)
Client

DeTrafford Estates Group

Job
Number
LKC 17 1166

Location (Observed measurements)

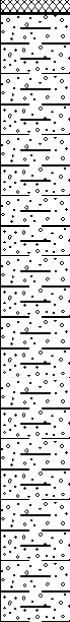
Dates

01-08-2018

Engineer

LKC

Sheet
1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
0.20-0.90	D1				(0.20) 0.20	MADE GROUND: Light grey gravel of limestone. More compacted with depth.			
0.90-2.00 0.90-2.00 1.00-1.45	B2 D3 SPT N=13		1,2/3,4,3,3		(0.70) 0.90	MADE GROUND: Dark brown gravelly sandy clay with frequent brick fragments and ceramic, occasional concrete, rare glass, plastic, ash and clinker.			
2.00-2.45 2.00-3.00	SPT N=8 B4		1,1/2,2,2,2		(3.30)	Firm consistency brown with orange and black mottling gravelly very sandy CLAY. Sand is fine to coarse. Gravel is fine to coarse, subrounded, of sandstone.			
3.00-3.45 3.00-4.20	SPT N=13 B5		2,2/3,4,4,2						
4.00-4.45 4.20-5.00	SPT N=19 B6		4,3/3,4,6,6		4.20	Dense red clayey SAND. Sand is fine to medium. (Probable weathered sandstone).			
5.00-5.45 5.00	SPT N=35 B7		2,7/6,7,11,11		(1.66)				
5.45-5.86	SPT 50/255		10,10/12,15,15,8		5.86	Complete at 5.86m			

Remarks

Borehole refused at 5.86m depth in possible weathered sandstone.
Borehole dry.

Scale
(approx)
1:40

Logged
By
KC

Figure No.

LKC 17 1166.WS101

Excavation Method

Drive-in Windowless Sampler

Dimensions
Ground Level (mOD)
Client

DeTrafford Estates Group

Job
Number
LKC 17 1166

Location (Observed measurements)

Dates

01-08-2018

Engineer

LKC

Sheet
1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
0.20-0.60	D1				(0.10) (0.20)	MADE GROUND: Tarmacadam.			
					(0.40)	MADE GROUND: Gravel sub-base.			
0.60-0.80	D2				0.60 (0.20)	MADE GROUND: Dark brown gravelly sandy clay with frequent brick, occasional ash and clinker, rare ceramic fragments.			
0.80-1.30	D3				0.80	MADE GROUND: Black sandy gravel of ash and clinker with rare brick.			
1.00-1.45	SPT N=5		1,0/1,1,1,2		(0.50)	MADE GROUND: Dark brown gravelly sandy clay with frequent brick and ceramic, occasional glass, ash and clinker.			
1.30-2.00	B4				1.30	Soft to firm consistency brown with black mottling slightly gravelly very sandy CLAY. Sand is fine to coarse. Gravel is fine to coarse, subrounded, of sandstone.			
1.30-2.00	D5								
2.00-2.45	SPT N=6		1,0/1,1,2,2						
2.00-3.00	D6								
3.00-3.45	SPT N=26		1,2/8,6,6,6		(3.40)				
4.00-4.45	SPT N=21		3,3/3,4,7,7						
4.70-5.12	SPT 50/265		11,13/15,14,14,7		4.70 (0.42) 5.12	Dense red clayey SAND. Sand is fine to medium. (Probable weathered sandstone).			
						Complete at 5.12m			

Remarks

Borehole dry.
Borehole refused at 5.12m depth in clay.

Scale
(approx)

1:40

Logged
By

KC

Figure No.

LKC 17 1166.WS102

 LK CONSULT LTD Eton Business Park, Eton Hill Road, Radcliffe, M26 2ZS Tel: 0161 763 7200 web: www.thelkgroup.com						Site Gallery Gardens, Manchester		Number WS103	
Excavation Method Drive-in Windowless Sampler		Dimensions		Ground Level (mOD)		Client DeTrafford Estates Group		Job Number LKC 17 1166	
		Location (Observed measurements)		Dates 01-08-2018		Engineer LKC		Sheet 1/1	
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
0.30-1.20	D1				(0.20) 0.20 (0.30)	MADE GROUND: Concrete with 5mm diameter rebar.			
1.00-1.45	SPT N=8		3,2/2,2,2,2			MADE GROUND: Gravel sub-base.			
1.20-3.00	D2					MADE GROUND: Dark brown gravelly sandy clay with frequent concrete, occasional brick fragments, pottery tile, ash and clinker, rare ceramic fragments.			
2.00-2.45	SPT N=4		1,1/1,1,1,1		(4.75)				
3.00-3.45	SPT N=5		2,1/2,1,1,1						
3.00-5.00	D3								
4.00-4.45	SPT N=14		4,4/3,3,3,5						
5.00-5.26	SPT 25*/145		9,16/28,22		5.05	Dense red clayey SAND. Sand is fine to medium. (Probable weathered sandstone).			
5.05-5.26	B4				(0.21) 5.26	Complete at 5.26m			
Remarks Borehole refused at 5.26m depth in weathered sandstone. Borehole dry.							Scale (approx) 1:40	Logged By KC	Figure No. LKC 17 1166.WS103

 LK CONSULT LTD Eton Business Park, Eton Hill Road, Radcliffe, M26 2ZS Tel: 0161 763 7200 web: www.thelkgroup.com						Site Gallery Gardens, Manchester		Number WS104	
Excavation Method Drive-in Windowless Sampler		Dimensions		Ground Level (mOD)		Client DeTrafford Estates Group		Job Number LKC 17 1166	
		Location (Observed measurements)		Dates 01-08-2018		Engineer LKC		Sheet 1/1	
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
0.10-1.30	D1				(0.10)	MADE GROUND: Light grey gravel of limestone. More compacted with depth.			
					(1.20)	MADE GROUND: Dark brown gravelly sandy clay with occasional brick fragments, ash and clinker.			
1.00-1.45	SPT N=19		2,1/2,1,9,7		1.30 (0.15)	MADE GROUND: Coarse yellow sandstone.			
1.45-3.00	D2				1.45	MADE GROUND: Brown gravelly sandy clay with frequent cobbles of limestone, occasional brick fragments, ash and clinker.			
2.00-2.45	SPT N=12		2,2/1,3,3,5		(1.75)				
3.00-3.44	SPT 50/285		9,11/10,13,14,13		3.20 (0.24)	Orangeish brown very gravelly clayey SAND. Gravel is fine to medium, subrounded, of sandstone. Sand is fine to coarse.			
3.20-3.44	B3				3.44	Complete at 3.44m			
Remarks Borehole refused at 3.44m depth in sand. Borehole dry.							Scale (approx) 1:40	Logged By KC	Figure No. LKC 17 1166.WS104

Machine :
Flush : Water

Core Dia : 92 mm

Method : Rotary Cored

Casing Diameter
Location
Ground Level (mOD)
Dates

13-12-2018

Client

DeTrafford Estates Group

Engineer

LKC

**Job
Number**

LKC 17 1166

Sheet

1/2

Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
							0.10 0.20	1) MADE GROUND (Tarmac). 1) MADE GROUND (MOT). 1) MADE GROUND (Clay with bricks).		
					13-Dec-18:		(2.80)			
							3.00	1) Sandy CLAY with occasional gravel.		
	13	0	0	AZCL			(5.00)			
							8.00	1) Weathered red SANDSTONE.		
							(1.00)			
							9.00	Weak red with yellow/grey colour banding coarse grained micaceous SANDSTONE moderately weathered. Occasional rounded quartz gravel inclusion.		
9.50				12						
9.90 9.94				NI						

Remarks

1). Drillers description

**Scale
(approx)**

1:50

**Logged
By**

CCW

Figure No.

LKC 17 1166.RBH101

**LK CONSULT LTD**Eton Business Park, Eton Hill Road, Radcliffe, M26 2ZS
Tel: 0161 763 7200 web: www.thelkgroup.com**Site**

Gallery Gardens, Manchester

**Borehole
Number****RBH101**

Machine : Flush : Water Core Dia : 92 mm Method : Rotary Cored		Casing Diameter		Ground Level (mOD)		Client DeTrafford Estates Group		Job Number LKC 17 1166	
		Location		Dates 13-12-2018		Engineer LKC		Sheet 2/2	

Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
10.64 10.67 11.00	100	58	13	12 NI						
12.50	100	60	29	12						
13.50 13.56 14.00	87	50	37	NI						
15.15	73	20	15	12 NI			(11.00)			
15.45 15.50 17.00	80	39	0	12						
17.98 18.05 18.50	100	60	46	NI						
20.00	93	16	0	12			20.00			

Remarks 1). Drillers description	Scale (approx) 1:50	Logged By CCW
	Figure No. LKC 17 1166.RBH101	

**LK CONSULT LTD**Eton Business Park, Eton Hill Road, Radcliffe, M26 2ZS
Tel: 0161 763 7200 web: www.thelkgroup.com**Site**

Gallery Gardens, Manchester

**Borehole
Number****RBH102****Machine :****Flush** : Water**Core Dia** : 92 mm**Method** : Rotary Cored**Casing Diameter****Ground Level (mOD)****Client**

DeTrafford Estates Group

**Job
Number**

LKC 17 1166

Location**Dates**

14-12-2018

Engineer

LKC

Sheet

1/2

Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
							0.10 0.20	1). MADE GROUND (Tarmac). 1). MADE GROUND (MOT) 1). MADE GROUND (Clay with bricks).		
							(2.30)			
							2.50	1). Sandy CLAY with occasional gravel.		
							(4.00)			
							6.50	1). Weathered SANDSTONE.		
							(1.00)			
							7.50	Weak red with grey/yellow banding coarse grained micaceous SANDSTONE, moderately strong. Occasional rounded quartz gravel inclusions.		
8.50 8.66				NI						
9.50				10						

Remarks

1). Drillers description.

**Scale
(approx)**

1:50

**Logged
By**

CCW

Figure No.

LKC 17 1166.RBH102

**LK CONSULT LTD**Eton Business Park, Eton Hill Road, Radcliffe, M26 2ZS
Tel: 0161 763 7200 web: www.thelkgroup.com**Site**

Gallery Gardens, Manchester

**Borehole
Number****RBH102**

Machine : Flush : Water Core Dia : 92 mm Method : Rotary Cored		Casing Diameter		Ground Level (mOD)		Client DeTrafford Estates Group		Job Number LKC 17 1166	
		Location		Dates 14-12-2018		Engineer LKC		Sheet 2/2	

Depth (m)	TCR	SCR	RQD	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
10.50	100	40	17	20						
11.00										
12.50	100	68	35							
14.00	87	60	49							
15.50	85	73	73	7						
17.00	80	75	48							
18.50	100	60	45							
20.00	93	55	32	12						

Remarks

1). Drillers description.

Scale (approx)

1:50

Logged By

CCW

Figure No.

LKC 17 1166.RBH102

Excavation Method Slow scrape to 1.2mbgl	Dimensions 0.6m x 2.2m	Ground Level (mOD)	Client DeTrafford Estates Group	Job Number LKC 17 1166
	Location (Observed measurements)	Dates 11-12-2018	Engineer LKC	Sheet 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.20-0.50	D1 0.0ppm				0.10 0.20 (0.30)	TARMACADAM MADE GROUND: Limestone and sandstone gravel.		
0.50-1.40	D2 0.0ppm				0.50 (1.00)	MADE GROUND: Dark brown sandy gravelly silt with abundant brick and brick fragments, frequent ash, clinker and pottery, occasional glass, timber and metals. MADE GROUND: Dark brown sandy clayey silt with occasional brick and brick fragments, pottery and glass, rare ash and clinker.		
1.50-2.10	B3				1.50 (1.40)	Reddish brown slightly gravelly very silty SAND. Sand is fine to medium. Gravel is fine to coarse and subrounded comprising quartzite.		
					2.90 (0.30) 3.20	Light reddish brown SAND and GRAVEL. Sand is fine to course. Gravel is fine to course and subangular to subrounded comprising sandstone and quartzite.		
						Complete at 3.20m		

Plan 	Remarks Red brick wall extended to approximately 2.5mbgl in the southeastern wall of the trial pit.		
	Scale (approx) 1:40	Logged By BS	Figure No. LKC 17 1166.TP101

**LK CONSULT LTD**Eton Business Park, Eton Hill Road, Radcliffe, M26 2ZS
Tel: 0161 763 7200 web: www.thelkgroup.com**Site**

Gallery Gardens, Manchester

**Trial Pit
Number****TP102****Excavation Method**

Slow scrape to 1.2mbgl

Dimensions

0.6m x 2.2m

Ground Level (mOD)**Client**

DeTrafford Estates Group

**Job
Number**

LKC 17 1166

Location (Observed measurements)**Dates**

11-12-2018

Engineer

LKC

Sheet

1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.20-0.50	D1 0.0ppm				0.10 0.20	TARMACADAM MADE GROUND: Limestone and sandstone gravel. MADE GROUND: Dark brown sandy gravelly silt with abundant brick and brick fragments, frequent ash, clinker and pottery, occasional glass, timber and metals.		
2.00-2.50	B2 0.0ppm				(1.60) 1.80 (0.20) 2.00	MADE GROUND: Dark brown to black organic slightly gravelly sandy silt with occasional brick fragments (possible relic topsoil). Reddish brown slightly gravelly very sandy SILT. Sand is fine to medium. Gravel is fine to coarse and subrounded comprising quartzite.		
2.70-3.00	B3				(0.90) 2.90 3.00	Light reddish brown gravelly silty SAND. Sand is fine to coarse. Gravel is fine to coarse and subangular to subrounded comprising sandstone and quartzite. Complete at 3.00m		

Plan

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Remarks

Scale (approx)

1:40

Logged By

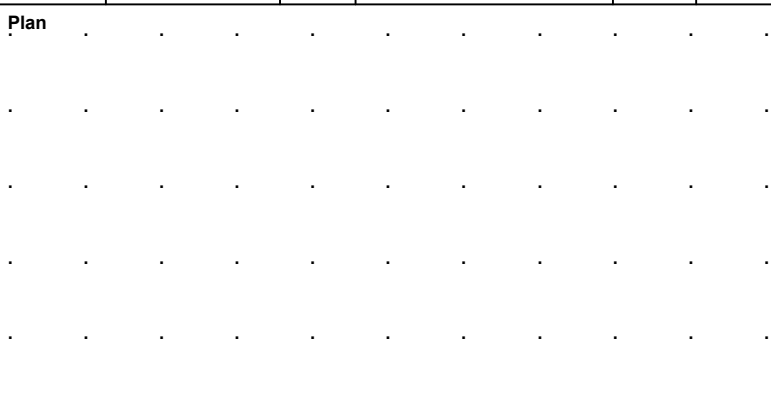
BS

Figure No.

LKC 17 1166.TP102

Excavation Method Slow scrape to 1.2mbgl	Dimensions 0.6m x 2.2m	Ground Level (mOD)	Client DeTrafford Estates Group	Job Number LKC 17 1166
	Location (Observed measurements)	Dates 11-12-2018	Engineer LKC	Sheet 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.10-0.50	D1 0.0ppm				(0.20) 0.20	MADE GROUND: Limestone and sandstone gravel.		
						MADE GROUND: Dark brown sandy gravelly silt with abundant brick and brick fragments, frequent ash, clinker and pottery, occasional glass, timber and metals.		
1.20-2.20	D2 0.0ppm				(2.20)			
					2.40	Complete at 2.40m		

Plan 	Remarks		
	Trial pit gradually collapsing from 1.2mbgl.		
	Scale (approx) 1:40	Logged By BS	Figure No. LKC 17 1166.TP103

**LK CONSULT LTD**Eton Business Park, Eton Hill Road, Radcliffe, M26 2ZS
Tel: 0161 763 7200 web: www.thelkgroup.com**Site**

Gallery Gardens, Manchester

**Trial Pit
Number****TP104****Excavation Method**

Slow scrape to 1.2mbgl

Dimensions

0.6m x 2.2m

Ground Level (mOD)**Client**

DeTrafford Estates Group

**Job
Number**

LKC 17 1166

Location (Observed measurements)**Dates**

14-12-2018

Engineer

LKC

Sheet

1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.10-0.70	D1 0.0ppm				0.10 (1.10) 1.20	MADE GROUND: Limestone and sandstone gravel. MADE GROUND: Dark brown sandy gravelly silt with abundant brick, concrete and brick fragments, occasional ash, clinker and pottery, occasional glass, timber and metals. Complete at 1.20m		

Plan

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Remarks

Trial pit terminated at 1.2mbgl in brick and concrete rubble made ground.

Scale (approx)

1:40

Logged By

BS

Figure No.

LKC 17 1166.TP105

**LK CONSULT LTD**Eton Business Park, Eton Hill Road, Radcliffe, M26 2ZS
Tel: 0161 763 7200 web: www.thelkgroup.com**Site**

Gallery Gardens, Manchester

**Trial Pit
Number****TP105****Excavation Method**

Slow scrape to 1.2mbgl

Dimensions

0.6m x 2.2m

Ground Level (mOD)**Client**

DeTrafford Estates Group

**Job
Number**

LKC 17 1166

Location (Observed measurements)**Dates**

11-12-2018

Engineer

LKC

Sheet

1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.50-1.50	D1 0.0ppm				0.10 (1.40) 1.50	MADE GROUND: Limestone and sandstone gravel. MADE GROUND: Dark brown sandy gravelly silt with abundant brick, concrete and brick fragments, occasional ash, clinker and pottery, occasional glass, timber and metals. Complete at 1.50m		

Plan

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Remarks

Trial pit terminated at 1.5mbgl in brick and concrete rubble made ground.

Scale (approx)

1:40

Logged By

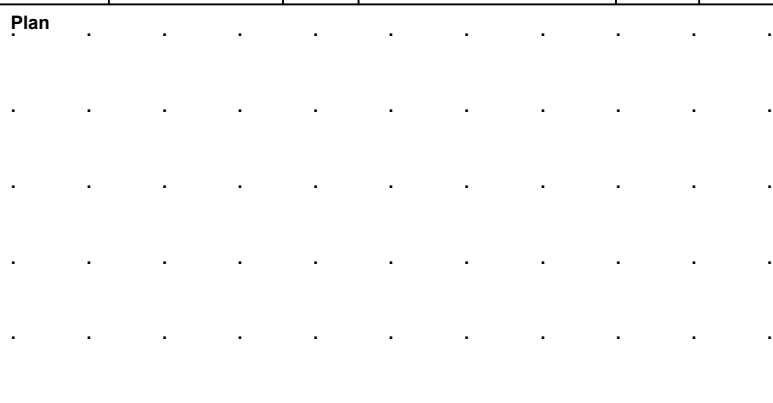
BS

Figure No.

LKC 17 1166.TP105

Excavation Method Slow scrape to 1.2mbgl	Dimensions 0.6m x 2.2m	Ground Level (mOD)	Client DeTrafford Estates Group	Job Number LKC 17 1166
	Location (Observed measurements)	Dates 11-12-2018	Engineer LKC	Sheet 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.10-1.00	D1 0.0ppm				0.10	MADE GROUND: Limestone and sandstone gravel.		
					(1.20)	MADE GROUND: Dark brown sandy gravelly silt with abundant brick, concrete and brick fragments, occasional ash, clinker and pottery, occasional glass, timber and metals.		
					1.30	Complete at 1.30m		

Plan 	Remarks		
	Trial pit terminated at 1.3mbgl in brick and concrete rubble made ground.		
	Scale (approx) 1:40	Logged By BS	Figure No. LKC 17 1166.TP106

**LK CONSULT LTD**Eton Business Park, Eton Hill Road, Radcliffe, M26 2ZS
Tel: 0161 763 7200 web: www.thelkgroup.com**Site**

Gallery Gardens, Manchester

**Trial Pit
Number****TP107****Excavation Method**

Slow scrape to 0.55mbgl

Dimensions

0.6m x 2.2m

Ground Level (mOD)**Client**

DeTrafford Estates Group

**Job
Number**

LKC 17 1166

Location (Observed measurements)**Dates**

11-12-2018

Engineer

LKC

Sheet

1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.10-0.55	D1 0.0ppm				0.05 (0.50) 0.55	MADE GROUND: Tarmacadam. MADE GROUND: Dark brown sandy gravelly silt with abundant brick, concrete and brick fragments, occasional ash, clinker and pottery, occasional glass, timber and metals. Complete at 0.55m		

Plan

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Remarks

Trial pit terminated at 0.55mbgl in brick as blue plastic water pipe was exposed in the base of the pit corresponding with the location of the GPR trace.

Scale (approx)

1:40

Logged By

BS

Figure No.

LKC 17 1166.TP107

**LK CONSULT LTD**Eton Business Park, Eton Hill Road, Radcliffe, M26 2ZS
Tel: 0161 763 7200 web: www.thelkgroup.com**Site**

Gallery Gardens, Manchester

**Trial Pit
Number****TP108****Excavation Method**

Slow scrape to 1.2mbgl

Dimensions

0.6m x 2.2m

Ground Level (mOD)**Client**

DeTrafford Estates Group

**Job
Number**

LKC 17 1166

Location (Observed measurements)**Dates**

11-12-2018

Engineer

LKC

Sheet

1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.10-1.10	D1 0.0ppm				0.10 (1.10) 1.20	MADE GROUND: Tarmacadam. MADE GROUND: Dark brown sandy gravelly silt with abundant brick, concrete and brick fragments, occasional ash, clinker and pottery, occasional glass, timber and metals. Complete at 1.20m		

Plan

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Remarks

Trial pit terminated at 1.2mbgl in brick and concrete rubble made ground.

Scale (approx)

1:40

Logged By

BS

Figure No.

LKC 17 1166.TP108

Appendix C – Certificates of Analysis (Soil)



2183

Final Report

Report No.: 18-40026-1

Initial Date of Issue: 04-Jan-2019

Client LK Consult

Client Address: Unit 29 Eton Business Park
Eton Hill Road
Radcliffe
Manchester
Lancashire
M26 2ZS

Contact(s): Chris Hughes
Contaminated Land

Project LKC 17 1166 Gallery Gardens,
Manchester

Quotation No.: **Date Received:** 19-Dec-2018

Order No.: 736612 **Date Instructed:** 19-Dec-2018

No. of Samples: 1

Turnaround (Wkdays): 7 **Results Due:** 31-Dec-2018

Date Approved: 04-Jan-2019

Approved By:



Details: Glynn Harvey, Laboratory Manager

Results - 2 Stage WAC

Project: LKC 17 1166 Gallery Gardens, Manchester

Project: ERG 21-1100 Safety, Cardener, Manchester							Landfill Waste Acceptance Criteria			
Chemtest Job No: 18-40026							Limits			
Chemtest Sample ID: 745004							Inert Waste Landfill	Stable, Non-reactive hazardous waste in non-hazardous Landfill	Hazardous Waste Landfill	
Sample Ref:										
Sample ID: TP105										
Sample Location:										
Top Depth(m): 0.50										
Bottom Depth(m): 1.50										
Sampling Date: 14-Dec-2018										
Determinand	SOP	Accred.	Units							
Total Organic Carbon	2625	U	%				2.7	3	5	6
Loss On Ignition	2610	U	%				5.8	--	--	10
Total BTEX	2760	U	mg/kg				< 0.010	6	--	--
Total PCBs (7 Congeners)	2815	U	mg/kg				< 0.10	1	--	--
TPH Total WAC (Mineral Oil)	2670	U	mg/kg				30	500	--	--
Total (Of 17) PAH's	2700	N	mg/kg				72	100	--	--
pH	2010	U					9.1	--	>6	--
Acid Neutralisation Capacity	2015	N	mol/kg				0.049	--	To evaluate	To evaluate
Eluate Analysis			2:1 mg/l	8:1 mg/l	2:1 mg/kg	Cumulative mg/kg 10:1	Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg			
Arsenic	1450	U	0.0032	0.0043	< 0.050	< 0.050	0.5	2	25	
Barium	1450	U	0.027	0.020	< 0.50	< 0.50	20	100	300	
Cadmium	1450	U	< 0.00010	< 0.00010	< 0.010	< 0.010	0.04	1	5	
Chromium	1450	U	0.0011	< 0.0010	< 0.050	< 0.050	0.5	10	70	
Copper	1450	U	0.0030	0.0024	< 0.050	< 0.050	2	50	100	
Mercury	1450	U	< 0.00050	< 0.00050	< 0.0010	< 0.0050	0.01	0.2	2	
Molybdenum	1450	U	0.041	0.015	0.081	0.18	0.5	10	30	
Nickel	1450	U	< 0.0010	< 0.0010	< 0.050	< 0.050	0.4	10	40	
Lead	1450	U	< 0.0010	< 0.0010	< 0.010	< 0.010	0.5	10	50	
Antimony	1450	U	0.0046	0.0028	< 0.010	0.030	0.06	0.7	5	
Selenium	1450	U	0.0046	0.0021	< 0.010	0.024	0.1	0.5	7	
Zinc	1450	U	0.0071	< 0.0010	< 0.50	< 0.50	4	50	200	
Chloride	1220	U	3.1	< 1.0	< 10	< 10	800	15000	25000	
Fluoride	1220	U	1.2	0.72	2.4	7.7	10	150	500	
Sulphate	1220	U	53	15	110	190	1000	20000	50000	
Total Dissolved Solids	1020	N	220	85	440	1000	4000	60000	100000	
Phenol Index	1920	U	< 0.030	< 0.030	< 0.30	< 0.50	1	-	-	
Dissolved Organic Carbon	1610	U	13	9.9	< 50	100	500	800	1000	

Solid Information	
Dry mass of test portion/kg	0.175
Moisture (%)	15

Leachate Test Information	
Leachant volume 1st extract/l	0.320
Leachant volume 2nd extract/l	1.400
Eluant recovered from 1st extract/l	0.196

Waste Acceptance Criteria

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

SOP	Title	Parameters included	Method summary
1020	Electrical Conductivity and Total Dissolved Solids (TDS) in Waters	Electrical Conductivity and Total Dissolved Solids (TDS) in Waters	Conductivity Meter
1220	Anions, Alkalinity & Ammonium in Waters	Fluoride; Chloride; Nitrite; Nitrate; Total; Oxidisable Nitrogen (TON); Sulfate; Phosphate; Alkalinity; Ammonium	Automated colorimetric analysis using 'Aquakem 600' Discrete Analyser.
1450	Metals in Waters by ICP-MS	Metals, including: Antimony; Arsenic; Barium; Beryllium; Boron; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Tin; Vanadium; Zinc	Filtration of samples followed by direct determination by inductively coupled plasma mass spectrometry (ICP-MS).
1610	Total/Dissolved Organic Carbon in Waters	Organic Carbon	TOC Analyser using Catalytic Oxidation
1920	Phenols in Waters by HPLC	Phenolic compounds including: Phenol, Cresols, Xylenols, Trimethylphenols Note: Chlorophenols are excluded.	Determination by High Performance Liquid Chromatography (HPLC) using electrochemical detection.
2010	pH Value of Soils	pH	pH Meter
2015	Acid Neutralisation Capacity	Acid Reserve	Titration
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <37°C.
2610	Loss on Ignition	loss on ignition (LOI)	Determination of the proportion by mass that is lost from a soil by ignition at 550°C.
2625	Total Organic Carbon in Soils	Total organic Carbon (TOC)	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.
2670	Total Petroleum Hydrocarbons (TPH) in Soils by GC-FID	TPH (C6–C40); optional carbon banding, e.g. 3-band – GRO, DRO & LRO*TPH C8–C40	Dichloromethane extraction / GC-FID
2700	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Soil by GC-FID	Acenaphthene; Acenaphthylene; Anthracene; Benzo[a]Anthracene; Benzo[a]Pyrene; Benzo[b]Fluoranthene; Benzo[ghi]Perylene; Benzo[k]Fluoranthene; Chrysene; Dibenzo[ah]Anthracene; Fluoranthene; Fluorene; Indeno[123cd]Pyrene; Naphthalene; Phenanthrene; Pyrene	Dichloromethane extraction / GC-FID (GC-FID detection is non-selective and can be subject to interference from co-eluting compounds)
2760	Volatile Organic Compounds (VOCs) in Soils by Headspace GC-MS	Volatile organic compounds, including BTEX and halogenated Aliphatic/Aromatics.(cf. USEPA Method 8260)*please refer to UKAS schedule	Automated headspace gas chromatographic (GC) analysis of a soil sample, as received, with mass spectrometric (MS) detection of volatile organic compounds.
2815	Polychlorinated Biphenyls (PCB) ICES7Congeners in Soils by GC-MS	ICES7 PCB congeners	Acetone/Hexane extraction / GC-MS
640	Characterisation of Waste (Leaching)	Waste material including soil, sludges and granular waste	ComplianceTest for Leaching of Granular Waste Material and Sludge

Report Information

Key

- U UKAS accredited
- M MCERTS and UKAS accredited
- N Unaccredited
- S This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
- SN This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
- T This analysis has been subcontracted to an unaccredited laboratory
- I/S Insufficient Sample
- U/S Unsuitable Sample
- N/E not evaluated
- < "less than"
- > "greater than"

Comments or interpretations are beyond the scope of UKAS accreditation

The results relate only to the items tested

Uncertainty of measurement for the determinands tested are available upon request

None of the results in this report have been recovery corrected

All results are expressed on a dry weight basis

The following tests were analysed on samples as received and the results subsequently corrected to a dry weight basis TPH, BTEX, VOCs, SVOCs, PCBs, Phenols

For all other tests the samples were dried at < 37°C prior to analysis

All Asbestos testing is performed at the indicated laboratory

Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

Sample Deviation Codes

- A - Date of sampling not supplied
- B - Sample age exceeds stability time (sampling to extraction)
- C - Sample not received in appropriate containers
- D - Broken Container
- E - Insufficient Sample (Applies to LOI in Trommel Fines Only)

Sample Retention and Disposal

All soil samples will be retained for a period of 45 days from the date of receipt

All water samples will be retained for 14 days from the date of receipt

Charges may apply to extended sample storage

If you require extended retention of samples, please email your requirements to:

customerservices@chemtest.com



Final Report

Report No.: 18-23075-1

Initial Date of Issue: 10-Aug-2018

Client LK Consult

Client Address: Unit 29 Eton Business Park
Eton Hill Road
Radcliffe
Manchester
Lancashire
M26 2ZS

Contact(s): Chris Hughes
Contaminated Land

Project LKC 17 1166 Gallery Gardens,
Manchester

Quotation No.: **Date Received:** 03-Aug-2018

Order No.: 736270 **Date Instructed:** 03-Aug-2018

No. of Samples: 6

Turnaround (Wkdays): 5 **Results Due:** 09-Aug-2018

Date Approved: 10-Aug-2018

Approved By:

Details: Martin Dyer, Laboratory Manager

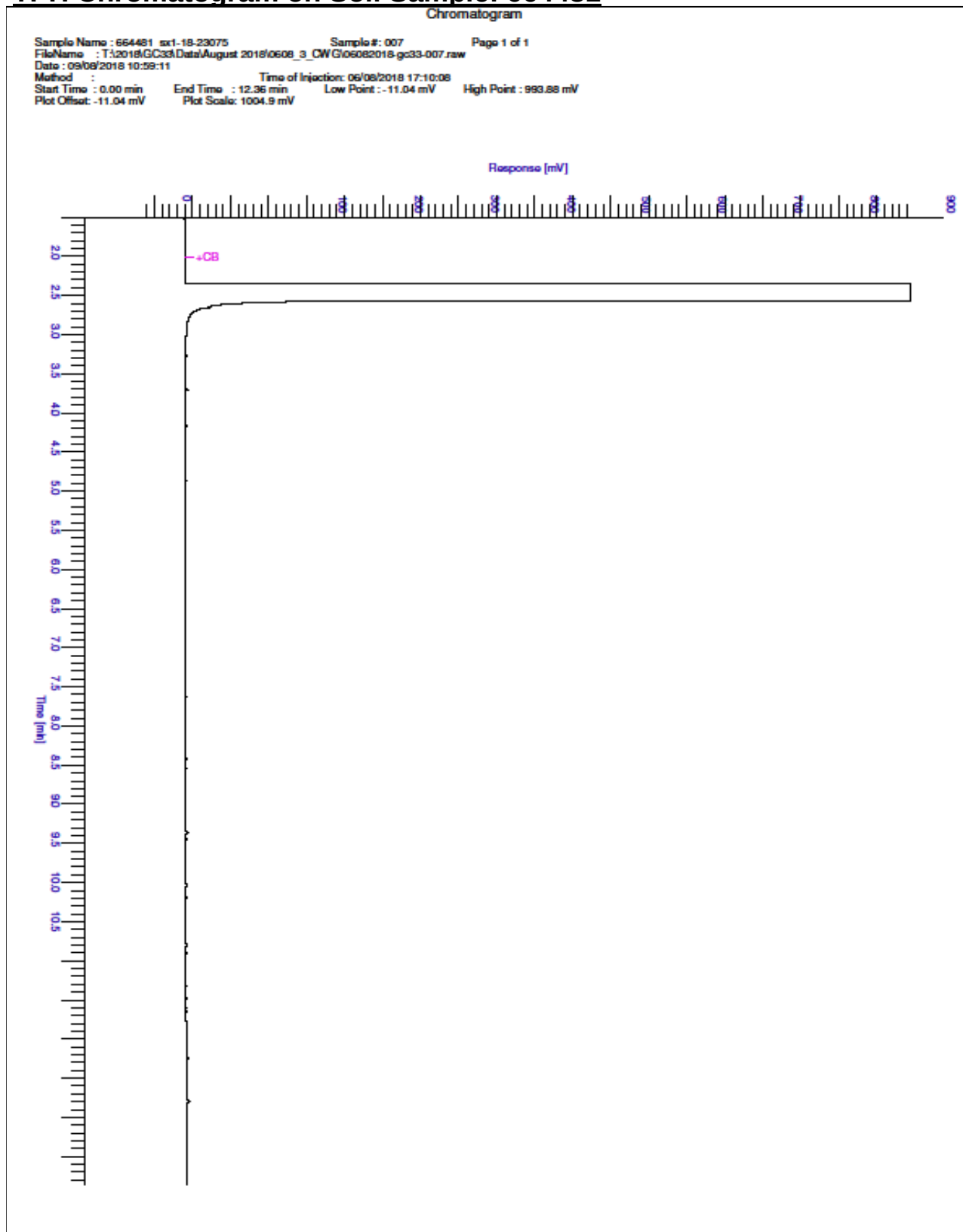
Results - Soil

Client: LK Consult	Chemtest Job No.:				18-23075	18-23075	18-23075	18-23075	18-23075	18-23075
Quotation No.:	Chemtest Sample ID.:				664477	664478	664479	664480	664481	664482
	Client Sample ID.:				WS101	WS101	WS102	WS102	WS103	WS104
	Sample Type:				SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
	Top Depth (m):				0.20	0.90	0.20	1.30	0.30	0.10
	Bottom Depth (m):				0.90	2.00	0.60	2.00	1.20	1.30
	Date Sampled:				01-Aug-2018	01-Aug-2018	01-Aug-2018	01-Aug-2018	01-Aug-2018	01-Aug-2018
	Asbestos Lab:				LIVERPOOL		LIVERPOOL		LIVERPOOL	LIVERPOOL
Determinand	Accred.	SOP	Units	LOD						
ACM Type	U	2192		N/A	Fibres/Clumps		-		-	-
Asbestos Identification	U	2192	%	0.001	Chrysotile		No Asbestos Detected		No Asbestos Detected	No Asbestos Detected
Asbestos by Gravimetry	U	2192	%	0.001	0.001					
Total Asbestos	N	2192	%	0.001	0.001					
Moisture	N	2030	%	0.020	14	11	17	16	9.7	13
Soil Colour	N	2040		N/A	Brown	Brown	Brown	Brown	Brown	Brown
Other Material	N	2040		N/A	Stones	Stones	Stones	Stones	Stones	Stones
Soil Texture	N	2040		N/A	Sand	Sand	Sand,	Sand	Sand	Sand
Chromatogram (TPH)	N			N/A					See Attached	
pH	M	2010		N/A	8.0	7.8	6.0	8.6	8.3	8.4
Boron (Hot Water Soluble)	M	2120	mg/kg	0.40					1.0	
Sulphate (2:1 Water Soluble) as SO4	M	2120	g/l	0.010	0.49	0.030	0.051	0.21	0.18	0.17
Cyanide (Free)	M	2300	mg/kg	0.50					< 0.50	
Cyanide (Total)	M	2300	mg/kg	0.50					< 0.50	
Arsenic	M	2450	mg/kg	1.0	42		41		26	35
Cadmium	M	2450	mg/kg	0.10	0.15		< 0.10		0.44	0.38
Chromium	M	2450	mg/kg	1.0	19		19		21	21
Copper	M	2450	mg/kg	0.50	61		61		53	82
Mercury	M	2450	mg/kg	0.10	0.96		1.2		0.56	0.85
Nickel	M	2450	mg/kg	0.50	21		13		18	17
Lead	M	2450	mg/kg	0.50	220		1000		330	260
Selenium	M	2450	mg/kg	0.20	0.25		0.38		< 0.20	< 0.20
Vanadium	U	2450	mg/kg	5.0	31		31		26	29
Zinc	M	2450	mg/kg	0.50	150		54		120	190
Chromium (Hexavalent)	N	2490	mg/kg	0.50	< 0.50		< 0.50		< 0.50	< 0.50
Organic Matter	M	2625	%	0.40	12		9.5		2.8	6.6
Fuel Type	N	2670		N/A					PAH	
Aliphatic TPH >C5-C6	N	2680	mg/kg	1.0					< 1.0	
Aliphatic TPH >C6-C8	N	2680	mg/kg	1.0					< 1.0	
Aliphatic TPH >C8-C10	M	2680	mg/kg	1.0					< 1.0	
Aliphatic TPH >C10-C12	M	2680	mg/kg	1.0					< 1.0	
Aliphatic TPH >C12-C16	M	2680	mg/kg	1.0					< 1.0	
Aliphatic TPH >C16-C21	M	2680	mg/kg	1.0					< 1.0	
Aliphatic TPH >C21-C35	M	2680	mg/kg	1.0					30	
Aliphatic TPH >C35-C44	N	2680	mg/kg	1.0					< 1.0	
Total Aliphatic Hydrocarbons	N	2680	mg/kg	5.0					31	
Aromatic TPH >C5-C7	N	2680	mg/kg	1.0					< 1.0	

Results - Soil

Client: LK Consult	Chemtest Job No.:				18-23075	18-23075	18-23075	18-23075	18-23075	18-23075
Quotation No.:	Chemtest Sample ID.:				664477	664478	664479	664480	664481	664482
	Client Sample ID.:				WS101	WS101	WS102	WS102	WS103	WS104
	Sample Type:				SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
	Top Depth (m):				0.20	0.90	0.20	1.30	0.30	0.10
	Bottom Depth (m):				0.90	2.00	0.60	2.00	1.20	1.30
	Date Sampled:				01-Aug-2018	01-Aug-2018	01-Aug-2018	01-Aug-2018	01-Aug-2018	01-Aug-2018
	Asbestos Lab:				LIVERPOOL		LIVERPOOL		LIVERPOOL	LIVERPOOL
Determinand	Accred.	SOP	Units	LOD						
Aromatic TPH >C7-C8	N	2680	mg/kg	1.0					< 1.0	
Aromatic TPH >C8-C10	M	2680	mg/kg	1.0					< 1.0	
Aromatic TPH >C10-C12	M	2680	mg/kg	1.0					< 1.0	
Aromatic TPH >C12-C16	M	2680	mg/kg	1.0					< 1.0	
Aromatic TPH >C16-C21	U	2680	mg/kg	1.0					3.2	
Aromatic TPH >C21-C35	M	2680	mg/kg	1.0					47	
Aromatic TPH >C35-C44	N	2680	mg/kg	1.0					< 1.0	
Total Aromatic Hydrocarbons	N	2680	mg/kg	5.0					50	
Total Petroleum Hydrocarbons	N	2680	mg/kg	10.0					81	
Benzene	M	2760	µg/kg	1.0					< 1.0	
Toluene	M	2760	µg/kg	1.0					< 1.0	
Ethylbenzene	M	2760	µg/kg	1.0					< 1.0	
m & p-Xylene	M	2760	µg/kg	1.0					< 1.0	
o-Xylene	M	2760	µg/kg	1.0					< 1.0	
Methyl Tert-Butyl Ether	M	2760	µg/kg	1.0					< 1.0	
Naphthalene	M	2800	mg/kg	0.10	1.1		0.18		0.43	1.1
Acenaphthylene	N	2800	mg/kg	0.10	0.14		< 0.10		0.19	0.24
Acenaphthene	M	2800	mg/kg	0.10	1.3		< 0.10		0.18	0.30
Fluorene	M	2800	mg/kg	0.10	0.83		< 0.10		0.21	0.33
Phenanthrene	M	2800	mg/kg	0.10	6.6		0.38		3.1	4.1
Anthracene	M	2800	mg/kg	0.10	1.3		< 0.10		0.35	0.74
Fluoranthene	M	2800	mg/kg	0.10	7.5		0.21		2.3	4.4
Pyrene	M	2800	mg/kg	0.10	6.9		0.18		2.3	4.3
Benzo[a]anthracene	M	2800	mg/kg	0.10	2.0		< 0.10		0.22	1.1
Chrysene	M	2800	mg/kg	0.10	2.4		< 0.10		0.29	1.3
Benzo[b]fluoranthene	M	2800	mg/kg	0.10	2.4		< 0.10		0.21	1.1
Benzo[k]fluoranthene	M	2800	mg/kg	0.10	0.62		< 0.10		< 0.10	0.24
Benzo[a]pyrene	M	2800	mg/kg	0.10	1.5		< 0.10		< 0.10	0.57
Indeno(1,2,3-c,d)Pyrene	M	2800	mg/kg	0.10	0.56		< 0.10		< 0.10	0.16
Dibenz(a,h)Anthracene	N	2800	mg/kg	0.10	< 0.10		< 0.10		< 0.10	< 0.10
Benzo[g,h,i]perylene	M	2800	mg/kg	0.10	1.2		< 0.10		< 0.10	0.46
Total Of 16 PAH's	N	2800	mg/kg	2.0	36		< 2.0		9.9	20
Total Phenols	M	2920	mg/kg	0.30					< 0.30	

TPH Chromatogram on Soil Sample: 664481



SOP	Title	Parameters included	Method summary
2010	pH Value of Soils	pH	pH Meter
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <37°C.
2040	Soil Description(Requirement of MCERTS)	Soil description	As received soil is described based upon BS5930
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES
2192	Asbestos	Asbestos	Polarised light microscopy / Gravimetry
2300	Cyanides & Thiocyanate in Soils	Free (or easy liberatable) Cyanide; total Cyanide; complex Cyanide; Thiocyanate	Alkaline extraction followed by colorimetric determination using Automated Flow Injection Analyser.
2450	Acid Soluble Metals in Soils	Metals, including: Arsenic; Barium; Beryllium; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Vanadium; Zinc	Acid digestion followed by determination of metals in extract by ICP-MS.
2490	Hexavalent Chromium in Soils	Chromium [VI]	Soil extracts are prepared by extracting dried and ground soil samples into boiling water. Chromium [VI] is determined by 'Aquakem 600' Discrete Analyser using 1,5-diphenylcarbazide.
2625	Total Organic Carbon in Soils	Total organic Carbon (TOC)	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.
2670	Total Petroleum Hydrocarbons (TPH) in Soils by GC-FID	TPH (C6–C40); optional carbon banding, e.g. 3-band – GRO, DRO & LRO*TPH C8–C40	Dichloromethane extraction / GC-FID
2680	TPH A/A Split	Aliphatics: >C5–C6, >C6–C8,>C8–C10, >C10–C12, >C12–C16, >C16–C21, >C21–C35, >C35– C44Aromatics: >C5–C7, >C7–C8, >C8– C10, >C10–C12, >C12–C16, >C16– C21, >C21– C35, >C35– C44	Dichloromethane extraction / GCxGC FID detection
2760	Volatile Organic Compounds (VOCs) in Soils by Headspace GC-MS	Volatile organic compounds, including BTEX and halogenated Aliphatic/Aromatics.(cf. USEPA Method 8260)*please refer to UKAS schedule	Automated headspace gas chromatographic (GC) analysis of a soil sample, as received, with mass spectrometric (MS) detection of volatile organic compounds.
2800	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Soil by GC-MS	Acenaphthene*; Acenaphthylene; Anthracene*; Benzo[a]Anthracene*; Benzo[a]Pyrene*; Benzo[b]Fluoranthene*; Benzo[ghi]Perylene*; Benzo[k]Fluoranthene; Chrysene*; Dibenzo[ah]Anthracene; Fluoranthene*; Fluorene*; Indeno[123cd]Pyrene*; Naphthalene*; Phenanthrene*; Pyrene*	Dichloromethane extraction / GC-MS
2920	Phenols in Soils by HPLC	Phenolic compounds including Resorcinol, Phenol, Methylphenols, Dimethylphenols, 1-Naphthol and TrimethylphenolsNote: chlorophenols are excluded.	60:40 methanol/water mixture extraction, followed by HPLC determination using electrochemical detection.

Report Information

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- U UKAS accredited
- M MCERTS and UKAS accredited
- N Unaccredited
- S This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
- SN This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
- T This analysis has been subcontracted to an unaccredited laboratory
- I/S Insufficient Sample
- U/S Unsuitable Sample
- N/E not evaluated
- < "less than"
- > "greater than"

Comments or interpretations are beyond the scope of UKAS accreditation

The results relate only to the items tested

Uncertainty of measurement for the determinands tested are available upon request

None of the results in this report have been recovery corrected

All results are expressed on a dry weight basis

The following tests were analysed on samples as received and the results subsequently corrected to a dry weight basis TPH, BTEX, VOCs, SVOCs, PCBs, Phenols

For all other tests the samples were dried at < 37°C prior to analysis

All Asbestos testing is performed at the indicated laboratory

Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

Sample Deviation Codes

- A - Date of sampling not supplied
- B - Sample age exceeds stability time (sampling to extraction)
- C - Sample not received in appropriate containers
- D - Broken Container
- E - Insufficient Sample (Applies to LOI in Trommel Fines Only)

Sample Retention and Disposal

All soil samples will be retained for a period of 45 days from the date of receipt

All water samples will be retained for 14 days from the date of receipt

Charges may apply to extended sample storage

If you require extended retention of samples, please email your requirements to:

customerservices@chemtest.co.uk



Final Report

Report No.: 18-39236-1

Initial Date of Issue: 21-Dec-2018

Client LK Consult

Client Address: Unit 29 Eton Business Park
Eton Hill Road
Radcliffe
Manchester
Lancashire
M26 2ZS

Contact(s): Chris Hughes
Contaminated Land

Project LKC 17 1166 Gallery Gardens,
Manchester

Quotation No.: **Date Received:** 13-Dec-2018

Order No.: 736595 **Date Instructed:** 13-Dec-2018

No. of Samples: 3

Turnaround (Wkdays): 5 **Results Due:** 19-Dec-2018

Date Approved: 21-Dec-2018

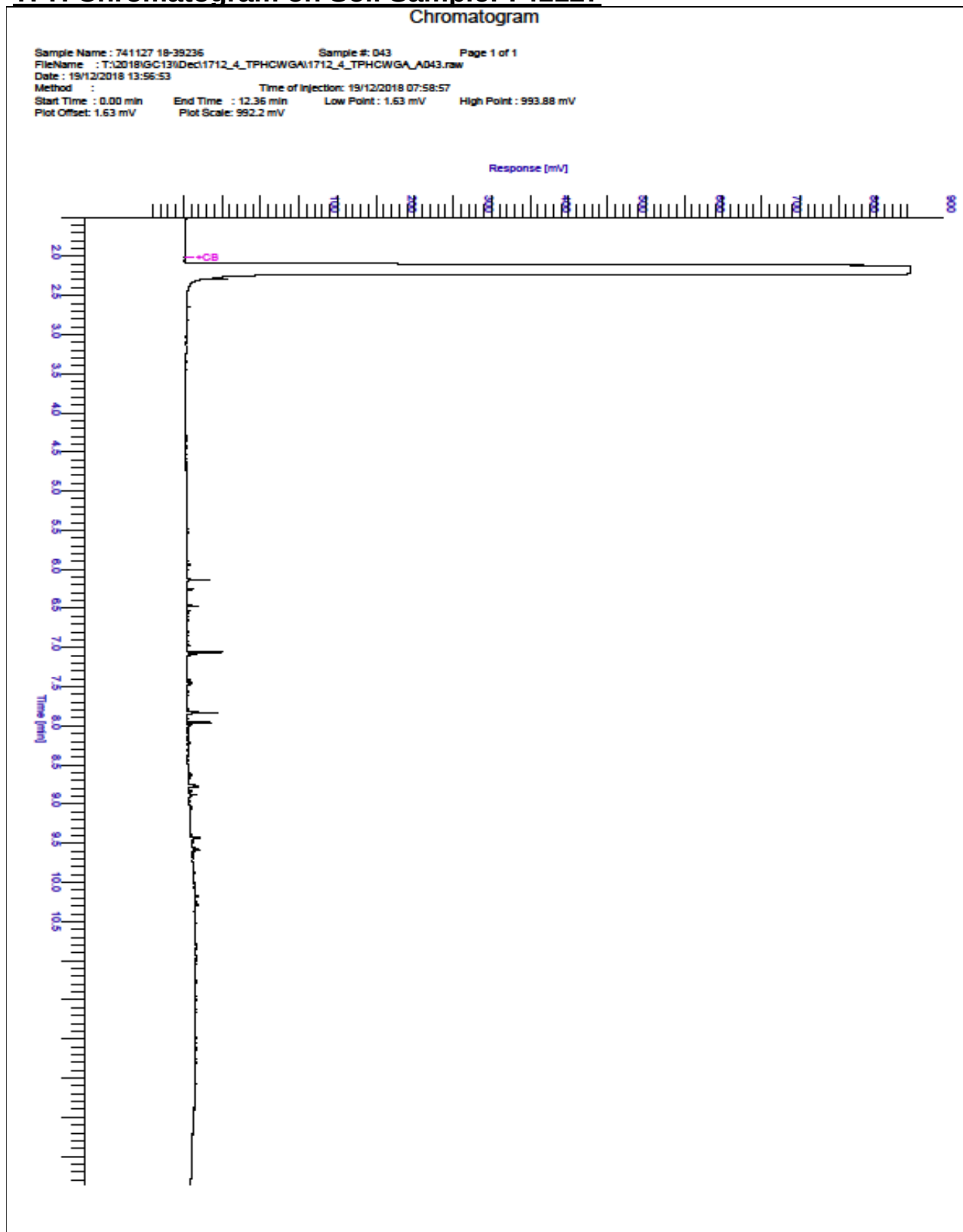
Approved By:

Details: Glynn Harvey, Laboratory Manager

Client: LK Consult	Chemtest Job No.:				18-39236	18-39236	18-39236
Quotation No.:	Chemtest Sample ID.:				741127	741128	741130
	Client Sample ID.:				TP101	TP101	TP103
	Sample Type:				SOIL	SOIL	SOIL
	Top Depth (m):				0.20	0.50	0.10
	Bottom Depth (m):				0.50	1.40	0.50
	Date Sampled:				11-Dec-2018	11-Dec-2018	11-Dec-2018
	Asbestos Lab:				DURHAM	DURHAM	DURHAM
Determinand	Accred.	SOP	Units	LOD			
ACM Type	U	2192		N/A	-	-	-
Asbestos Identification	U	2192	%	0.001	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected
Moisture	N	2030	%	0.020	13	15	13
Soil Colour	N	2040		N/A	Brown	Brown	Brown
Other Material	N	2040		N/A	Stones	Stones	Stones
Soil Texture	N	2040		N/A	Sand	Sand	Sand
Chromatogram (TPH)	N			N/A	See Attached		
pH	M	2010		N/A	8.1	8.3	9.3
Boron (Hot Water Soluble)	M	2120	mg/kg	0.40	0.56		
Sulphate (2:1 Water Soluble) as SO4	M	2120	g/l	0.010	< 0.010	0.014	0.61
Cyanide (Free)	M	2300	mg/kg	0.50	< 0.50		
Cyanide (Total)	M	2300	mg/kg	0.50	< 0.50		
Arsenic	M	2450	mg/kg	1.0	17	52	21
Cadmium	M	2450	mg/kg	0.10	0.16	0.12	0.40
Chromium	M	2450	mg/kg	1.0	17	19	19
Copper	M	2450	mg/kg	0.50	61	130	37
Mercury	M	2450	mg/kg	0.10	0.32	3.3	0.27
Nickel	M	2450	mg/kg	0.50	17	28	19
Lead	M	2450	mg/kg	0.50	100	280	130
Selenium	M	2450	mg/kg	0.20	0.45	0.41	0.24
Vanadium	U	2450	mg/kg	5.0	26	32	30
Zinc	M	2450	mg/kg	0.50	50	66	78
Chromium (Hexavalent)	N	2490	mg/kg	0.50	< 0.50	< 0.50	< 0.50
Organic Matter	M	2625	%	0.40	6.7	8.6	4.0
Fuel Type	N	2670		N/A	PAH		
Aliphatic TPH >C5-C6	N	2680	mg/kg	1.0	< 1.0		
Aliphatic TPH >C6-C8	N	2680	mg/kg	1.0	< 1.0		
Aliphatic TPH >C8-C10	M	2680	mg/kg	1.0	< 1.0		
Aliphatic TPH >C10-C12	M	2680	mg/kg	1.0	< 1.0		
Aliphatic TPH >C12-C16	M	2680	mg/kg	1.0	7.6		
Aliphatic TPH >C16-C21	M	2680	mg/kg	1.0	2.3		
Aliphatic TPH >C21-C35	M	2680	mg/kg	1.0	21		
Aliphatic TPH >C35-C44	N	2680	mg/kg	1.0	< 1.0		
Total Aliphatic Hydrocarbons	N	2680	mg/kg	5.0	30		
Aromatic TPH >C5-C7	N	2680	mg/kg	1.0	< 1.0		
Aromatic TPH >C7-C8	N	2680	mg/kg	1.0	< 1.0		
Aromatic TPH >C8-C10	M	2680	mg/kg	1.0	< 1.0		

Client: LK Consult	Chemtest Job No.:				18-39236	18-39236	18-39236
Quotation No.:	Chemtest Sample ID.:				741127	741128	741130
	Client Sample ID.:				TP101	TP101	TP103
	Sample Type:				SOIL	SOIL	SOIL
	Top Depth (m):				0.20	0.50	0.10
	Bottom Depth (m):				0.50	1.40	0.50
	Date Sampled:				11-Dec-2018	11-Dec-2018	11-Dec-2018
	Asbestos Lab:				DURHAM	DURHAM	DURHAM
Determinand	Accred.	SOP	Units	LOD			
Aromatic TPH >C10-C12	M	2680	mg/kg	1.0	< 1.0		
Aromatic TPH >C12-C16	M	2680	mg/kg	1.0	73		
Aromatic TPH >C16-C21	U	2680	mg/kg	1.0	120		
Aromatic TPH >C21-C35	M	2680	mg/kg	1.0	860		
Aromatic TPH >C35-C44	N	2680	mg/kg	1.0	99		
Total Aromatic Hydrocarbons	N	2680	mg/kg	5.0	1100		
Total Petroleum Hydrocarbons	N	2680	mg/kg	10.0	1200		
Benzene	M	2760	µg/kg	1.0	< 1.0		
Toluene	M	2760	µg/kg	1.0	< 1.0		
Ethylbenzene	M	2760	µg/kg	1.0	< 1.0		
m & p-Xylene	M	2760	µg/kg	1.0	< 1.0		
o-Xylene	M	2760	µg/kg	1.0	< 1.0		
Methyl Tert-Butyl Ether	M	2760	µg/kg	1.0	< 1.0		
Naphthalene	M	2800	mg/kg	0.10	0.39	0.35	0.64
Acenaphthylene	N	2800	mg/kg	0.10	0.49	0.34	< 0.10
Acenaphthene	M	2800	mg/kg	0.10	6.2	3.5	2.5
Fluorene	M	2800	mg/kg	0.10	4.1	2.7	1.4
Phenanthrene	M	2800	mg/kg	0.10	19	12	13
Anthracene	M	2800	mg/kg	0.10	6.0	3.6	3.4
Fluoranthene	M	2800	mg/kg	0.10	15	9.2	15
Pyrene	M	2800	mg/kg	0.10	12	8.0	14
Benzo[a]anthracene	M	2800	mg/kg	0.10	3.2	2.1	5.2
Chrysene	M	2800	mg/kg	0.10	3.2	2.5	6.3
Benzo[b]fluoranthene	M	2800	mg/kg	0.10	2.1	1.6	6.0
Benzo[k]fluoranthene	M	2800	mg/kg	0.10	0.70	0.59	2.4
Benzo[a]pyrene	M	2800	mg/kg	0.10	1.1	0.76	4.7
Indeno(1,2,3-c,d)Pyrene	M	2800	mg/kg	0.10	0.34	0.26	2.6
Dibenz(a,h)Anthracene	N	2800	mg/kg	0.10	< 0.10	< 0.10	0.36
Benzo[g,h,i]perylene	M	2800	mg/kg	0.10	0.32	0.47	2.9
Total Of 16 PAH's	N	2800	mg/kg	2.0	74	48	80
Total Phenols	M	2920	mg/kg	0.30	< 0.30		

TPH Chromatogram on Soil Sample: 741127



SOP	Title	Parameters included	Method summary
2010	pH Value of Soils	pH	pH Meter
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <37°C.
2040	Soil Description(Requirement of MCERTS)	Soil description	As received soil is described based upon BS5930
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES
2192	Asbestos	Asbestos	Polarised light microscopy / Gravimetry
2300	Cyanides & Thiocyanate in Soils	Free (or easy liberatable) Cyanide; total Cyanide; complex Cyanide; Thiocyanate	Alkaline extraction followed by colorimetric determination using Automated Flow Injection Analyser.
2450	Acid Soluble Metals in Soils	Metals, including: Arsenic; Barium; Beryllium; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Vanadium; Zinc	Acid digestion followed by determination of metals in extract by ICP-MS.
2490	Hexavalent Chromium in Soils	Chromium [VI]	Soil extracts are prepared by extracting dried and ground soil samples into boiling water. Chromium [VI] is determined by 'Aquakem 600' Discrete Analyser using 1,5-diphenylcarbazide.
2625	Total Organic Carbon in Soils	Total organic Carbon (TOC)	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.
2670	Total Petroleum Hydrocarbons (TPH) in Soils by GC-FID	TPH (C6–C40); optional carbon banding, e.g. 3-band – GRO, DRO & LRO*TPH C8–C40	Dichloromethane extraction / GC-FID
2680	TPH A/A Split	Aliphatics: >C5–C6, >C6–C8,>C8–C10, >C10–C12, >C12–C16, >C16–C21, >C21–C35, >C35– C44Aromatics: >C5–C7, >C7–C8, >C8– C10, >C10–C12, >C12–C16, >C16– C21, >C21– C35, >C35– C44	Dichloromethane extraction / GCxGC FID detection
2760	Volatile Organic Compounds (VOCs) in Soils by Headspace GC-MS	Volatile organic compounds, including BTEX and halogenated Aliphatic/Aromatics.(cf. USEPA Method 8260)*please refer to UKAS schedule	Automated headspace gas chromatographic (GC) analysis of a soil sample, as received, with mass spectrometric (MS) detection of volatile organic compounds.
2800	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Soil by GC-MS	Acenaphthene*; Acenaphthylene; Anthracene*; Benzo[a]Anthracene*; Benzo[a]Pyrene*; Benzo[b]Fluoranthene*; Benzo[ghi]Perylene*; Benzo[k]Fluoranthene; Chrysene*; Dibenz[ah]Anthracene; Fluoranthene*; Fluorene*; Indeno[123cd]Pyrene*; Naphthalene*; Phenanthrene*; Pyrene*	Dichloromethane extraction / GC-MS
2920	Phenols in Soils by HPLC	Phenolic compounds including Resorcinol, Phenol, Methylphenols, Dimethylphenols, 1-Naphthol and TrimethylphenolsNote: chlorophenols are excluded.	60:40 methanol/water mixture extraction, followed by HPLC determination using electrochemical detection.

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- < "less than"
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Uncertainty of measurement for the determinands tested are available upon request

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All results are expressed on a dry weight basis

The following tests were analysed on samples as received and the results subsequently corrected to a dry weight basis TPH, BTEX, VOCs, SVOCs, PCBs, Phenols

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- A - Date of sampling not supplied
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Sample Retention and Disposal

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All water samples will be retained for 14 days from the date of receipt

Charges may apply to extended sample storage

If you require extended retention of samples, please email your requirements to:

customerservices@chemtest.com



2183

Final Report

Report No.: 18-39240-1

Initial Date of Issue: 27-Dec-2018

Client LK Consult

Client Address: Unit 29 Eton Business Park
Eton Hill Road
Radcliffe
Manchester
Lancashire
M26 2ZS

Contact(s): Chris Hughes
Contaminated Land

Project LKC 17 1166 Gallery Gardens,
Manchester

Quotation No.: **Date Received:** 13-Dec-2018

Order No.: 736595 **Date Instructed:** 13-Dec-2018

No. of Samples: 1

Turnaround (Wkdays): 7 **Results Due:** 21-Dec-2018

Date Approved: 27-Dec-2018

Approved By:



Details: Martin Dyer, Laboratory Manager

Results - 2 Stage WAC

Project: LKC 17 1166 Gallery Gardens, Manchester

Chemtest Job No: 18-39240 Chemtest Sample ID: 741143 Sample Ref: Sample ID: TP103 Sample Location: Top Depth(m): 1.20 Bottom Depth(m): 2.50 Sampling Date: 11-Dec-2018							Landfill Waste Acceptance Criteria Limits		
							Inert Waste Landfill	Stable, Non-reactive hazardous waste in non-hazardous Landfill	Hazardous Waste Landfill
Determinand	SOP	Accred.	Units						
Total Organic Carbon	2625	U	%				3.5	3	5
Loss On Ignition	2610	U	%				4.7	--	10
Total BTEX	2760	U	mg/kg				< 0.010	6	--
Total PCBs (7 Congeners)	2815	U	mg/kg				< 0.10	1	--
TPH Total WAC (Mineral Oil)	2670	U	mg/kg				46	500	--
Total (Of 17) PAH's	2700	N	mg/kg				8.4	100	--
pH	2010	U					9.1	--	>6
Acid Neutralisation Capacity	2015	N	mol/kg				0.11	--	To evaluate
Eluate Analysis			2:1 mg/l	8:1 mg/l	2:1 mg/kg	Cumulative mg/kg 10:1	Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg		
Arsenic	1450	U	0.0076	0.014	< 0.050	0.13	0.5	2	25
Barium	1450	U	0.016	0.0063	< 0.50	< 0.50	20	100	300
Cadmium	1450	U	< 0.00010	< 0.00010	< 0.010	< 0.010	0.04	1	5
Chromium	1450	U	0.0080	0.0011	< 0.050	< 0.050	0.5	10	70
Copper	1450	U	0.0056	0.0071	< 0.050	< 0.050	2	50	100
Mercury	1450	U	< 0.00050	< 0.00050	< 0.0010	< 0.0050	0.01	0.2	2
Molybdenum	1450	U	0.033	0.0097	0.065	0.13	0.5	10	30
Nickel	1450	U	0.0011	< 0.0010	< 0.050	< 0.050	0.4	10	40
Lead	1450	U	< 0.0010	0.0044	< 0.010	0.038	0.5	10	50
Antimony	1450	U	0.0032	0.0020	< 0.010	0.022	0.06	0.7	5
Selenium	1450	U	0.0043	0.0020	< 0.010	0.023	0.1	0.5	7
Zinc	1450	U	0.0044	0.0017	< 0.50	< 0.50	4	50	200
Chloride	1220	U	7.6	1.8	15	25	800	15000	25000
Fluoride	1220	U	1.3	0.63	2.6	7.1	10	150	500
Sulphate	1220	U	200	32	400	540	1000	20000	50000
Total Dissolved Solids	1020	N	330	78	660	1100	4000	60000	100000
Phenol Index	1920	U	< 0.030	< 0.030	< 0.30	< 0.50	1	-	-
Dissolved Organic Carbon	1610	U	11	5.0	< 50	58	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.175
Moisture (%)	14

Leachate Test Information	
Leachant volume 1st extract/l	0.322
Leachant volume 2nd extract/l	1.400
Eluant recovered from 1st extract/l	0.224

Waste Acceptance Criteria

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

SOP	Title	Parameters included	Method summary
1020	Electrical Conductivity and Total Dissolved Solids (TDS) in Waters	Electrical Conductivity and Total Dissolved Solids (TDS) in Waters	Conductivity Meter
1220	Anions, Alkalinity & Ammonium in Waters	Fluoride; Chloride; Nitrite; Nitrate; Total; Oxidisable Nitrogen (TON); Sulfate; Phosphate; Alkalinity; Ammonium	Automated colorimetric analysis using 'Aquakem 600' Discrete Analyser.
1450	Metals in Waters by ICP-MS	Metals, including: Antimony; Arsenic; Barium; Beryllium; Boron; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Tin; Vanadium; Zinc	Filtration of samples followed by direct determination by inductively coupled plasma mass spectrometry (ICP-MS).
1610	Total/Dissolved Organic Carbon in Waters	Organic Carbon	TOC Analyser using Catalytic Oxidation
1920	Phenols in Waters by HPLC	Phenolic compounds including: Phenol, Cresols, Xylenols, Trimethylphenols Note: Chlorophenols are excluded.	Determination by High Performance Liquid Chromatography (HPLC) using electrochemical detection.
2010	pH Value of Soils	pH	pH Meter
2015	Acid Neutralisation Capacity	Acid Reserve	Titration
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <37°C.
2610	Loss on Ignition	loss on ignition (LOI)	Determination of the proportion by mass that is lost from a soil by ignition at 550°C.
2625	Total Organic Carbon in Soils	Total organic Carbon (TOC)	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.
2670	Total Petroleum Hydrocarbons (TPH) in Soils by GC-FID	TPH (C6–C40); optional carbon banding, e.g. 3-band – GRO, DRO & LRO*TPH C8–C40	Dichloromethane extraction / GC-FID
2700	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Soil by GC-FID	Acenaphthene; Acenaphthylene; Anthracene; Benzo[a]Anthracene; Benzo[a]Pyrene; Benzo[b]Fluoranthene; Benzo[ghi]Perylene; Benzo[k]Fluoranthene; Chrysene; Dibenzo[ah]Anthracene; Fluoranthene; Fluorene; Indeno[123cd]Pyrene; Naphthalene; Phenanthrene; Pyrene	Dichloromethane extraction / GC-FID
2760	Volatile Organic Compounds (VOCs) in Soils by Headspace GC-MS	Volatile organic compounds, including BTEX and halogenated Aliphatic/Aromatics.(cf. USEPA Method 8260)*please refer to UKAS schedule	Automated headspace gas chromatographic (GC) analysis of a soil sample, as received, with mass spectrometric (MS) detection of volatile organic compounds.
2815	Polychlorinated Biphenyls (PCB) ICES7Congeners in Soils by GC-MS	ICES7 PCB congeners	Acetone/Hexane extraction / GC-MS
640	Characterisation of Waste (Leaching)	Waste material including soil, sludges and granular waste	ComplianceTest for Leaching of Granular Waste Material and Sludge

Report Information

Key

- U UKAS accredited
- M MCERTS and UKAS accredited
- N Unaccredited
- S This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
- SN This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
- T This analysis has been subcontracted to an unaccredited laboratory
- I/S Insufficient Sample
- U/S Unsuitable Sample
- N/E not evaluated
- < "less than"
- > "greater than"

Comments or interpretations are beyond the scope of UKAS accreditation

The results relate only to the items tested

Uncertainty of measurement for the determinands tested are available upon request

None of the results in this report have been recovery corrected

All results are expressed on a dry weight basis

The following tests were analysed on samples as received and the results subsequently corrected to a dry weight basis TPH, BTEX, VOCs, SVOCs, PCBs, Phenols

For all other tests the samples were dried at < 37°C prior to analysis

All Asbestos testing is performed at the indicated laboratory

Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

Sample Deviation Codes

- A - Date of sampling not supplied
- B - Sample age exceeds stability time (sampling to extraction)
- C - Sample not received in appropriate containers
- D - Broken Container
- E - Insufficient Sample (Applies to LOI in Trommel Fines Only)

Sample Retention and Disposal

All soil samples will be retained for a period of 45 days from the date of receipt

All water samples will be retained for 14 days from the date of receipt

Charges may apply to extended sample storage

If you require extended retention of samples, please email your requirements to:

customerservices@chemtest.com



Final Report

Report No.: 18-40025-1

Initial Date of Issue: 02-Jan-2019

Client LK Consult

Client Address: Unit 29 Eton Business Park
Eton Hill Road
Radcliffe
Manchester
Lancashire
M26 2ZS

Contact(s): Chris Hughes
Contaminated Land

Project LKC 17 1166 Gallery Gardens,
Manchester

Quotation No.:		Date Received:	19-Dec-2018
Order No.:	736612	Date Instructed:	19-Dec-2018
No. of Samples:	4		
Turnaround (Wkdays):	5	Results Due:	27-Dec-2018
Date Approved:	02-Jan-2019		

Approved By:

Details: Glynn Harvey, Laboratory Manager

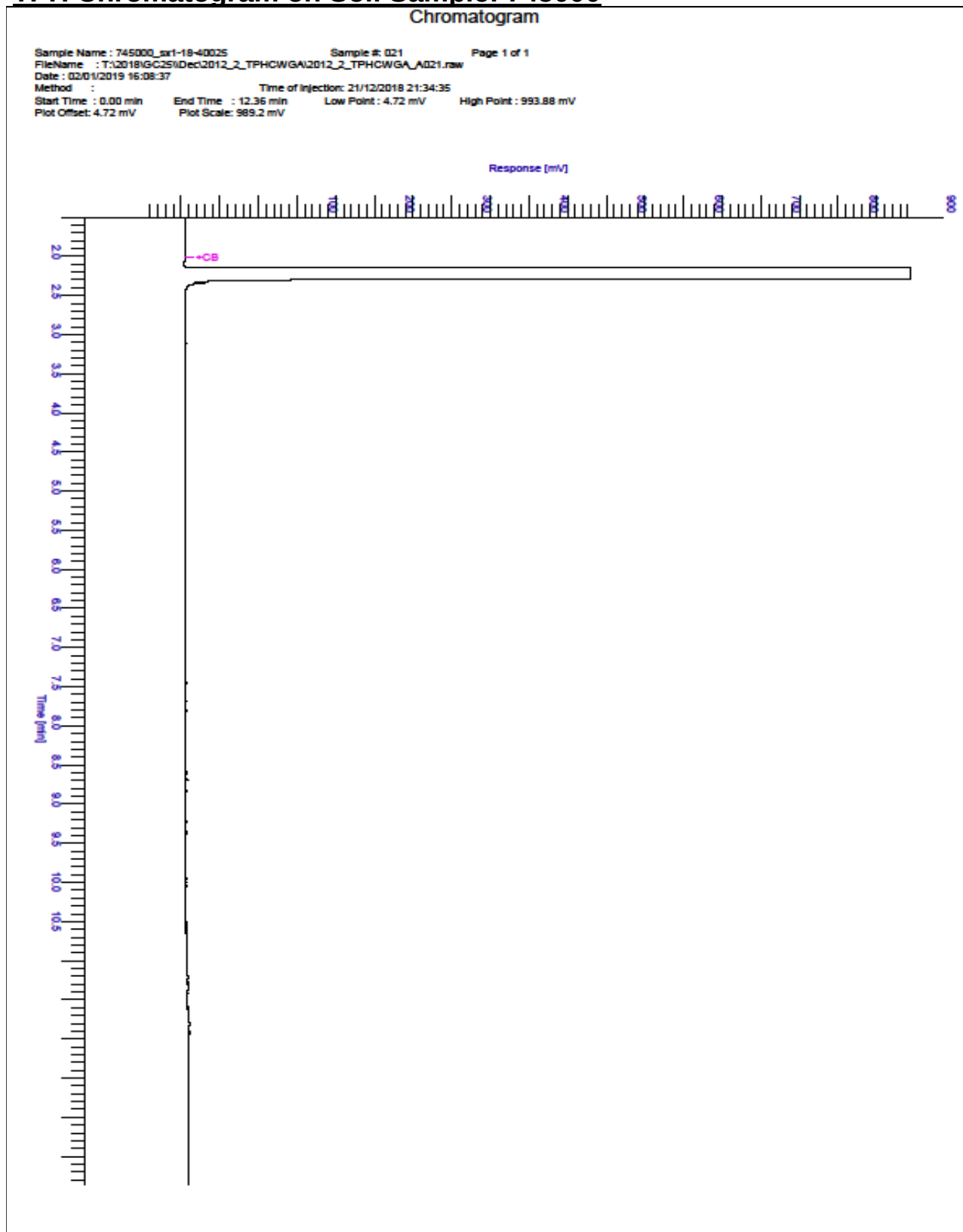
Results - Soil

Client: LK Consult	Chemtest Job No.:				18-40025	18-40025	18-40025	18-40025
Quotation No.:	Chemtest Sample ID.:				744999	745000	745001	745003
	Client Sample ID.:				TP105	TP105	TP106	TP108
	Sample Type:				SOIL	SOIL	SOIL	SOIL
	Top Depth (m):				0.10	0.50	0.10	0.10
	Bottom Depth (m):				0.70	1.50	0.55	1.00
	Date Sampled:				14-Dec-2018	14-Dec-2018	14-Dec-2018	14-Dec-2018
	Asbestos Lab:				COVENTRY	COVENTRY	IN-TRAN-C	COVENTRY
Determinand	Accred.	SOP	Units	LOD				
ACM Type	U	2192		N/A	-	-	-	-
Asbestos Identification	U	2192	%	0.001	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected
Moisture	N	2030	%	0.020	11	15	9.8	14
Soil Colour	N	2040		N/A	Brown,	Brown,	Brown,	Brown,
Other Material	N	2040		N/A	Stones,	Stones,	Stones,	Stones,
Soil Texture	N	2040		N/A	Sand,	Sand,	Sand,	Sand,
Chromatogram (TPH)	N			N/A		See Attached		
pH	M	2010		N/A	10.6	8.5	11.6	8.3
Boron (Hot Water Soluble)	M	2120	mg/kg	0.40		0.65		
Sulphate (2:1 Water Soluble) as SO4	M	2120	g/l	0.010	0.66	0.069	0.76	0.92
Cyanide (Free)	M	2300	mg/kg	0.50		< 0.50		
Cyanide (Total)	M	2300	mg/kg	0.50		0.50		
Arsenic	M	2450	mg/kg	1.0	23	33	34	31
Cadmium	M	2450	mg/kg	0.10	0.61	0.30	0.70	0.15
Chromium	M	2450	mg/kg	1.0	22	21	25	16
Copper	M	2450	mg/kg	0.50	55	99	86	92
Mercury	M	2450	mg/kg	0.10	0.86	1.9	0.75	1.5
Nickel	M	2450	mg/kg	0.50	22	28	30	27
Lead	M	2450	mg/kg	0.50	290	520	410	480
Selenium	M	2450	mg/kg	0.20	< 0.20	0.38	0.30	0.40
Vanadium	U	2450	mg/kg	5.0	33	36	45	31
Zinc	M	2450	mg/kg	0.50	100	120	120	87
Chromium (Hexavalent)	N	2490	mg/kg	0.50	< 0.50	< 0.50	< 0.50	< 0.50
Organic Matter	M	2625	%	0.40	5.0	7.3	7.6	7.9
Fuel Type	N	2670		N/A		PAH		
Aliphatic TPH >C5-C6	N	2680	mg/kg	1.0		< 1.0		
Aliphatic TPH >C6-C8	N	2680	mg/kg	1.0		< 1.0		
Aliphatic TPH >C8-C10	M	2680	mg/kg	1.0		< 1.0		
Aliphatic TPH >C10-C12	M	2680	mg/kg	1.0		< 1.0		
Aliphatic TPH >C12-C16	M	2680	mg/kg	1.0		< 1.0		
Aliphatic TPH >C16-C21	M	2680	mg/kg	1.0		< 1.0		
Aliphatic TPH >C21-C35	M	2680	mg/kg	1.0		2.0		
Aliphatic TPH >C35-C44	N	2680	mg/kg	1.0		< 1.0		
Total Aliphatic Hydrocarbons	N	2680	mg/kg	5.0		< 5.0		
Aromatic TPH >C5-C7	N	2680	mg/kg	1.0		< 1.0		
Aromatic TPH >C7-C8	N	2680	mg/kg	1.0		< 1.0		
Aromatic TPH >C8-C10	M	2680	mg/kg	1.0		< 1.0		

Results - Soil

Client: LK Consult	Chemtest Job No.:				18-40025	18-40025	18-40025	18-40025
Quotation No.:	Chemtest Sample ID.:				744999	745000	745001	745003
	Client Sample ID.:				TP105	TP105	TP106	TP108
	Sample Type:				SOIL	SOIL	SOIL	SOIL
	Top Depth (m):				0.10	0.50	0.10	0.10
	Bottom Depth (m):				0.70	1.50	0.55	1.00
	Date Sampled:				14-Dec-2018	14-Dec-2018	14-Dec-2018	14-Dec-2018
	Asbestos Lab:				COVENTRY	COVENTRY	IN-TRAN-C	COVENTRY
Determinand	Accred.	SOP	Units	LOD				
Aromatic TPH >C10-C12	M	2680	mg/kg	1.0		< 1.0		
Aromatic TPH >C12-C16	M	2680	mg/kg	1.0		< 1.0		
Aromatic TPH >C16-C21	U	2680	mg/kg	1.0		3.8		
Aromatic TPH >C21-C35	M	2680	mg/kg	1.0		63		
Aromatic TPH >C35-C44	N	2680	mg/kg	1.0		< 1.0		
Total Aromatic Hydrocarbons	N	2680	mg/kg	5.0		67		
Total Petroleum Hydrocarbons	N	2680	mg/kg	10.0		69		
Benzene	M	2760	µg/kg	1.0		< 1.0		
Toluene	M	2760	µg/kg	1.0		< 1.0		
Ethylbenzene	M	2760	µg/kg	1.0		< 1.0		
m & p-Xylene	M	2760	µg/kg	1.0		< 1.0		
o-Xylene	M	2760	µg/kg	1.0		< 1.0		
Methyl Tert-Butyl Ether	M	2760	µg/kg	1.0		< 1.0		
Naphthalene	M	2800	mg/kg	0.10	3.0	6.6	7.8	1.2
Acenaphthylene	N	2800	mg/kg	0.10	0.42	0.33	0.66	0.70
Acenaphthene	M	2800	mg/kg	0.10	5.9	4.4	16	6.4
Fluorene	M	2800	mg/kg	0.10	3.8	3.5	11	3.9
Phenanthrene	M	2800	mg/kg	0.10	36	31	100	26
Anthracene	M	2800	mg/kg	0.10	9.5	6.9	29	9.6
Fluoranthene	M	2800	mg/kg	0.10	58	27	140	34
Pyrene	M	2800	mg/kg	0.10	55	29	120	31
Benzo[a]anthracene	M	2800	mg/kg	0.10	24	12	63	14
Chrysene	M	2800	mg/kg	0.10	26	12	62	13
Benzo[b]fluoranthene	M	2800	mg/kg	0.10	31	13	78	13
Benzo[k]fluoranthene	M	2800	mg/kg	0.10	14	5.3	32	4.7
Benzo[a]pyrene	M	2800	mg/kg	0.10	35	13	87	12
Indeno(1,2,3-c,d)Pyrene	M	2800	mg/kg	0.10	21	6.3	51	5.7
Dibenz(a,h)Anthracene	N	2800	mg/kg	0.10	3.3	0.86	11	0.63
Benzo[g,h,i]perylene	M	2800	mg/kg	0.10	23	8.2	52	7.2
Total Of 16 PAH's	N	2800	mg/kg	2.0	350	180	860	180
Total Phenols	M	2920	mg/kg	0.30		< 0.30		

TPH Chromatogram on Soil Sample: 745000



SOP	Title	Parameters included	Method summary
2010	pH Value of Soils	pH	pH Meter
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <37°C.
2040	Soil Description(Requirement of MCERTS)	Soil description	As received soil is described based upon BS5930
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES
2192	Asbestos	Asbestos	Polarised light microscopy / Gravimetry
2300	Cyanides & Thiocyanate in Soils	Free (or easy liberatable) Cyanide; total Cyanide; complex Cyanide; Thiocyanate	Alkaline extraction followed by colorimetric determination using Automated Flow Injection Analyser.
2450	Acid Soluble Metals in Soils	Metals, including: Arsenic; Barium; Beryllium; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Vanadium; Zinc	Acid digestion followed by determination of metals in extract by ICP-MS.
2490	Hexavalent Chromium in Soils	Chromium [VI]	Soil extracts are prepared by extracting dried and ground soil samples into boiling water. Chromium [VI] is determined by 'Aquakem 600' Discrete Analyser using 1,5-diphenylcarbazide.
2625	Total Organic Carbon in Soils	Total organic Carbon (TOC)	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.
2670	Total Petroleum Hydrocarbons (TPH) in Soils by GC-FID	TPH (C6–C40); optional carbon banding, e.g. 3-band – GRO, DRO & LRO*TPH C8–C40	Dichloromethane extraction / GC-FID
2680	TPH A/A Split	Aliphatics: >C5–C6, >C6–C8,>C8–C10, >C10–C12, >C12–C16, >C16–C21, >C21–C35, >C35– C44Aromatics: >C5–C7, >C7–C8, >C8– C10, >C10–C12, >C12–C16, >C16– C21, >C21– C35, >C35– C44	Dichloromethane extraction / GCxGC FID detection
2760	Volatile Organic Compounds (VOCs) in Soils by Headspace GC-MS	Volatile organic compounds, including BTEX and halogenated Aliphatic/Aromatics.(cf. USEPA Method 8260)*please refer to UKAS schedule	Automated headspace gas chromatographic (GC) analysis of a soil sample, as received, with mass spectrometric (MS) detection of volatile organic compounds.
2800	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Soil by GC-MS	Acenaphthene*; Acenaphthylene; Anthracene*; Benzo[a]Anthracene*; Benzo[a]Pyrene*; Benzo[b]Fluoranthene*; Benzo[ghi]Perylene*; Benzo[k]Fluoranthene; Chrysene*; Dibenzo[ah]Anthracene; Fluoranthene*; Fluorene*; Indeno[123cd]Pyrene*; Naphthalene*; Phenanthrene*; Pyrene*	Dichloromethane extraction / GC-MS
2920	Phenols in Soils by HPLC	Phenolic compounds including Resorcinol, Phenol, Methylphenols, Dimethylphenols, 1-Naphthol and TrimethylphenolsNote: chlorophenols are excluded.	60:40 methanol/water mixture extraction, followed by HPLC determination using electrochemical detection.

Report Information

Key

- U UKAS accredited
- M MCERTS and UKAS accredited
- N Unaccredited
- S This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
- SN This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
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- I/S Insufficient Sample
- U/S Unsuitable Sample
- N/E not evaluated
- < "less than"
- > "greater than"

Comments or interpretations are beyond the scope of UKAS accreditation

The results relate only to the items tested

Uncertainty of measurement for the determinands tested are available upon request

None of the results in this report have been recovery corrected

All results are expressed on a dry weight basis

The following tests were analysed on samples as received and the results subsequently corrected to a dry weight basis TPH, BTEX, VOCs, SVOCs, PCBs, Phenols

For all other tests the samples were dried at < 37°C prior to analysis

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Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

Sample Deviation Codes

- A - Date of sampling not supplied
- B - Sample age exceeds stability time (sampling to extraction)
- C - Sample not received in appropriate containers
- D - Broken Container
- E - Insufficient Sample (Applies to LOI in Trommel Fines Only)

Sample Retention and Disposal

All soil samples will be retained for a period of 45 days from the date of receipt

All water samples will be retained for 14 days from the date of receipt

Charges may apply to extended sample storage

If you require extended retention of samples, please email your requirements to:

customerservices@chemtest.com

Appendix D – Certificates of Analysis (Geotechnical)



TEST REPORT

Client LK Consult Ltd

Address Unit 29 Eton Business
Eton Hill Road
Radcliffe
Greater Manchester
M26 2ZS

Contract LKC 17 1166 -
Gallery Gardens, Manchester

Job Number MRN 3383/35
Date of Issue 17 September 2018
Page 1 of 5

Approved Signatories

S J Hutchings, O P Davies

Notes

- 1 All remaining samples and remnants from this contract will be disposed 28 days from the date of this report unless you notify us to the contrary.
- 2 Result certificates, in this report, not bearing a UKAS mark, are not included in our UKAS accreditation schedule.
- 3 Opinions and interpretations expressed herein are outside the scope of our UKAS accreditation
- 4 Certified that the samples have been examined and tested in accordance with the terms of the contract/order and unless otherwise stated conform to the standards/specifications quoted. This does not, however, guarantee the balance of the materials from which the tested samples have been taken to be of equal quality.



MURRAY RIX

33C Vauxhall Ind. Estate, Greg Street
Reddish, Stockport SK5 7BR
TEL 0161 475 0870 FAX 0161 475 0871



TEST CERTIFICATE

LIQUID AND PLASTIC LIMIT

BS 1377: PART 2: 1990 Clause 4.4 ONE POINT METHOD & Clause 5.3

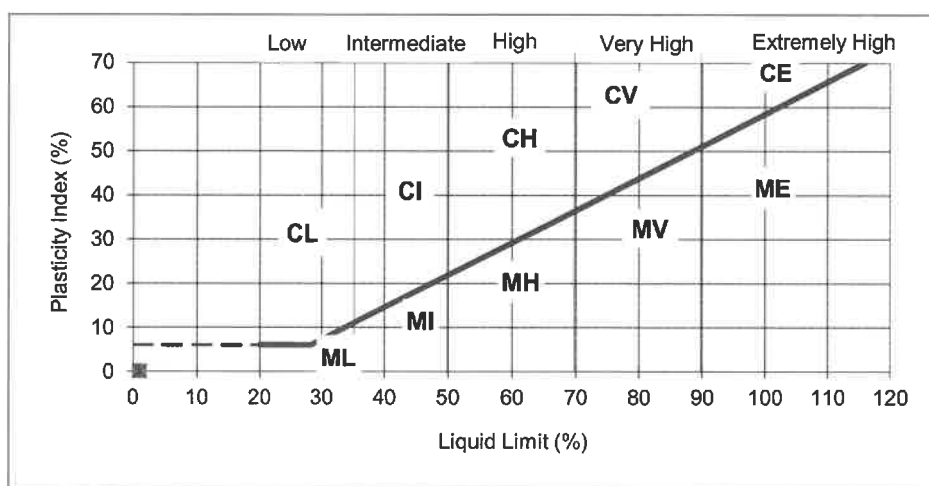
MOISTURE CONTENT METHOD BS 1377: PART 2: 1990 Clause 3.2

CLIENT	LK Consult Ltd
SITE	Gallery Gardens, Manchester
JOB NUMBER	MRN 3383/35

SAMPLE LABEL	WS101 / 2.0-3.0m	DATE SAMPLED	30-Aug-18
SAMPLE No.	78625	DATE RECEIVED	05-Sep-18
DATE TESTED	07-Sep-18	SAMPLED BY	Client

MATERIAL	Brown silty SAND
ADVISED SOURCE	Site Investigation Sample

Moisture Content (Natural) (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Passing 425 micron (%)
16	N/A	Non Plastic	N/A	30



REMARKS

Sample tested after wet sieving

SIGNED

NAME

Page 2 of 5

O.P. Davies BA (Hons)
(Laboratory Manager)

DATE

17-Sep-18

MURRAY RIX

33C Vauxhall Ind. Estate, Greg Street
Reddish, Stockport SK5 7BR
TEL 0161 475 0870 FAX 0161 475 0871



TEST CERTIFICATE

PARTICLE SIZE DISTRIBUTION

BS 1377: PART 2: Clause 9.2: 1990

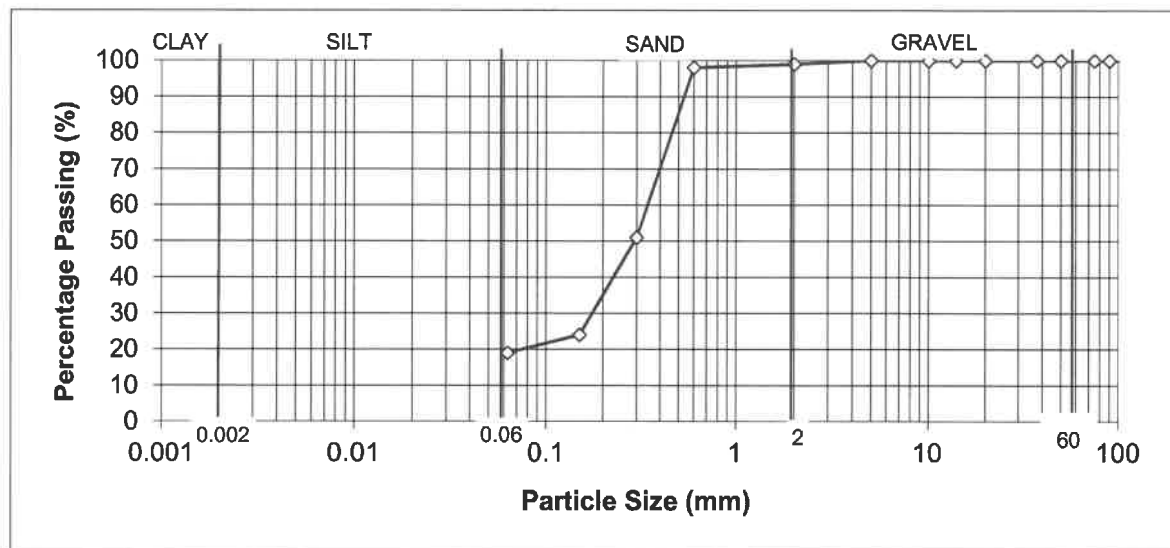
Determination of Moisture Content in accordance with BS 1377: PART 2: Clause 3: 1990 (Oven Dry)

CLIENT	LK Consult Ltd
SITE	Gallery Gardens, Manchester
JOB NUMBER	MRN 3383/35

SAMPLE LABEL	WS101 / 4.2-5.0m	DATE SAMPLED	30-Aug-18
LAB SAMPLE No	78626	DATE RECEIVED	05-Sep-18
DATE TESTED	07-Sep-18	SAMPLED BY	Client

MATERIAL	Brown silty SAND with rare gravel
ADVISED SOURCE	Site Investigation Sample

Sieve Size (mm)	% Passing (%)	Specification (%)	Sieve Size (mm)	% Passing (%)	Specification (%)
125	100		10	100	
90	100		5	100	
75	100		2	99	
50	100		0.6	98	
37.5	100		0.3	51	
20	100		0.15	24	
14	100		0.063	19	



REMARKS

As received moisture content = 13%

SIGNED

NAME

O.P. Davies BA (Hons)
(Laboratory Manager)

DATE

17-Sep-18

MURRAY RIX

33C VAUXHALL INDUSTRIAL ESTATE, GREG STREET
REDDISH, STOCKPORT SK5 7BR
TEL 0161 475 0870 FAX 161 475N 0871

TEST CERTIFICATE

UNDRAINED SHEAR STRENGTH IN TRIAXIAL COMPRESSION BS 1377: PART 7: 1990:CLAUSE 8 SINGLE STAGE

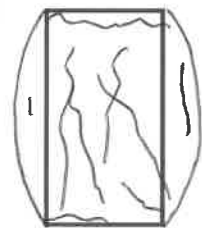
CLIENT	LK Consult Ltd
SITE	Gallery Gardens, Manchester
JOB NUMBER	MRN 3383/35

SAMPLE LABEL	WS102 / 1.3-2.0m	DATE SAMPLED	30 August 2018
LAB SAMPLE No	78627	DATE RECEIVED	05 September 2018
DATE TESTED	10 September 2018	SAMPLED BY	Client

MATERIAL	Soft brown silty very sandy CLAY
ADVISED SOURCE	Site Investigation sample

SPECIMEN LENGTH	76	mm
SPECIMEN DIAMETER	38	mm
MOISTURE CONTENT OF SAMPLE	17	%
BULK DENSITY		Mg/m ³
DRY DENSITY		Mg/m ³
DEPTH OF TOP OF SPECIMEN		m
RATE OF STRAIN	2	%/min
RUBBER MEMBRANE THICKNESS	0.6	mm

SPECIMEN AT FAILURE



Measured Cell Pressure (kPa)	Strain at Failure (%)	Membrane Correction (kPa)	Corrected Max Deviator Stress (kPa)	Shear Stress Cu (kPa)
40	15	2.0	45.8	23

REMARKS

U38 sub-sample taken from bulk sample to give required length / diameter ratio

SIGNED

NAME O.P. Davies BA (Hons)
(Laboratory Manager)

DATE 17 September 2018

MURRAY RIX

33C Vauxhall Ind. Estate, Greg Street
Reddish, Stockport SK5 7BR
TEL 0161 475 0870 FAX 0161 475 0871



TEST CERTIFICATE

PARTICLE SIZE DISTRIBUTION

BS 1377: PART 2: Clause 9.2: 1990

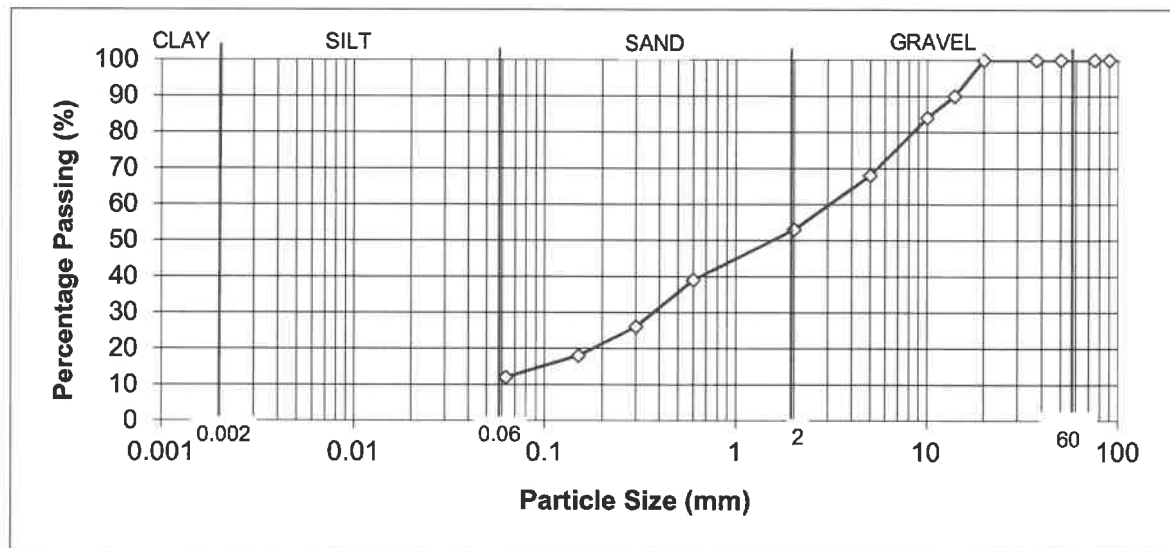
Determination of Moisture Content in accordance with BS 1377: PART 2: Clause 3: 1990 (Oven Dry)

CLIENT	LK Consult Ltd
SITE	Gallery Gardens, Manchester
JOB NUMBER	MRN 3383/35

SAMPLE LABEL	WS104 3.2-3.44m	DATE SAMPLED	30-Aug-18
LAB SAMPLE No	78628	DATE RECEIVED	05-Sep-18
DATE TESTED	07-Sep-18	SAMPLED BY	Client

MATERIAL	Brown silty SAND and GRAVEL
ADVISED SOURCE	Site Investigation Sample

Sieve Size (mm)	% Passing (%)	Specification (%)	Sieve Size (mm)	% Passing (%)	Specification (%)
125	100		10	84	
90	100		5	68	
75	100		2	53	
50	100		0.6	39	
37.5	100		0.3	26	
20	100		0.15	18	
14	90		0.063	12	



REMARKS

As received moisture content = 5.4%

SIGNED

NAME

O.P. Davies BA (Hons)
(Laboratory Manager)

DATE

17-Sep-18



TEST REPORT

Client LK Consult Ltd

Address Unit 29 Eton Business
Eton Hill Road
Radcliffe
Greater Manchester
M26 2ZS

Contract LKC 17 1166 -
Gallery Gardens, Manchester

Job Number MRN 3524/11
Date of Issue 14 January 2019
Page 1 of 26

Approved Signatories

S J Hutchings, O P Davies

Notes

- 1 All remaining samples and remnants from this contract will be disposed 28 days from the date of this report unless you notify us to the contrary.
- 2 Result certificates, in this report, not bearing a UKAS mark, are not included in our UKAS accreditation schedule.
- 3 Opinions and interpretations expressed herein are outside the scope of our UKAS accreditation
- 4 Certified that the samples have been examined and tested in accordance with the terms of the contract/order and unless otherwise stated conform to the standards/specifications quoted. This does not, however, guarantee the balance of the materials from which the tested samples have been taken to be of equal quality.



33C, Vauxhall Industrial Estate, Greg Street, Reddish, Stockport SK5 7BR Tel: 0161 475 0870 Fax: 0161 475 0871
Email: steve@mtt-uk.com Website: www.murrayrix.com

Also at: London: 020 8523 1999

Murray Rix is the trading name of Murray Rix (Northern) Limited. Registered in England 2878361

MURRAY RIX

UNIT 33C, VAUXHALL INDUSTRIAL ESTATE
GREG STREET, STOCKPORT SK5 7BR
TEL 0161 475 0870

TEST CERTIFICATE

DETERMINATION OF POINT LOAD STRENGTH INDEX OF ROCK
METHOD IN ACCORDANCE WITH ASTM STANDARD D 5731

CLIENT	LK Consult Ltd
SITE	LKC 17 1166 - Gallery Gardens, Manchester
JOB NUMBER	MRN 3524/11

SAMPLE LABEL	BH1 9.5-15.5m	DATE SAMPLED	20-Dec-18
LAB SAMPLE No	80800 - 80803	DATE RECEIVED	21-Dec-18
DATE TESTED	07-Jan-19	SAMPLED BY	Client

MATERIAL	Rock Core
ADVISED SOURCE	Site Investigation Sample

Sample Number	Test Type	D (mm)	*W (mm)	Load (P) (kN)	D_e^2 (mm ²)	D_e (mm)	I_s (MPa)	F	$I_{s(50)}$ (MPa)
1	D	84.9		0.2	7208.01	84.90	0.03	1.27	0.04
2	D	85.2		0.2	7259.04	85.20	0.03	1.27	0.04
3	D	85.4		0.2	7293.16	85.40	0.03	1.27	0.03
4	D	86.2		0.4	7430.44	86.20	0.05	1.28	0.07
5	D	83.9		0.8	7039.21	83.90	0.11	1.26	0.14
6	D	85.4		0.9	7293.16	85.40	0.12	1.27	0.16
7	D	86.1		1.4	7413.21	86.10	0.19	1.28	0.24
8	D	86.1		0.8	7413.21	86.10	0.11	1.28	0.14
9	D	86.1		1	7413.21	86.10	0.13	1.28	0.17
10	L	74	57	0.5	5370.52	73.28	0.09	1.19	0.11
11					0.00	0.00	0.00	0.00	0.00
12					0.00	0.00	0.00	0.00	0.00
13					0.00	0.00	0.00	0.00	0.00
14					0.00	0.00	0.00	0.00	0.00
15					0.00	0.00	0.00	0.00	0.00
16					0.00	0.00	0.00	0.00	0.00
17					0.00	0.00	0.00	0.00	0.00
18					0.00	0.00	0.00	0.00	0.00
19					0.00	0.00	0.00	0.00	0.00
20					0.00	0.00	0.00	0.00	0.00

*W Entry required if test type is not Diametrical

REMARKS

SIGNED



NAME O.P. Davies BA (Hons)
(Laboratory Manager)

DATE 14-Jan-19

MURRAY RIX

UNIT 33C, VAUXHALL INDUSTRIAL ESTATE
GREG STREET, STOCKPORT SK5 7BR
TEL 0161 475 0870

TEST CERTIFICATE

DETERMINATION OF POINT LOAD STRENGTH INDEX OF ROCK
METHOD IN ACCORDANCE WITH ASTM STANDARD D 5731

CLIENT	LK Consult Ltd
SITE	LKC 17 1166 - Gallery Gardens, Manchester
JOB NUMBER	MRN 3524/11

SAMPLE LABEL	BH1 15.5-20.0m	DATE SAMPLED	20-Dec-18
LAB SAMPLE No	80804 - 80806	DATE RECEIVED	21-Dec-18
DATE TESTED	07-Jan-19	SAMPLED BY	Client

MATERIAL	Rock Core
ADVISED SOURCE	Site Investigation Sample

Sample Number	Test Type	D (mm)	*W (mm)	Load (P) (kN)	D_e^2 (mm ²)	D_e (mm)	I_s (MPa)	F	$I_{s(50)}$ (MPa)
1	D	86.2		1	7430.44	86.20	0.13	1.28	0.17
2	D	84.4		1.3	7123.36	84.40	0.18	1.27	0.23
3	D	85		0.9	7225.00	85.00	0.12	1.27	0.16
4	D	82.7		0.9	6839.29	82.70	0.13	1.25	0.17
5	D	84.7		0.8	7174.09	84.70	0.11	1.27	0.14
6	D	85.8		1.1	7361.64	85.80	0.15	1.28	0.19
7	D	85.2		0.7	7259.04	85.20	0.10	1.27	0.12
8	D	84.7		0.8	7174.09	84.70	0.11	1.27	0.14
9	D	83.8		1	7022.44	83.80	0.14	1.26	0.18
10	D	86		0.7	7396.00	86.00	0.09	1.28	0.12
11					0.00	0.00	0.00	0.00	0.00
12					0.00	0.00	0.00	0.00	0.00
13					0.00	0.00	0.00	0.00	0.00
14					0.00	0.00	0.00	0.00	0.00
15					0.00	0.00	0.00	0.00	0.00
16					0.00	0.00	0.00	0.00	0.00
17					0.00	0.00	0.00	0.00	0.00
18					0.00	0.00	0.00	0.00	0.00
19					0.00	0.00	0.00	0.00	0.00
20					0.00	0.00	0.00	0.00	0.00

*W Entry required if test type is not Diametrical

REMARKS

SIGNED

NAME O.P. Davies BA (Hons)
(Laboratory Manager)

DATE 14-Jan-19

MURRAY RIX

UNIT 33C, VAUXHALL INDUSTRIAL ESTATE
GREG STREET, STOCKPORT SK5 7BR
TEL 0161 475 0870

TEST CERTIFICATE

DETERMINATION OF POINT LOAD STRENGTH INDEX OF ROCK
METHOD IN ACCORDANCE WITH ASTM STANDARD D 5731

CLIENT	LK Consult Ltd
SITE	LKC 17 1166 - Gallery Gardens, Manchester
JOB NUMBER	MRN 3524/11

SAMPLE LABEL	BH2 9.5-15.5m	DATE SAMPLED	20-Dec-18
LAB SAMPLE No	80807-80810	DATE RECEIVED	21-Dec-18
DATE TESTED	07-Jan-19	SAMPLED BY	Client

MATERIAL	Rock Core
ADVISED SOURCE	Site Investigation Sample

Sample Number	Test Type	D (mm)	*W (mm)	Load (P) (kN)	D_e^2 (mm ²)	D_e (mm)	I_s (MPa)	F	$I_{s(50)}$ (MPa)
1	D	84.4		0.7	7123.36	84.40	0.10	1.27	0.12
2	D	84.4		1.4	7123.36	84.40	0.20	1.27	0.25
3	D	84		0.7	7056.00	84.00	0.10	1.26	0.13
4	D	85.8		1.2	7361.64	85.80	0.16	1.28	0.21
5	D	85.6		1.3	7327.36	85.60	0.18	1.27	0.23
6	D	85.5		1.6	7310.25	85.50	0.22	1.27	0.28
7	D	85		0.9	7225.00	85.00	0.12	1.27	0.16
8	D	86.2		1.4	7430.44	86.20	0.19	1.28	0.24
9	D	86.4		1	7464.96	86.40	0.13	1.28	0.17
10	D	85.6		1.1	7327.36	85.60	0.15	1.27	0.19
11					0.00	0.00	0.00	0.00	0.00
12					0.00	0.00	0.00	0.00	0.00
13					0.00	0.00	0.00	0.00	0.00
14					0.00	0.00	0.00	0.00	0.00
15					0.00	0.00	0.00	0.00	0.00
16					0.00	0.00	0.00	0.00	0.00
17					0.00	0.00	0.00	0.00	0.00
18					0.00	0.00	0.00	0.00	0.00
19					0.00	0.00	0.00	0.00	0.00
20					0.00	0.00	0.00	0.00	0.00

*W Entry required if test type is not Diametrical

REMARKS

SIGNED

NAME O.P. Davies BA (Hons)
(Laboratory Manager)

DATE 14-Jan-19

MURRAY RIX

UNIT 33C, VAUXHALL INDUSTRIAL ESTATE
GREG STREET, STOCKPORT SK5 7BR
TEL 0161 475 0870

TEST CERTIFICATE

DETERMINATION OF POINT LOAD STRENGTH INDEX OF ROCK
METHOD IN ACCORDANCE WITH ASTM STANDARD D 5731

CLIENT	LK Consult Ltd
SITE	LKC 17 1166 - Gallery Gardens, Manchester
JOB NUMBER	MRN 3524/11

SAMPLE LABEL	BH2 15.5-20.0m	DATE SAMPLED	20-Dec-18
LAB SAMPLE No	80811 - 80813	DATE RECEIVED	21-Dec-18
DATE TESTED	07-Jan-19	SAMPLED BY	Client

MATERIAL	Rock Core
ADVISED SOURCE	Site Investigation Sample

Sample Number	Test Type	D (mm)	*W (mm)	Load (P) (kN)	D_e^2 (mm ²)	D_e (mm)	I_s (MPa)	F	$I_{s(50)}$ (MPa)
1	D	86.4		1.4	7464.96	86.40	0.19	1.28	0.24
2	D	85.8		1.3	7361.64	85.80	0.18	1.28	0.23
3	D	86		1.5	7396.00	86.00	0.20	1.28	0.26
4	D	86		1.8	7396.00	86.00	0.24	1.28	0.31
5	D	86.4		1.6	7464.96	86.40	0.21	1.28	0.27
6	D	86.6		1.8	7499.56	86.60	0.24	1.28	0.31
7	D	85.2		1.4	7259.04	85.20	0.19	1.27	0.25
8	D	86.1		1.8	7413.21	86.10	0.24	1.28	0.31
9	D	85.3		1.4	7276.09	85.30	0.19	1.27	0.24
10	D	85.7		1.6	7344.49	85.70	0.22	1.27	0.28
11					0.00	0.00	0.00	0.00	0.00
12					0.00	0.00	0.00	0.00	0.00
13					0.00	0.00	0.00	0.00	0.00
14					0.00	0.00	0.00	0.00	0.00
15					0.00	0.00	0.00	0.00	0.00
16					0.00	0.00	0.00	0.00	0.00
17					0.00	0.00	0.00	0.00	0.00
18					0.00	0.00	0.00	0.00	0.00
19					0.00	0.00	0.00	0.00	0.00
20					0.00	0.00	0.00	0.00	0.00

*W Entry required if test type is not Diametrical

REMARKS

SIGNED

NAME O.P. Davies BA (Hons)
(Laboratory Manager)

DATE 14-Jan-19

MURRAY RIX

33C VAUXHALL INDUSTRIAL ESTATE, GREG STREET
REDDISH, STOCKPORT SK5 7BR
TEL 0161 475 0870 FAX 0161 475 0871

TEST CERTIFICATE SUGGESTED METHODS FOR DETERMINING THE UNIAXIAL COMPRESSIVE STRENGTH AND DEFORMABILITY OF ROCK MATERIALS

Part 1

Client
Address

LK Consult Ltd
Unit 29 Eton Business Park
Eton Hill Road
Radcliffe
Greater Manchester
M26 2ZS

Site

LKC 17 1166 – Gallery Gardens, Manchester

Job No. MRN 3524/11

Laboratory Sample Number 80800

Site Reference Number BH1 9.5-11.0m

Date of Receipt 21 December 2018

Date of Test 07 January 2019

Dimensions

Tested by	PS	Diameter	85.4 mm
Length after preparation	102.5 mm	Length/diameter ratio	1.2

Method of End Preparation Saw/Grinding

Time in Water prior to test 0 hours

Material	Sandstone	Site Mark	BH1 9.5-11.0m
Sample Location	BH1 9.5-11.0m	Tested By	PS

Date of Drilling 20 December 2018

Drilled by LK Consult

Description of core after test	Split vertically top to bottom, no visible end effects
--------------------------------	--

Compressive Strength

Load at Failure	kN	47.0	Measured Compressive Strength	N/mm ²	8.21
-----------------	----	------	-------------------------------	-------------------	------

Compressive Strength 8.21 MPa

Comments/Deviations from standard method/Abnormalities noted during visual inspection – length / diameter ratio did not comply with test method recommendation of 2.5-3.0, specimen tested was largest piece available from the section

Name O.P. Davies BA (Hons)
(Laboratory Manager)

Signature



Date 14 January 2019

MURRAY RIX

33C VAUXHALL INDUSTRIAL ESTATE, GREG STREET
REDDISH, STOCKPORT SK5 7BR
TEL 0161 475 0870 FAX 0161 475 0871

TEST CERTIFICATE SUGGESTED METHODS FOR DETERMINING THE UNIAXIAL COMPRESSIVE STRENGTH AND DEFORMABILITY OF ROCK MATERIALS Part 2

Client

LK Consult Ltd

Site

LKC 17 1166 – Gallery Gardens, Manchester

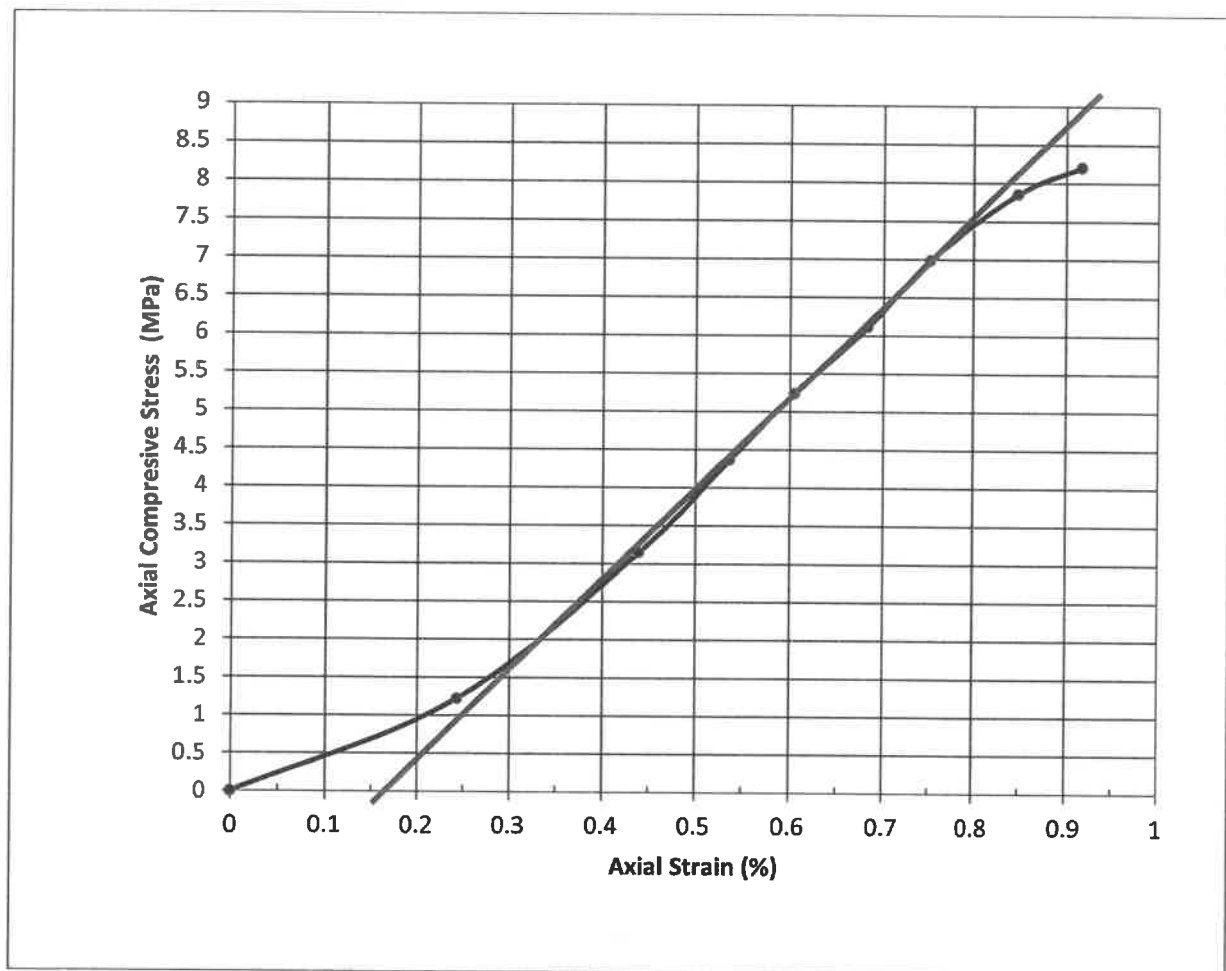
Job No. MRN 3524/11

Laboratory Sample Number 80800

Site Reference Number BH1 9.5-11.0m

Date of Receipt 21 December 2018

Date of Test 07 January 2019



Average Youngs Modulus = 1.20GPa

Secant Modulus (at 50% of Failure Stress) = 0.79GPa

Name O.P. Davies BA (Hons)
(Laboratory Manager)

Signature

Date 14 January 2019

MURRAY RIX

33C VAUXHALL INDUSTRIAL ESTATE, GREG STREET
REDDISH, STOCKPORT SK5 7BR
TEL 0161 475 0870 FAX 0161 475 0871

TEST CERTIFICATE SUGGESTED METHODS FOR DETERMINING THE UNIAXIAL COMPRESSIVE STRENGTH AND DEFORMABILITY OF ROCK MATERIALS

Part 1

Client
Address

LK Consult Ltd
Unit 29 Eton Business Park
Eton Hill Road
Radcliffe
Greater Manchester
M26 2ZS

Site

LKC 17 1166 – Gallery Gardens, Manchester

Job No. MRN 3524/11

Laboratory Sample Number 80801

Site Reference Number BH1 11.0-12.5m

Date of Receipt 21 December 2018

Date of Test 07 January 2019

Dimensions

Tested by	PS	Diameter	86.1 mm
Length after preparation	105.0 mm	Length/diameter ratio	1.22

Method of End Preparation Saw/Grinding

Time in Water prior to test 0 hours

Material	Sandstone	Site Mark	BH1 11.0-12.5m
Sample Location	BH1 11.0-12.5m	Tested By	PS

Date of Drilling 20 December 2018

Drilled by LK Consult

Description of core after test	Split vertically top to bottom, no visible end effects
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Compressive Strength

Load at Failure	kN	51.0	Measured Compressive Strength	N/mm ²	8.76
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Compressive Strength 8.76 MPa

Comments/Deviations from standard method/Abnormalities noted during visual inspection –
length / diameter ratio did not comply with test method recommendation of 2.5-3.0, specimen tested was
largest piece available from the section

Name O.P. Davies BA (Hons)
(Laboratory Manager)

Signature



Date 14 January 2019

MURRAY RIX

33C VAUXHALL INDUSTRIAL ESTATE, GREG STREET
REDDISH, STOCKPORT SK5 7BR
TEL 0161 475 0870 FAX 0161 475 0871

TEST CERTIFICATE SUGGESTED METHODS FOR DETERMINING THE UNIAXIAL COMPRESSIVE STRENGTH AND DEFORMABILITY OF ROCK MATERIALS Part 2

Client

LK Consult Ltd

Site

LKC 17 1166 – Gallery Gardens, Manchester

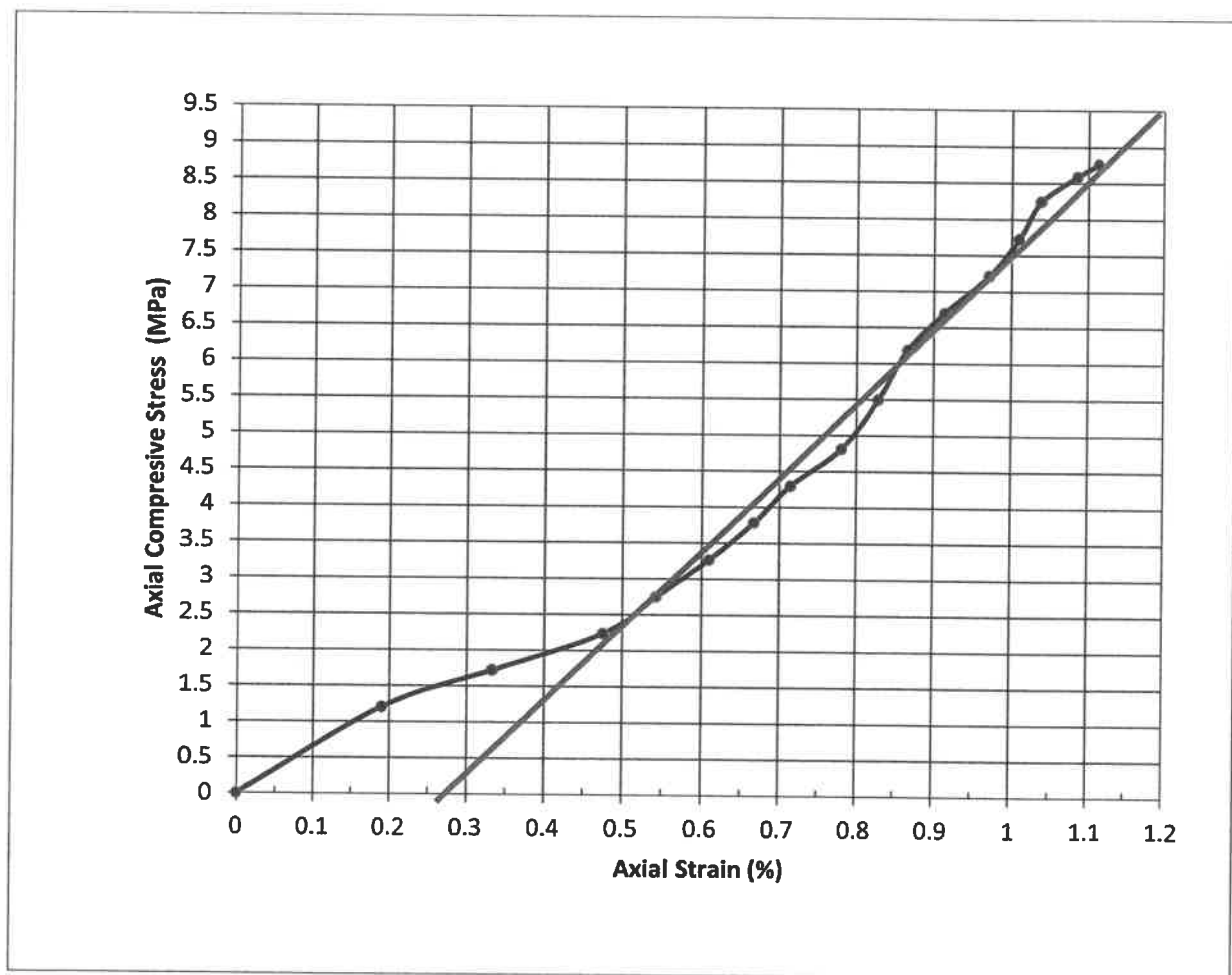
Job No. MRN 3524/11

Laboratory Sample Number 80801

Site Reference Number BH1 11.0-12.5m

Date of Receipt 21 December 2018

Date of Test 07 January 2019



Average Youngs Modulus = 1.02GPa

Secant Modulus (at 50% of Failure Stress) = 0.63GPa

Name O.P. Davies BA (Hons)
(Laboratory Manager)

Signature 

Date 14 January 2019

MURRAY RIX

33C VAUXHALL INDUSTRIAL ESTATE, GREG STREET
REDDISH, STOCKPORT SK5 7BR
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TEST CERTIFICATE SUGGESTED METHODS FOR DETERMINING THE UNIAXIAL COMPRESSIVE STRENGTH AND DEFORMABILITY OF ROCK MATERIALS Part 1

Client LK Consult Ltd
Address Unit 29 Eton Business Park
Eton Hill Road
Radcliffe
Greater Manchester
M26 2ZS

Site LKC 17 1166 – Gallery Gardens, Manchester

Job No. MRN 3524/11

Laboratory Sample Number 80803

Site Reference Number BH1 14.0-15.5m

Date of Receipt 21 December 2018

Date of Test 07 January 2019

Dimensions

Tested by	PS	Diameter	85.4 mm
Length after preparation	146.5 mm	Length/diameter ratio	1.72

Method of End Preparation Saw/Grinding

Time in Water prior to test 0 hours

Material	Sandstone	Site Mark	BH1 14.0-15.5m
Sample Location	BH1 14.0-15.5m	Tested By	PS

Date of Drilling 20 December 2018

Drilled by LK Consult

Description of core after test	Split vertically top to bottom, no visible end effects
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Compressive Strength

Load at Failure	kN	42.5	Measured Compressive Strength	N/mm ²	7.42
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Compressive Strength 7.42 MPa

Comments/Deviations from standard method/Abnormalities noted during visual inspection – length / diameter ratio did not comply with test method recommendation of 2.5-3.0, specimen tested was largest piece available from the section

Name O.P. Davies BA (Hons)
(Laboratory Manager)

Signature



Date 14 January 2019

MURRAY RIX

33C VAUXHALL INDUSTRIAL ESTATE, GREG STREET
REDDISH, STOCKPORT SK5 7BR
TEL 0161 475 0870 FAX 0161 475 0871

TEST CERTIFICATE SUGGESTED METHODS FOR DETERMINING THE UNIAXIAL COMPRESSIVE STRENGTH AND DEFORMABILITY OF ROCK MATERIALS Part 2

Client

LK Consult Ltd

Site

LKC 17 1166 – Gallery Gardens, Manchester

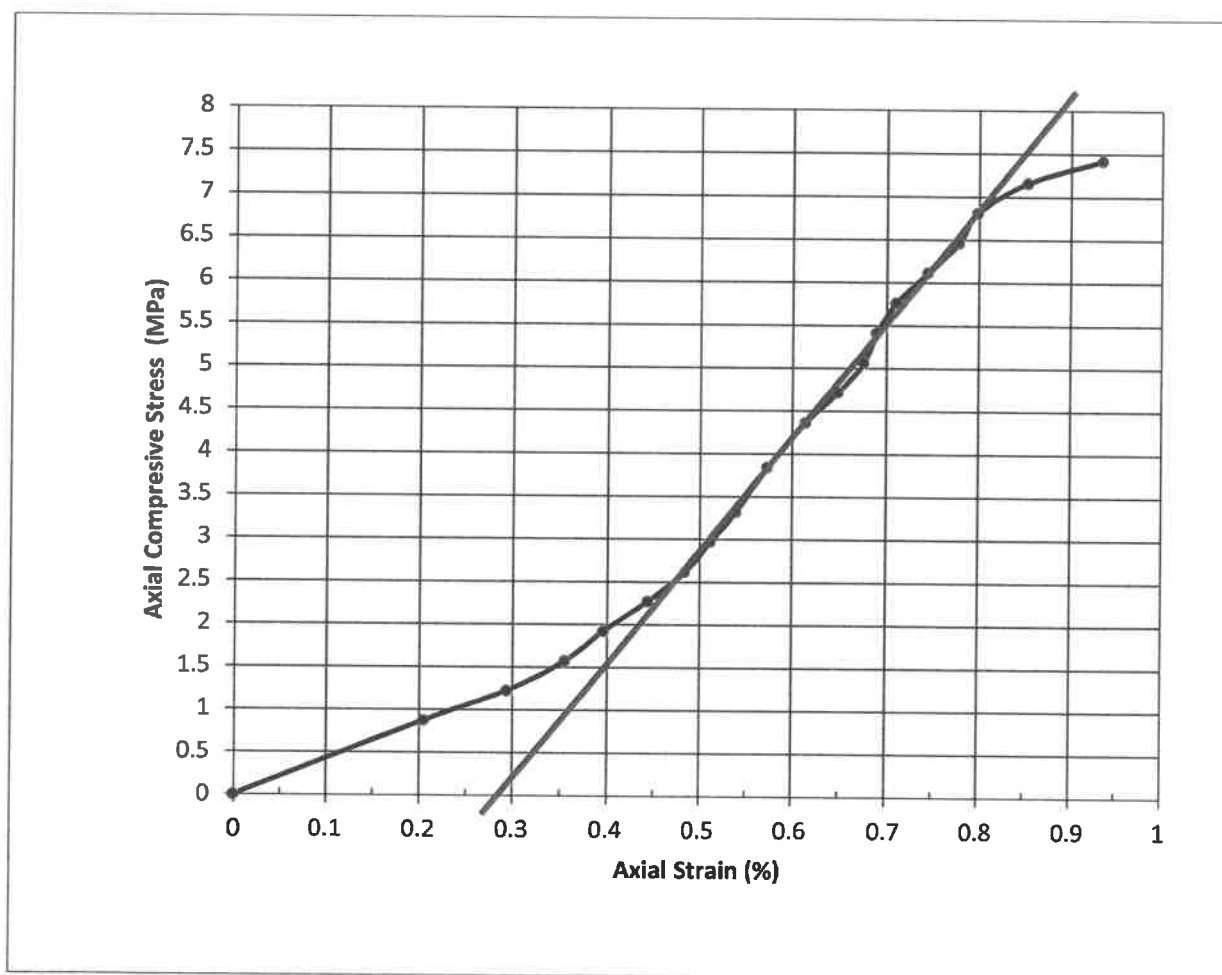
Job No. MRN 3524/11

Laboratory Sample Number 80803

Site Reference Number BH1 14.0-15.5m

Date of Receipt 21 December 2018

Date of Test 07 January 2019



Average Youngs Modulus = 1.31GPa

Secant Modulus (at 50% of Failure Stress) = 0.66GPa

Name O.P. Davies BA (Hons)
(Laboratory Manager)

Signature

Date 14 January 2019

MURRAY RIX

33C VAUXHALL INDUSTRIAL ESTATE, GREG STREET
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TEST CERTIFICATE SUGGESTED METHODS FOR DETERMINING THE UNIAXIAL COMPRESSIVE STRENGTH AND DEFORMABILITY OF ROCK MATERIALS

Part 1

Client LK Consult Ltd
Address Unit 29 Eton Business Park
Eton Hill Road
Radcliffe
Greater Manchester
M26 2ZS

Site LKC 17 1166 – Gallery Gardens, Manchester

Job No. MRN 3524/11

Laboratory Sample Number 80804

Site Reference Number BH1 15.5-17.0m

Date of Receipt 21 December 2018

Date of Test 07 January 2019

Dimensions

Tested by	PS	Diameter	86.0 mm
Length after preparation	155.3 mm	Length/diameter ratio	1.81

Method of End Preparation Saw/Grinding

Time in Water prior to test 0 hours

Material	Sandstone	Site Mark	BH1 15.5-17.0m
Sample Location	BH1 15.5-17.0m	Tested By	PS

Date of Drilling 20 December 2018

Drilled by LK Consult

Description of core after test	Split vertically top to bottom, no visible end effects
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Compressive Strength

Load at Failure	kN	26.0	Measured Compressive Strength	N/mm ²	4.48
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Compressive Strength 4.48 MPa

Comments/Deviations from standard method/Abnormalities noted during visual inspection –
length / diameter ratio did not comply with test method recommendation of 2.5-3.0, specimen tested was
largest piece available from the section

Name O.P. Davies BA (Hons)
(Laboratory Manager)

Signature



Date 14 January 2019

MURRAY RIX

33C VAUXHALL INDUSTRIAL ESTATE, GREG STREET
REDDISH, STOCKPORT SK5 7BR
TEL 0161 475 0870 FAX 0161 475 0871

TEST CERTIFICATE SUGGESTED METHODS FOR DETERMINING THE UNIAXIAL COMPRESSIVE STRENGTH AND DEFORMABILITY OF ROCK MATERIALS Part 2

Client

LK Consult Ltd

Site

LKC 17 1166 – Gallery Gardens, Manchester

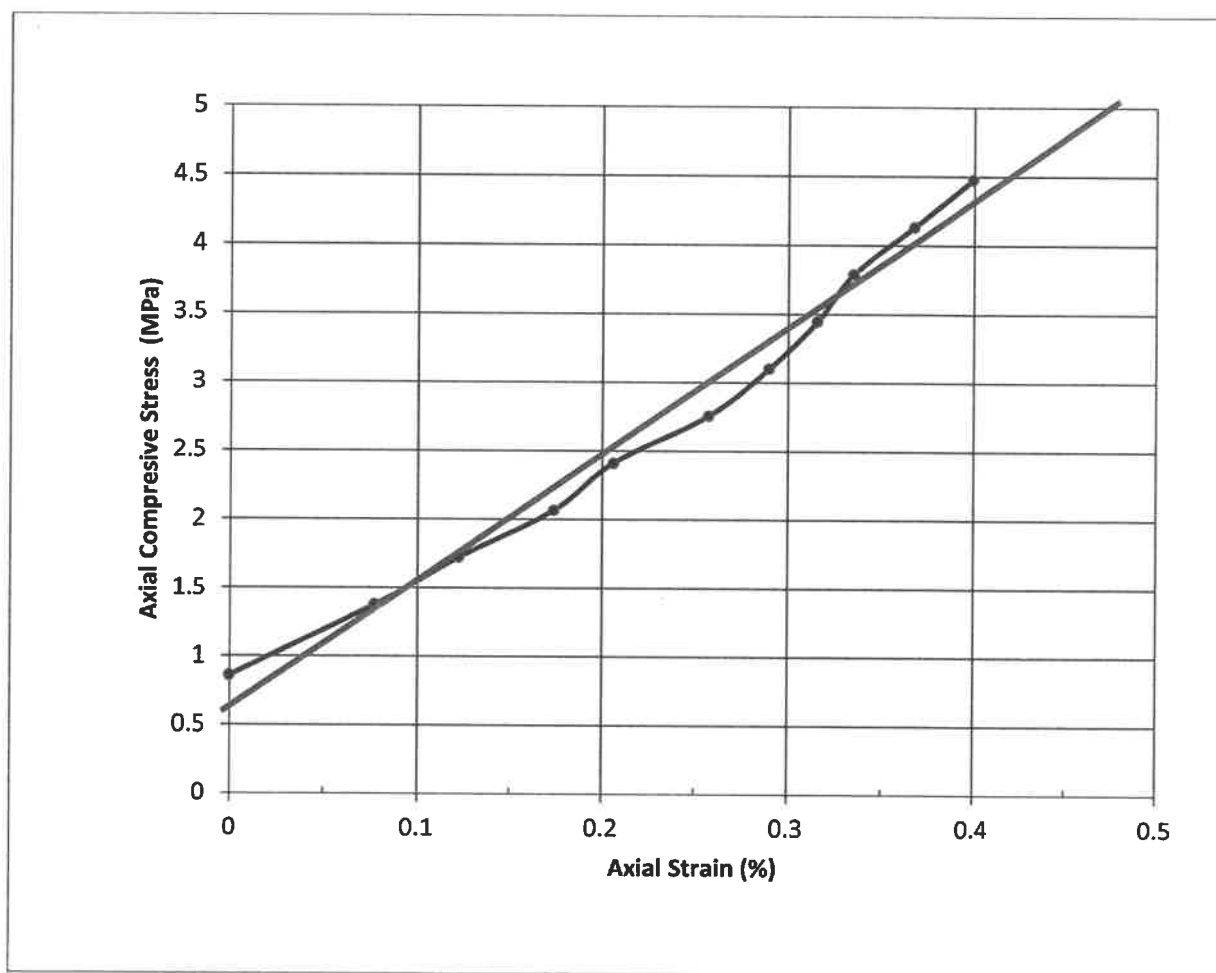
Job No. MRN 3524/11

Laboratory Sample Number 80804

Site Reference Number BH1 15.5-17.0m

Date of Receipt 21 December 2018

Date of Test 07 January 2019



Average Youngs Modulus = 0.93GPa

Secant Modulus (at 50% of Failure Stress) = 1.18GPa

Name O.P. Davies BA (Hons)
(Laboratory Manager)

Signature

Date 14 January 2019

MURRAY RIX

33C VAUXHALL INDUSTRIAL ESTATE, GREG STREET
REDDISH, STOCKPORT SK5 7BR
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TEST CERTIFICATE SUGGESTED METHODS FOR DETERMINING THE UNIAXIAL COMPRESSIVE STRENGTH AND DEFORMABILITY OF ROCK MATERIALS Part 1

Client LK Consult Ltd
Address Unit 29 Eton Business Park
Eton Hill Road
Radcliffe
Greater Manchester
M26 2ZS

Site LKC 17 1166 – Gallery Gardens, Manchester

Job No. MRN 3524/11

Laboratory Sample Number 80806

Site Reference Number BH1 18.5-20.0m

Date of Receipt 21 December 2018

Date of Test 07 January 2019

Dimensions

Tested by	PS	Diameter	85.9 mm
Length after preparation	110.3 mm	Length/diameter ratio	1.28

Method of End Preparation Saw/Grinding

Time in Water prior to test 0 hours

Material	Sandstone	Site Mark	BH1 18.5-20.0m
Sample Location	BH1 18.5-20.0m	Tested By	PS

Date of Drilling 20 December 2018

Drilled by LK Consult

Description of core after test	Split vertically top to bottom, no visible end effects
--------------------------------	--

Compressive Strength

Load at Failure	kN	55.0	Measured Compressive Strength	N/mm ²	9.49
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Compressive Strength 9.49 MPa

Comments/Deviations from standard method/Abnormalities noted during visual inspection – length / diameter ratio did not comply with test method recommendation of 2.5-3.0, specimen tested was largest piece available from the section

Name O.P. Davies BA (Hons)
(Laboratory Manager)

Signature



Date 14 January 2019

MURRAY RIX

33C VAUXHALL INDUSTRIAL ESTATE, GREG STREET
REDDISH, STOCKPORT SK5 7BR
TEL 0161 475 0870 FAX 0161 475 0871

TEST CERTIFICATE SUGGESTED METHODS FOR DETERMINING THE UNIAXIAL COMPRESSIVE STRENGTH AND DEFORMABILITY OF ROCK MATERIALS Part 2

Client

LK Consult Ltd

Site

LKC 17 1166 – Gallery Gardens, Manchester

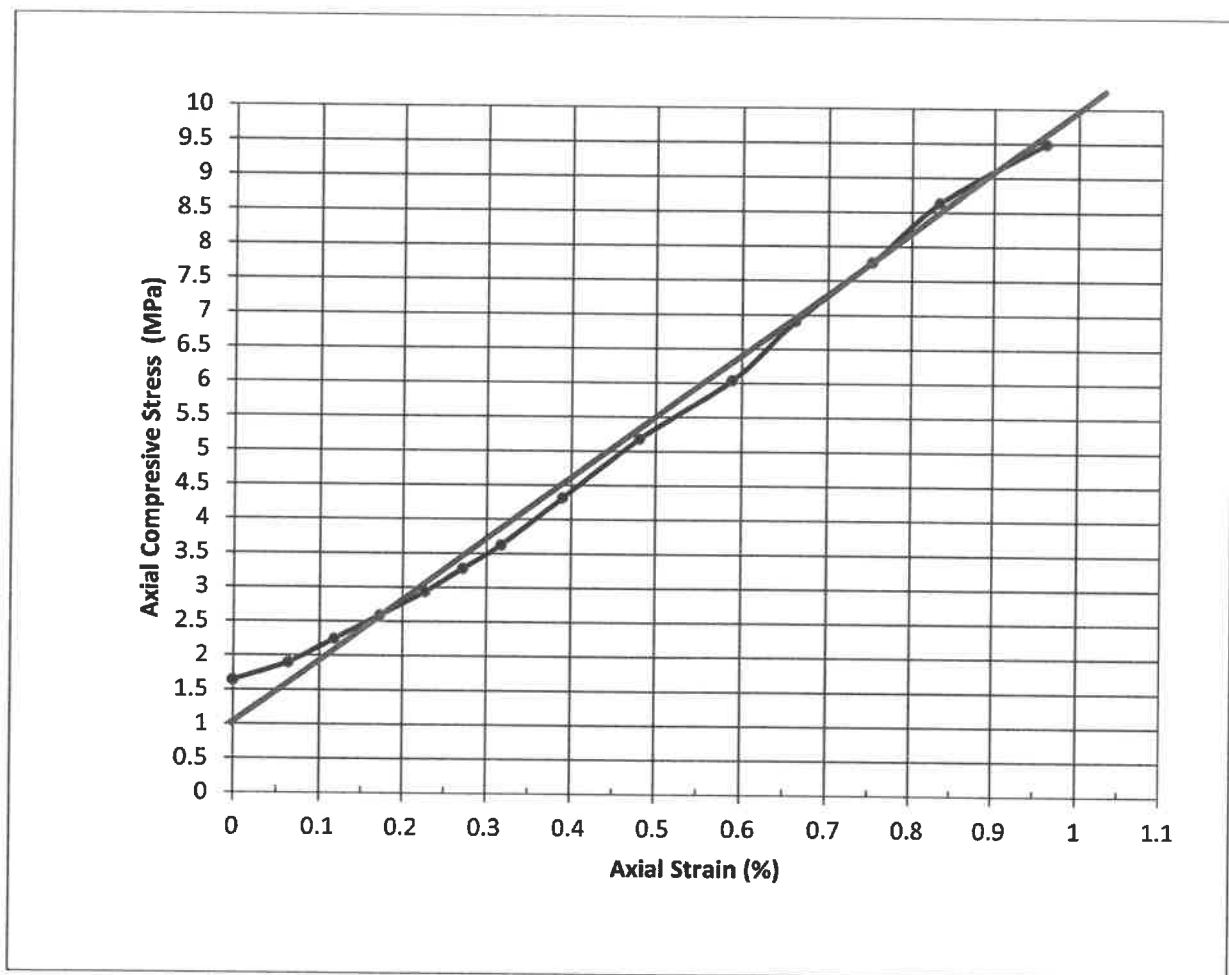
Job No. MRN 3524/11

Laboratory Sample Number 80806

Site Reference Number BH1 18.5-20.0m

Date of Receipt 21 December 2018

Date of Test 07 January 2019



Average Youngs Modulus = 0.89GPa

Secant Modulus (at 50% of Failure Stress) = 1.13GPa

Name O.P. Davies BA (Hons)
(Laboratory Manager)

Signature

Date 14 January 2019

MURRAY RIX

33C VAUXHALL INDUSTRIAL ESTATE, GREG STREET
REDDISH, STOCKPORT SK5 7BR
TEL 0161 475 0870 FAX 0161 475 0871

TEST CERTIFICATE SUGGESTED METHODS FOR DETERMINING THE UNIAXIAL COMPRESSIVE STRENGTH AND DEFORMABILITY OF ROCK MATERIALS

Part 1

Client LK Consult Ltd
Address Unit 29 Eton Business Park
Eton Hill Road
Radcliffe
Greater Manchester
M26 2ZS

Site LKC 17 1166 – Gallery Gardens, Manchester

Job No. MRN 3524/11

Laboratory Sample Number 80807

Site Reference Number BH2 9.5-11.0m

Date of Receipt 21 December 2018

Date of Test 07 January 2019

Dimensions

Tested by	PS	Diameter	85.3 mm
Length after preparation	105.3 mm	Length/diameter ratio	1.23

Method of End Preparation Saw/Grinding

Time in Water prior to test 0 hours

Material	Sandstone	Site Mark	BH2 9.5-11.0m
Sample Location	BH2 9.5-11.0m	Tested By	PS

Date of Drilling 20 December 2018

Drilled by LK Consult

Description of core after test	Split vertically top to bottom, no visible end effects
--------------------------------	--

Compressive Strength

Load at Failure	kN	27.5	Measured Compressive Strength	N/mm ²	4.81
-----------------	----	------	-------------------------------	-------------------	------

Compressive Strength 4.81 MPa

Comments/Deviations from standard method/Abnormalities noted during visual inspection – length / diameter ratio did not comply with test method recommendation of 2.5-3.0, specimen tested was largest piece available from the section

Name O.P. Davies BA (Hons)
(Laboratory Manager)

Signature



Date 14 January 2019

MURRAY RIX

33C VAUXHALL INDUSTRIAL ESTATE, GREG STREET
REDDISH, STOCKPORT SK5 7BR
TEL 0161 475 0870 FAX 0161 475 0871

TEST CERTIFICATE SUGGESTED METHODS FOR DETERMINING THE UNIAXIAL COMPRESSIVE STRENGTH AND DEFORMABILITY OF ROCK MATERIALS Part 2

Client

LK Consult Ltd

Site

LKC 17 1166 – Gallery Gardens, Manchester

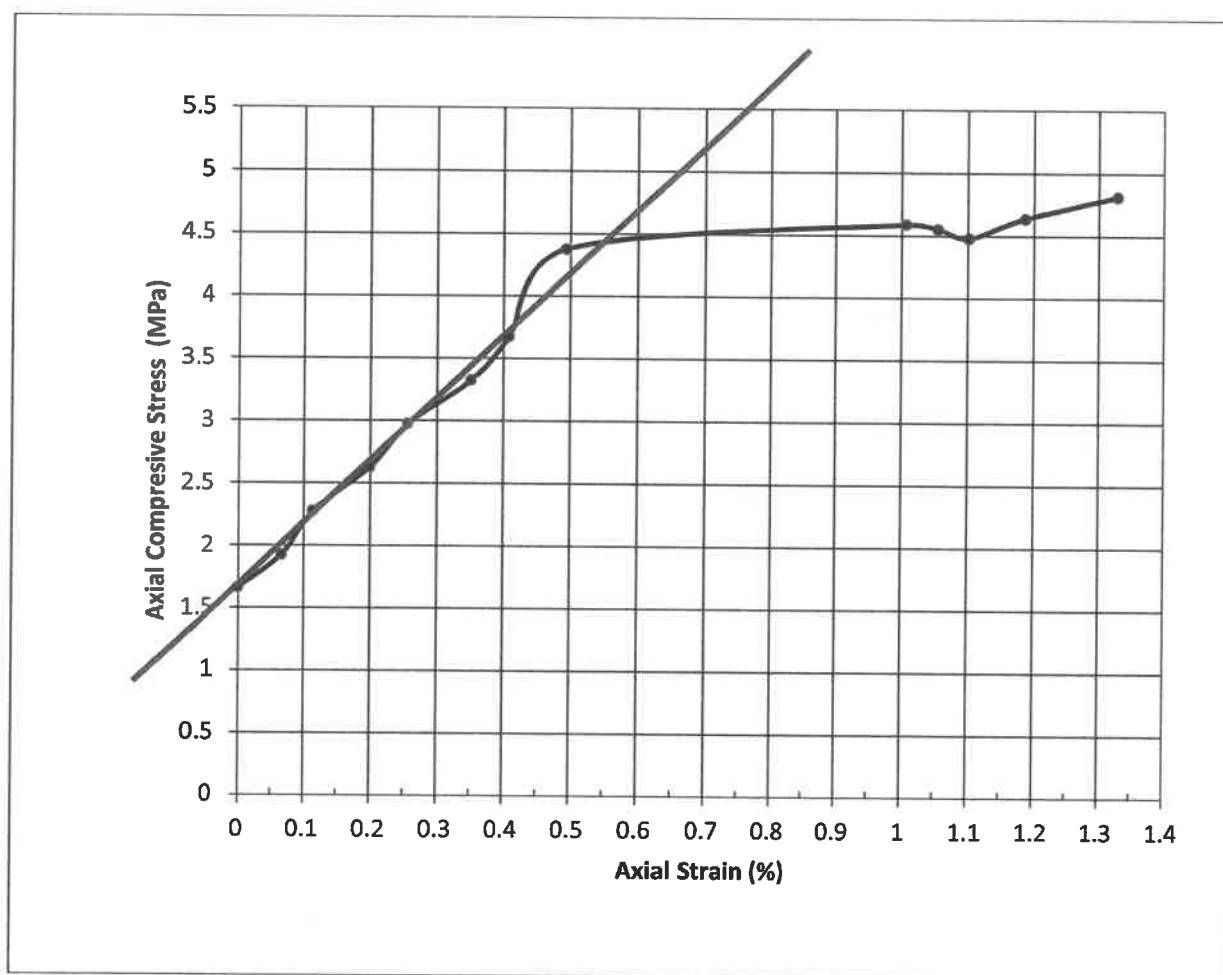
Job No. MRN 3524/11

Laboratory Sample Number 80807

Site Reference Number BH2 9.5-11.0m

Date of Receipt 21 December 2018

Date of Test 07 January 2019



Average Youngs Modulus = 0.51GPa

Secant Modulus (at 50% of Failure Stress) = 1.50GPa

Name O.P. Davies BA (Hons)
(Laboratory Manager)

Signature

Date 14 January 2019

MURRAY RIX

33C VAUXHALL INDUSTRIAL ESTATE, GREG STREET
REDDISH, STOCKPORT SK5 7BR
TEL 0161 475 0870 FAX 0161 475 0871

TEST CERTIFICATE
SUGGESTED METHODS FOR DETERMINING THE UNIAXIAL COMPRESSIVE
STRENGTH AND DEFORMABILITY OF ROCK MATERIALS
Part 1

Client LK Consult Ltd
Address Unit 29 Eton Business Park
Eton Hill Road
Radcliffe
Greater Manchester
M26 2ZS

Site LKC 17 1166 – Gallery Gardens, Manchester

Job No. MRN 3524/11

Laboratory Sample Number 80808

Site Reference Number BH2 11.0-12.5m

Date of Receipt 21 December 2018

Date of Test 07 January 2019

Dimensions

Tested by	PS	Diameter	86.2 mm
Length after preparation	88.0 mm	Length/diameter ratio	1.02

Method of End Preparation Saw/Grinding

Time in Water prior to test 0 hours

Material	Sandstone	Site Mark	BH2 11.0-12.5m
Sample Location	BH2 11.0-12.5m	Tested By	PS

Date of Drilling 20 December 2018

Drilled by LK Consult

Description of core after test	Split vertically top to bottom, no visible end effects
--------------------------------	--

Compressive Strength

Load at Failure	kN	65.0	Measured Compressive Strength	N/mm ²	11.14
-----------------	----	------	-------------------------------	-------------------	-------

Compressive Strength 11.14 MPa

Comments/Deviations from standard method/Abnormalities noted during visual inspection –
length / diameter ratio did not comply with test method recommendation of 2.5-3.0, specimen tested was
largest piece available from the section

Name O.P. Davies BA (Hons)
(Laboratory Manager)

Signature



Date 14 January 2019

MURRAY RIX

33C VAUXHALL INDUSTRIAL ESTATE, GREG STREET
REDDISH, STOCKPORT SK5 7BR
TEL 0161 475 0870 FAX 0161 475 0871

TEST CERTIFICATE SUGGESTED METHODS FOR DETERMINING THE UNIAXIAL COMPRESSIVE STRENGTH AND DEFORMABILITY OF ROCK MATERIALS Part 2

Client

LK Consult Ltd

Site

LKC 17 1166 – Gallery Gardens, Manchester

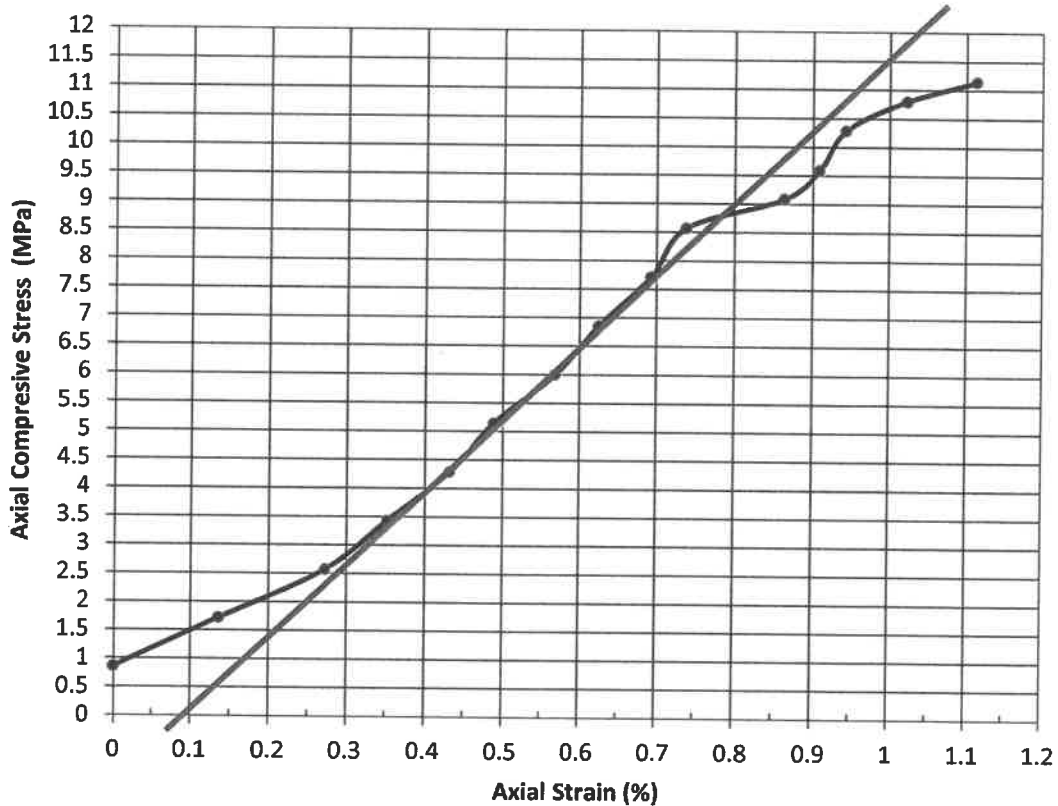
Job No. MRN 3524/11

Laboratory Sample Number 80808

Site Reference Number BH2 11.0-12.5m

Date of Receipt 21 December 2018

Date of Test 07 January 2019



Average Youngs Modulus = 1.27GPa

Secant Modulus (at 50% of Failure Stress) = 1.03GPa

Name O.P. Davies BA (Hons)
(Laboratory Manager)

Signature

Date 14 January 2019

MURRAY RIX

33C VAUXHALL INDUSTRIAL ESTATE, GREG STREET
REDDISH, STOCKPORT SK5 7BR
TEL 0161 475 0870 FAX 0161 475 0871

TEST CERTIFICATE SUGGESTED METHODS FOR DETERMINING THE UNIAXIAL COMPRESSIVE STRENGTH AND DEFORMABILITY OF ROCK MATERIALS Part 1

Client LK Consult Ltd
Address Unit 29 Eton Business Park
Eton Hill Road
Radcliffe
Greater Manchester
M26 2ZS

Site LKC 17 1166 – Gallery Gardens, Manchester

Job No. MRN 3524/11

Laboratory Sample Number 80809

Site Reference Number BH2 12.5-14.0m

Date of Receipt 21 December 2018

Date of Test 07 January 2019

Dimensions

Tested by	PS	Diameter	86.5 mm
Length after preparation	125.5 mm	Length/diameter ratio	1.45

Method of End Preparation Saw/Grinding

Time in Water prior to test 0 hours

Material	Sandstone	Site Mark	BH2 12.5-14.0m
Sample Location	BH2 12.5-14.0m	Tested By	PS

Date of Drilling 20 December 2018

Drilled by LK Consult

Description of core after test	Split vertically top to bottom, no visible end effects
--------------------------------	--

Compressive Strength

Load at Failure	kN	66.0	Measured Compressive Strength	N/mm ²	11.23
-----------------	----	------	-------------------------------	-------------------	-------

Compressive Strength 11.23 MPa

Comments/Deviations from standard method/Abnormalities noted during visual inspection –
length / diameter ratio did not comply with test method recommendation of 2.5-3.0, specimen tested was
largest piece available from the section

Name O.P. Davies BA (Hons)
(Laboratory Manager)

Signature



Date 14 January 2019

MURRAY RIX

33C VAUXHALL INDUSTRIAL ESTATE, GREG STREET
REDDISH, STOCKPORT SK5 7BR
TEL 0161 475 0870 FAX 0161 475 0871

TEST CERTIFICATE SUGGESTED METHODS FOR DETERMINING THE UNIAXIAL COMPRESSIVE STRENGTH AND DEFORMABILITY OF ROCK MATERIALS Part 2

Client

LK Consult Ltd

Site

LKC 17 1166 – Gallery Gardens, Manchester

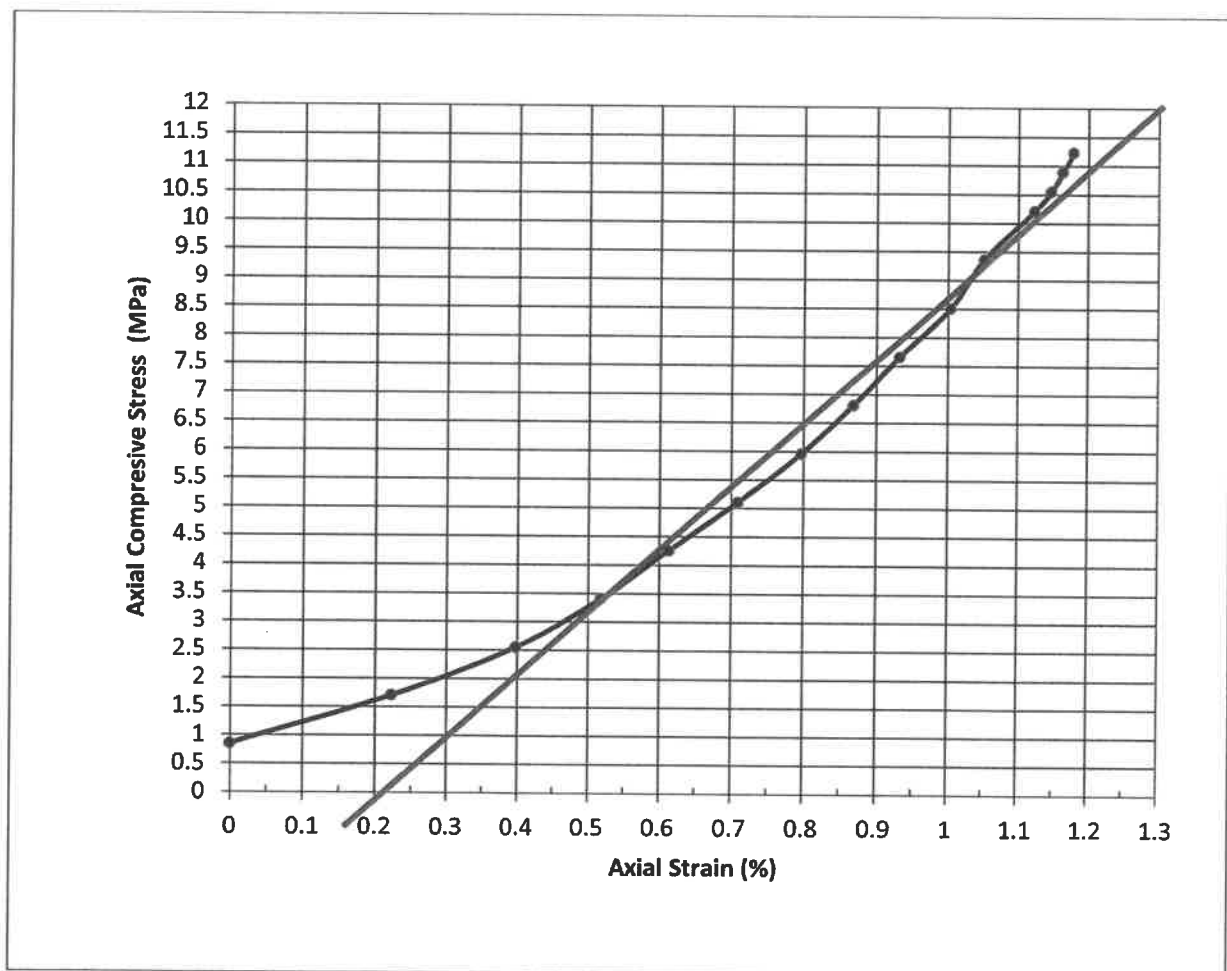
Job No. MRN 3524/11

Laboratory Sample Number 80809

Site Reference Number BH2 12.5-14.0m

Date of Receipt 21 December 2018

Date of Test 07 January 2019



Average Youngs Modulus = 1.11GPa

Secant Modulus (at 50% of Failure Stress) = 0.73GPa

Name O.P. Davies BA (Hons)
(Laboratory Manager)

Signature

Date 14 January 2019

MURRAY RIX

33C VAUXHALL INDUSTRIAL ESTATE, GREG STREET
REDDISH, STOCKPORT SK5 7BR
TEL 0161 475 0870 FAX 0161 475 0871

TEST CERTIFICATE SUGGESTED METHODS FOR DETERMINING THE UNIAXIAL COMPRESSIVE STRENGTH AND DEFORMABILITY OF ROCK MATERIALS

Part 1

Client
Address

LK Consult Ltd
Unit 29 Eton Business Park
Eton Hill Road
Radcliffe
Greater Manchester
M26 2ZS

Site

LKC 17 1166 – Gallery Gardens, Manchester

Job No. MRN 3524/11

Laboratory Sample Number 80812

Site Reference Number BH2 17.0-18.5m

Date of Receipt 21 December 2018

Date of Test 07 January 2019

Dimensions

Tested by	PS	Diameter	86.6 mm
Length after preparation	193.0 mm	Length/diameter ratio	2.22

Method of End Preparation Saw/Grinding

Time in Water prior to test 0 hours

Material	Sandstone	Site Mark	BH2 17.0-18.5m
Sample Location	BH2 17.0-18.5m	Tested By	PS

Date of Drilling 20 December 2018

Drilled by LK Consult

Description of core after test	Split vertically top to bottom, no visible end effects
--------------------------------	--

Compressive Strength

Load at Failure	kN	82.4	Measured Compressive Strength	N/mm ²	13.99
-----------------	----	------	-------------------------------	-------------------	-------

Compressive Strength 13.99 MPa

Comments/Deviations from standard method/Abnormalities noted during visual inspection –
length / diameter ratio did not comply with test method recommendation of 2.5-3.0, specimen tested was
largest piece available from the section

Name O.P. Davies BA (Hons)
(Laboratory Manager)

Signature



Date 14 January 2019

MURRAY RIX

33C VAUXHALL INDUSTRIAL ESTATE, GREG STREET
REDDISH, STOCKPORT SK5 7BR
TEL 0161 475 0870 FAX 0161 475 0871

TEST CERTIFICATE SUGGESTED METHODS FOR DETERMINING THE UNIAXIAL COMPRESSIVE STRENGTH AND DEFORMABILITY OF ROCK MATERIALS Part 2

Client

LK Consult Ltd

Site

LKC 17 1166 – Gallery Gardens, Manchester

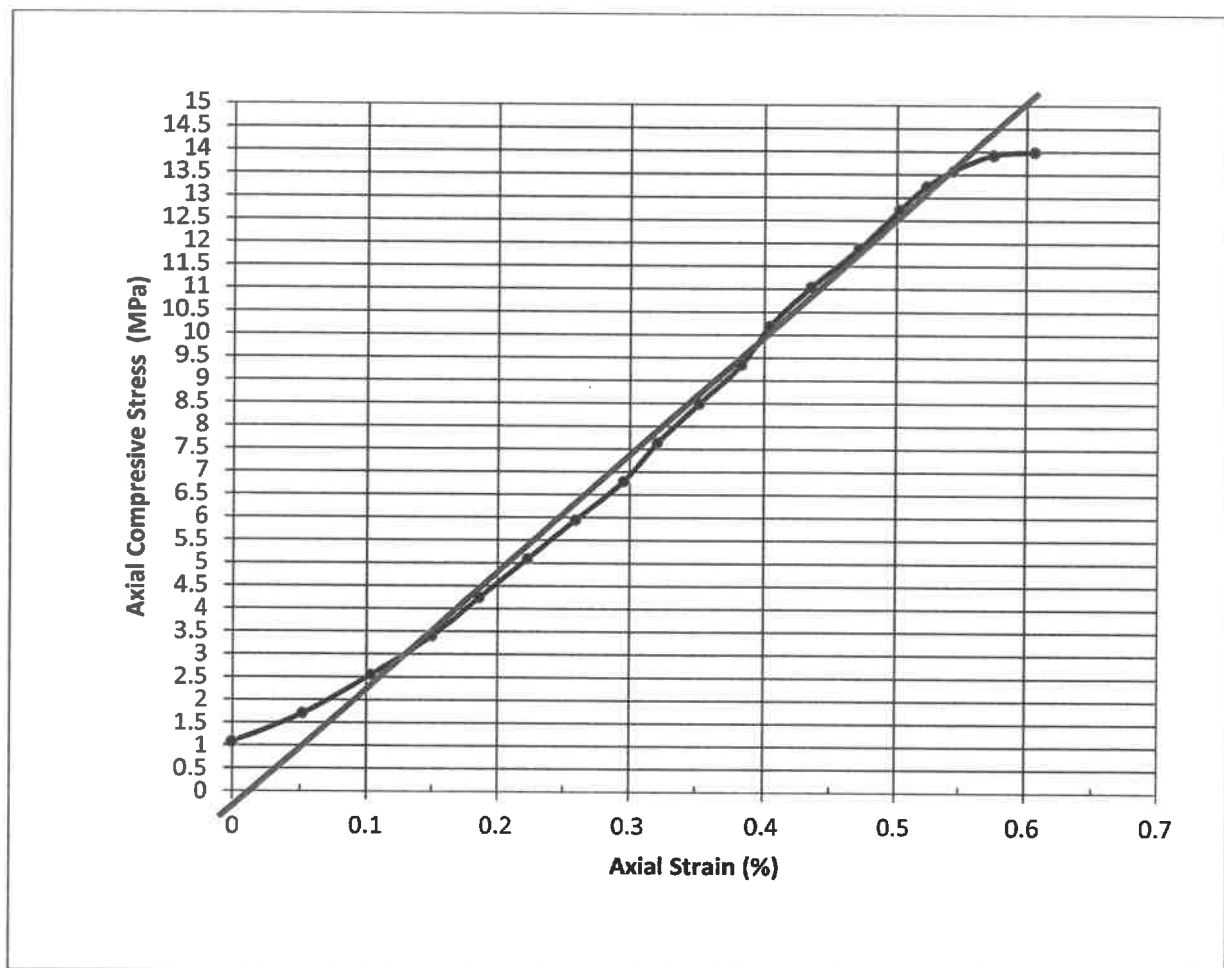
Job No. MRN 3524/11

Laboratory Sample Number 80812

Site Reference Number BH2 17.0-18.5m

Date of Receipt 21 December 2018

Date of Test 07 January 2019



Average Youngs Modulus = 2.59GPa

Secant Modulus (at 50% of Failure Stress) = 2.26GPa

Name O.P. Davies BA (Hons)
(Laboratory Manager)

Signature

Date 14 January 2019

MURRAY RIX

33C VAUXHALL INDUSTRIAL ESTATE, GREG STREET
REDDISH, STOCKPORT SK5 7BR
TEL 0161 475 0870 FAX 0161 475 0871

TEST CERTIFICATE SUGGESTED METHODS FOR DETERMINING THE UNIAXIAL COMPRESSIVE STRENGTH AND DEFORMABILITY OF ROCK MATERIALS

Part 1

Client
Address

LK Consult Ltd
Unit 29 Eton Business Park
Eton Hill Road
Radcliffe
Greater Manchester
M26 2ZS

Site

LKC 17 1166 – Gallery Gardens, Manchester

Job No. MRN 3524/11

Laboratory Sample Number 80813

Site Reference Number BH2 18.5-20.0m

Date of Receipt 21 December 2018

Date of Test 07 January 2019

Dimensions

Tested by	PS	Diameter	86.2 mm
Length after preparation	134.8 mm	Length/diameter ratio	1.56

Method of End Preparation Saw/Grinding

Time in Water prior to test 0 hours

Material	Sandstone	Site Mark	BH2 18.5-20.0m
Sample Location	BH2 18.5-20.0m	Tested By	PS

Date of Drilling 20 December 2018

Drilled by LK Consult

Description of core after test	Split vertically top to bottom, no visible end effects
--------------------------------	--

Compressive Strength

Load at Failure	kN	51.0	Measured Compressive Strength	N/mm ²	8.74
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Compressive Strength 8.74 MPa

Comments/Deviations from standard method/Abnormalities noted during visual inspection – length / diameter ratio did not comply with test method recommendation of 2.5-3.0, specimen tested was largest piece available from the section

Name O.P. Davies BA (Hons)
(Laboratory Manager)

Signature



Date 14 January 2019

MURRAY RIX

33C VAUXHALL INDUSTRIAL ESTATE, GREG STREET
REDDISH, STOCKPORT SK5 7BR
TEL 0161 475 0870 FAX 0161 475 0871

TEST CERTIFICATE SUGGESTED METHODS FOR DETERMINING THE UNIAXIAL COMPRESSIVE STRENGTH AND DEFORMABILITY OF ROCK MATERIALS Part 2

Client

LK Consult Ltd

Site

LKC 17 1166 – Gallery Gardens, Manchester

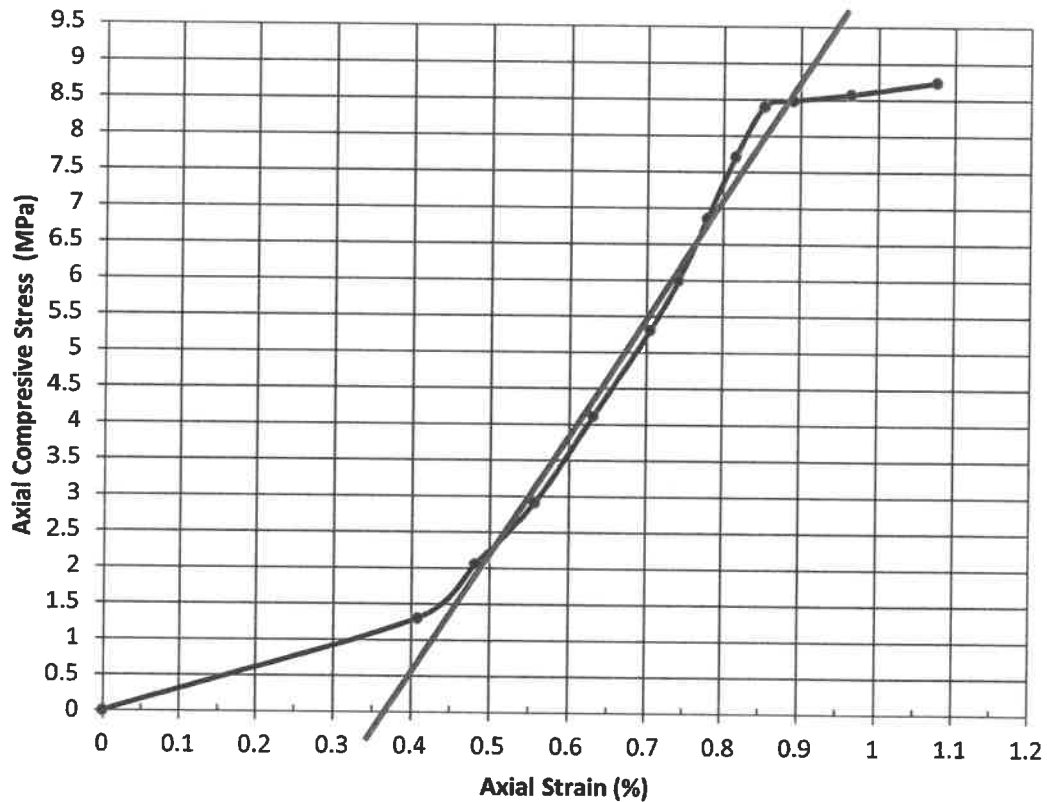
Job No. MRN 3524/11

Laboratory Sample Number 80813

Site Reference Number BH2 18.5-20.0m

Date of Receipt 21 December 2018

Date of Test 07 January 2019



Average Youngs Modulus = 1.61GPa

Secant Modulus (at 50% of Failure Stress) = 0.67GPa

Name O.P. Davies BA (Hons)
(Laboratory Manager)

Signature

Date 14 January 2019

MURRAY RIX

33C VAUXHALL INDUSTRIAL ESTATE, GREG STREET
REDDISH, STOCKPORT SK5 7BR
TEL 0161 475 0870 FAX 0161 475 0871

TEST CERTIFICATE SUGGESTED METHODS FOR DETERMINING THE UNIAXIAL COMPRESSIVE STRENGTH AND DEFORMABILITY OF ROCK MATERIALS

Summary

Client LK Consult Ltd
Site LKC 17 1166 – Gallery Gardens, Manchester
Job No. MRN 3524/11

Date of Receipt 21 December 2018 **Date of Test** 07 January 2019

Sample Number	Diameter (mm)	Length (mm)	Failure Stress (MPa)	Youngs Modulus (GPa)	
				Average ⁺	Secant [*]
80800	85.4	102.5	8.21	1.20	0.79
80801	86.1	105.0	8.76	1.02	0.63
80803	85.4	146.5	7.42	1.31	0.66
80804	86.0	155.3	4.48	0.93	1.18
80806	85.9	110.3	9.49	0.89	1.13
80807	85.3	105.3	4.81	0.51	1.50
80808	86.2	88.0	11.14	1.27	1.03
80809	86.5	125.5	11.23	1.11	0.73
80812	86.6	193.0	13.99	2.59	2.26
80813	86.2	134.8	8.74	1.61	0.67

Remarks

+ Average modulus of the central "straight" portion of the Stress / Strain Curve

* Secant modulus from the origin to the strain at 50% of the Failure Stress

Name O.P. Davies BA (Hons)
(Laboratory Manager)

Signature



Date 14 January 2019



TEST REPORT

Client LK Consult Ltd

Address Unit 29 Eton Business
Eton Hill Road
Radcliffe
Greater Manchester
M26 2ZS

Contract LKC 17 1166 -
Gallery Gardens, Manchester

Job Number MRN 3524/1
Date of Issue 10 January 2019
Page 1 of 3

Approved Signatories

S J Hutchings, O P Davies

Notes

- 1 All remaining samples and remnants from this contract will be disposed 28 days from the date of this report unless you notify us to the contrary.
- 2 Result certificates, in this report, not bearing a UKAS mark, are not included in our UKAS accreditation schedule.
- 3 Opinions and interpretations expressed herein are outside the scope of our UKAS accreditation
- 4 Certified that the samples have been examined and tested in accordance with the terms of the contract/order and unless otherwise stated conform to the standards/specifications quoted. This does not, however, guarantee the balance of the materials from which the tested samples have been taken to be of equal quality.



TEST CERTIFICATE
PARTICLE SIZE DISTRIBUTION
 BS 1377: PART 2: Clause 9.5: 1990

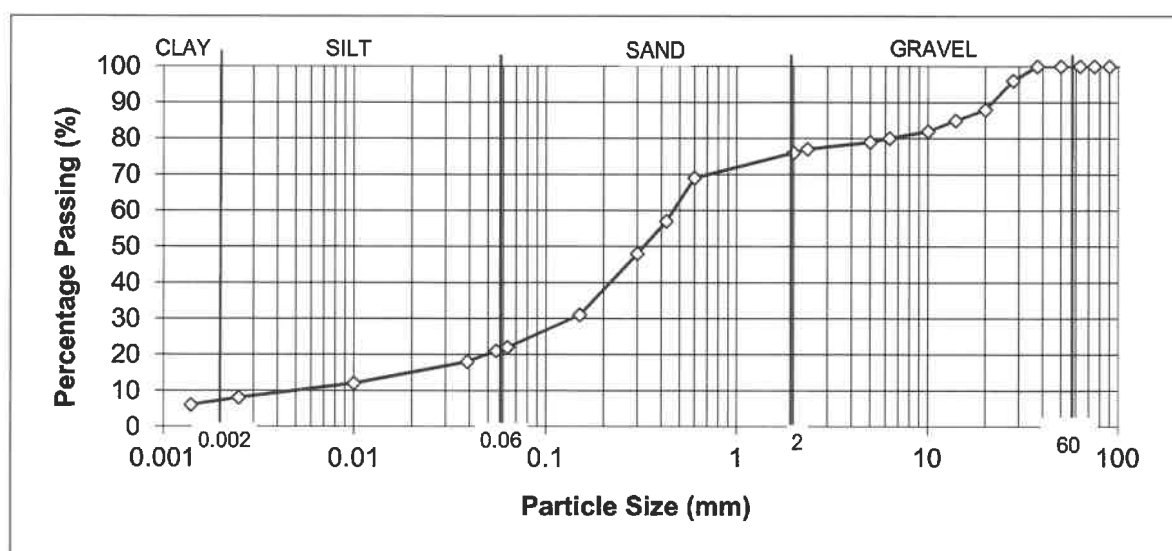
Determination of Moisture Content in accordance with BS 1377: PART 2: Clause 3: 1990 (Oven Dry)

CLIENT	LK Consult Ltd
SITE	LKC 17 1166 - Gallery Gardens, Manchester
JOB NUMBER	MRN 3524/1

SAMPLE LABEL	TP101 1.5-2.1m	DATE SAMPLED	20-Dec-18
LAB SAMPLE No	80660	DATE RECEIVED	21-Dec-18
DATE TESTED	02-Jan-19	SAMPLED BY	Client

MATERIAL	Brown clayey silty SAND with frequent gravel
ADVISED SOURCE	Site Investigation Sample

Sieve Size (mm)	% Passing (%)	Specification (%)	Sieve Size (mm)	% Passing (%)	Specification (%)
125	100		2.36	77	
90	100		2	76	
75	100		0.6	69	
63	100		0.425	57	
50	100		0.3	48	
37.5	100		0.15	31	
28	96		0.063	22	
20	88		0.055	21	
14	85		0.039	18	
10	82		0.01	12	
6.3	80		0.0025	8	
5	79		0.0014	6	



REMARKS

As received moisture content = 17%

SIGNED

NAME

O.P. Davies BA (Hons)
(Laboratory Manager)

DATE

10-Jan-19

MURRAY RIX

33C VAUXHALL INDUSTRIAL ESTATE
GREG STREET, REDDISH, STOCKPORT SK5 7BR
TEL 0161 475 0870 FAX 0161 475 0871

TEST CERTIFICATE

PARTICLE SIZE DISTRIBUTION

BS 1377: PART 2: Clause 9.5: 1990

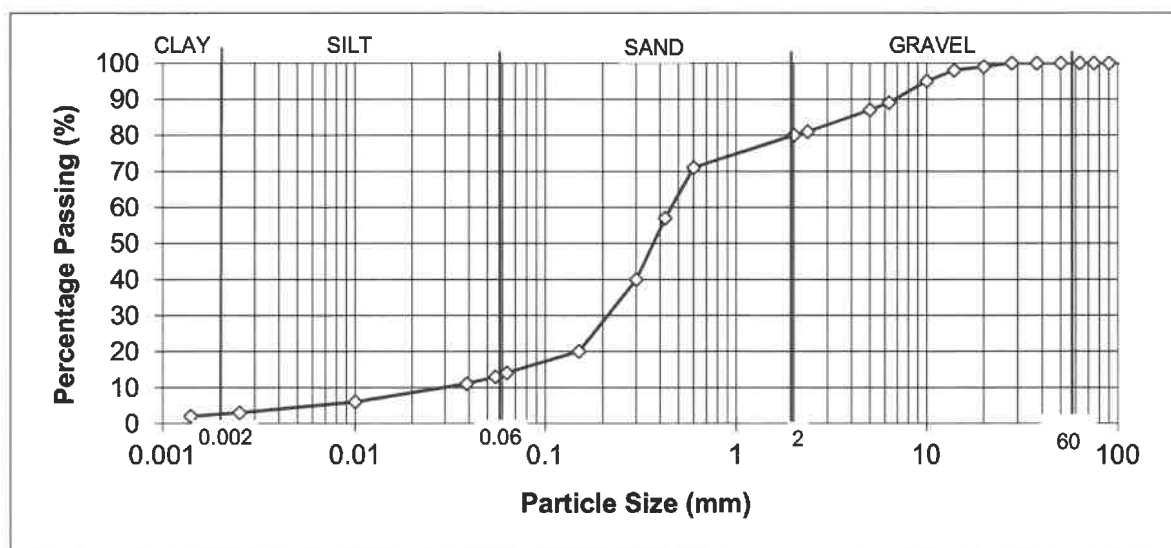
Determination of Moisture Content in accordance with BS 1377: PART 2: Clause 3: 1990 (Oven Dry)

CLIENT	LK Consult Ltd
SITE	LKC 17 1166 - Gallery Gardens, Manchester
JOB NUMBER	MRN 3524/1

SAMPLE LABEL	TP102 2.7-3.0m	DATE SAMPLED	20-Dec-18
LAB SAMPLE No	80661	DATE RECEIVED	21-Dec-18
DATE TESTED	02-Jan-19	SAMPLED BY	Client

MATERIAL	Brown slightly clayey silty SAND with occasional gravel
ADVISED SOURCE	Site Investigation Sample

Sieve Size (mm)	% Passing (%)	Specification (%)	Sieve Size (mm)	% Passing (%)	Specification (%)
125	100		2.36	81	
90	100		2	80	
75	100		0.6	71	
63	100		0.425	57	
50	100		0.3	40	
37.5	100		0.15	20	
28	100		0.063	14	
20	99		0.055	13	
14	98		0.039	11	
10	95		0.01	6	
6.3	89		0.0025	3	
5	87		0.0014	2	



REMARKS

As received moisture content = 12%

SIGNED

NAME

O.P. Davies BA (Hons)
(Laboratory Manager)

DATE

10-Jan-19

Appendix E – Certificates of Analysis (Water)



2183

Final Report

Report No.: 19-02758-1

Initial Date of Issue: 31-Jan-2019

Client LK Consult

Client Address: Unit 29 Eton Business Park
Eton Hill Road
Radcliffe
Manchester
Lancashire
M26 2ZS

Contact(s): Chris Hughes
Contaminated Land

Project LKC 17 1166 Gallery Gardens,
Manchester

Quotation No.:		Date Received:	25-Jan-2019
Order No.:	736671	Date Instructed:	25-Jan-2019
No. of Samples:	2		
Turnaround (Wkdays):	5	Results Due:	31-Jan-2019
Date Approved:	31-Jan-2019		

Approved By:



Details: Martin Dyer, Laboratory Manager

Project: LKC 17 1166 Gallery Gardens, Manchester

Client: LK Consult	Chemtest Job No.:				19-02758	19-02758
Quotation No.:	Chemtest Sample ID.:				761102	761103
	Client Sample ID.:				BH1	BH2
	Sample Type:				WATER	WATER
	Date Sampled:				24-Jan-2019	24-Jan-2019
Determinand	Accred.	SOP	Units	LOD		
pH	U	1010		N/A	8.4	8.2
Sulphate	U	1220	mg/l	1.0	43	220
Cyanide (Total)	U	1300	mg/l	0.050	< 0.050	< 0.050
Cyanide (Free)	U	1300	mg/l	0.050	< 0.050	< 0.050
Calcium	U	1415	mg/l	5.0	66	160
Total Hardness as CaCO ₃	U	1270	mg/l	15	190	490
Arsenic (Dissolved)	U	1450	µg/l	1.0	1.6	< 1.0
Boron (Dissolved)	U	1450	µg/l	20	< 20	70
Cadmium (Dissolved)	U	1450	µg/l	0.080	< 0.080	< 0.080
Chromium (Dissolved)	U	1450	µg/l	1.0	< 1.0	< 1.0
Copper (Dissolved)	U	1450	µg/l	1.0	1.3	< 1.0
Nickel (Dissolved)	U	1450	µg/l	1.0	< 1.0	< 1.0
Lead (Dissolved)	U	1450	µg/l	1.0	< 1.0	< 1.0
Selenium (Dissolved)	U	1450	µg/l	1.0	1.8	4.6
Zinc (Dissolved)	U	1450	µg/l	1.0	8.9	6.7
Mercury Low Level	U	1460	µg/l	0.010	< 0.010	< 0.010
Chromium (Hexavalent)	U	1490	µg/l	20	< 20	< 20
Dissolved Organic Carbon	U	1610	mg/l	2.0	2.6	< 2.0
Fuel Type	N	1670		N/A	N/A	N/A
Aliphatic TPH >C5-C6	N	1675	µg/l	0.10	< 0.10	< 0.10
Aliphatic TPH >C6-C8	N	1675	µg/l	0.10	< 0.10	< 0.10
Aliphatic TPH >C8-C10	N	1675	µg/l	0.10	< 0.10	< 0.10
Aliphatic TPH >C10-C12	N	1675	µg/l	0.10	< 0.10	< 0.10
Aliphatic TPH >C12-C16	N	1675	µg/l	0.10	< 0.10	< 0.10
Aliphatic TPH >C16-C21	N	1675	µg/l	0.10	< 0.10	< 0.10
Aliphatic TPH >C21-C35	N	1675	µg/l	0.10	< 0.10	< 0.10
Aliphatic TPH >C35-C44	N	1675	µg/l	0.10	< 0.10	< 0.10
Total Aliphatic Hydrocarbons	N	1675	µg/l	5.0	< 5.0	< 5.0
Aromatic TPH >C5-C7	N	1675	µg/l	0.10	< 0.10	< 0.10
Aromatic TPH >C7-C8	N	1675	µg/l	0.10	< 0.10	< 0.10
Aromatic TPH >C8-C10	N	1675	µg/l	0.10	< 0.10	< 0.10
Aromatic TPH >C10-C12	N	1675	µg/l	0.10	< 0.10	< 0.10
Aromatic TPH >C12-C16	N	1675	µg/l	0.10	< 0.10	< 0.10
Aromatic TPH >C16-C21	N	1675	µg/l	0.10	< 0.10	< 0.10
Aromatic TPH >C21-C35	N	1675	µg/l	0.10	< 0.10	< 0.10
Aromatic TPH >C35-C44	N	1675	µg/l	0.10	< 0.10	< 0.10
Total Aromatic Hydrocarbons	N	1675	µg/l	5.0	< 5.0	< 5.0
Total Petroleum Hydrocarbons	N	1675	µg/l	10	< 10	< 10
Benzene	U	1760	µg/l	1.0	< 1.0	< 1.0
Toluene	U	1760	µg/l	1.0	< 1.0	< 1.0

Project: LKC 17 1166 Gallery Gardens, Manchester

Client: LK Consult	Chemtest Job No.:				19-02758	19-02758
Quotation No.:	Chemtest Sample ID.:				761102	761103
	Client Sample ID.:				BH1	BH2
	Sample Type:				WATER	WATER
	Date Sampled:				24-Jan-2019	24-Jan-2019
Determinand	Accred.	SOP	Units	LOD		
Ethylbenzene	U	1760	µg/l	1.0	< 1.0	< 1.0
m & p-Xylene	U	1760	µg/l	1.0	< 1.0	< 1.0
o-Xylene	U	1760	µg/l	1.0	< 1.0	< 1.0
Methyl Tert-Butyl Ether	N	1760	µg/l	1.0	< 1.0	< 1.0
Naphthalene	N	1800	µg/l	0.010	< 0.010	< 0.010
Acenaphthylene	N	1800	µg/l	0.010	< 0.010	< 0.010
Acenaphthene	N	1800	µg/l	0.010	< 0.010	< 0.010
Fluorene	N	1800	µg/l	0.010	< 0.010	< 0.010
Phenanthrene	N	1800	µg/l	0.010	< 0.010	< 0.010
Anthracene	N	1800	µg/l	0.010	< 0.010	< 0.010
Fluoranthene	N	1800	µg/l	0.010	< 0.010	< 0.010
Pyrene	N	1800	µg/l	0.010	< 0.010	< 0.010
Benzo[a]anthracene	N	1800	µg/l	0.010	< 0.010	< 0.010
Chrysene	N	1800	µg/l	0.010	< 0.010	< 0.010
Benzo[b]fluoranthene	N	1800	µg/l	0.010	< 0.010	< 0.010
Benzo[k]fluoranthene	N	1800	µg/l	0.010	< 0.010	< 0.010
Benzo[a]pyrene	N	1800	µg/l	0.010	< 0.010	< 0.010
Indeno(1,2,3-c,d)Pyrene	N	1800	µg/l	0.010	< 0.010	< 0.010
Dibenz(a,h)Anthracene	N	1800	µg/l	0.010	< 0.010	< 0.010
Benzo[g,h,i]perylene	N	1800	µg/l	0.010	< 0.010	< 0.010
Total Of 6 PAH's	N	1800	µg/l	0.20	< 0.20	< 0.20
Total Phenols	U	1920	mg/l	0.030	< 0.030	< 0.030

SOP	Title	Parameters included	Method summary
1010	pH Value of Waters	pH	pH Meter
1220	Anions, Alkalinity & Ammonium in Waters	Fluoride; Chloride; Nitrite; Nitrate; Total; Oxidisable Nitrogen (TON); Sulfate; Phosphate; Alkalinity; Ammonium	Automated colorimetric analysis using 'Aquakem 600' Discrete Analyser.
1270	Total Hardness of Waters	Total hardness	Calculation applied to calcium and magnesium results, expressed as mg l ⁻¹ CaCO ₃ equivalent.
1300	Cyanides & Thiocyanate in Waters	Free (or easy liberatable) Cyanide; total Cyanide; complex Cyanide; Thiocyanate	Continuous Flow Analysis.
1415	Cations in Waters by ICP-MS	Sodium; Potassium; Calcium; Magnesium	Direct determination by inductively coupled plasma - mass spectrometry (ICP-MS).
1450	Metals in Waters by ICP-MS	Metals, including: Antimony; Arsenic; Barium; Beryllium; Boron; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Tin; Vanadium; Zinc	Filtration of samples followed by direct determination by inductively coupled plasma mass spectrometry (ICP-MS).
1460	Mercury low-level in Waters by AFS	Mercury	Atomic Fluorescence Spectrometry, with collimated UV source, wavelength 253.7 nm.
1490	Hexavalent Chromium in Waters	Chromium [VI]	Automated colorimetric analysis by 'Aquakem 600' Discrete Analyser using 1,5-diphenylcarbazide.
1610	Total/Dissolved Organic Carbon in Waters	Organic Carbon	TOC Analyser using Catalytic Oxidation
1670	Total Petroleum Hydrocarbons (TPH) in Waters by GC-FID	TPH (C6–C40); optional carbon banding, e.g. 3-band – GRO, DRO & LRO	Pentane extraction / GC FID detection
1675	TPH Aliphatic/Aromatic split in Waters by GC-FID(cf. Texas Method 1006 / TPH CWG)	Aliphatics: >C5–C6, >C6–C8, >C8–C10, >C10–C12, >C12–C16, >C16–C21, >C21–C35, >C35–C44 Aromatics: >C5–C7, >C7–C8, >C8–C10, >C10–C12, >C12–C16, >C16–C21, >C21–C35, >C35–C44	Pentane extraction / GCxGC FID detection
1760	Volatile Organic Compounds (VOCs) in Waters by Headspace GC-MS	Volatile organic compounds, including BTEX and halogenated Aliphatic/Aromatics. (cf. USEPA Method 8260)	Automated headspace gas chromatographic (GC) analysis of water samples with mass spectrometric (MS) detection of volatile organic compounds.
1800	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Waters by GC-MS	Acenaphthene; Acenaphthylene; Anthracene; Benzo[a]Anthracene; Benzo[a]Pyrene; Benzo[b]Fluoranthene; Benzo[ghi]Perylene; Benzo[k]Fluoranthene; Chrysene; Dibenz[ah]Anthracene; Fluoranthene; Fluorene; Indeno[123cd]Pyrene; Naphthalene; Phenanthrene; Pyrene	Pentane extraction / GCMS detection
1920	Phenols in Waters by HPLC	Phenolic compounds including: Phenol, Cresols, Xylenols, Trimethylphenols Note: Chlorophenols are excluded.	Determination by High Performance Liquid Chromatography (HPLC) using electrochemical detection.

Report Information

Key

- U UKAS accredited
- M MCERTS and UKAS accredited
- N Unaccredited
- S This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
- SN This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
- T This analysis has been subcontracted to an unaccredited laboratory
- I/S Insufficient Sample
- U/S Unsuitable Sample
- N/E not evaluated
- < "less than"
- > "greater than"

Comments or interpretations are beyond the scope of UKAS accreditation

The results relate only to the items tested

Uncertainty of measurement for the determinands tested are available upon request

None of the results in this report have been recovery corrected

All results are expressed on a dry weight basis

The following tests were analysed on samples as received and the results subsequently corrected to a dry weight basis TPH, BTEX, VOCs, SVOCs, PCBs, Phenols

For all other tests the samples were dried at < 37°C prior to analysis

All Asbestos testing is performed at the indicated laboratory

Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

Sample Deviation Codes

- A - Date of sampling not supplied
- B - Sample age exceeds stability time (sampling to extraction)
- C - Sample not received in appropriate containers
- D - Broken Container
- E - Insufficient Sample (Applies to LOI in Trommel Fines Only)

Sample Retention and Disposal

All soil samples will be retained for a period of 45 days from the date of receipt

All water samples will be retained for 14 days from the date of receipt

Charges may apply to extended sample storage

If you require extended retention of samples, please email your requirements to:

customerservices@chemtest.com

Appendix F – Gas Monitoring Results



ATMOSPHERIC / GROUND CONDITIONS	
Atmospheric Pressure Trend on Site	Rising
Atmospheric Pressure (Prev 24hrs)	Rising
Weather Conditions	Raining, cool, still
Ground Conditions	Wet

[illegible]

ppm	Parts per million
mb	Millibars
ltr/hr	Litres per hour
mbgl	Metres below ground level
LEL	Lower explosive limit in air
OEL	Occupational exposure limit

1. Equipment is serviced and checked as recommended by the manufacturer. Refer to calibration records and service certificates.
2. CH4 is explosive between the range of 5 - 15% v/v. 100% lower explosive limit is equal to 5% v/v CH4.
3. Flow readings are based on a 1 minute average value where flow is detected (equipment range of +/- 12 ltr/hr)
4. After CIRIA C665. GSV = gas concentration (%) x flow rate. Peak CH4 and Steady CO2 values used.
5. Monitoring is carried out in line with procedures set by LKC Ltd with reference to CIRIA C665. Refer to procedural documents



EQUIPMENT* ¹		
Instrument / Model Type	Serial Number	Comments
Geotechnical Instruments GA2000+	GA10350	Serviced, calibrated & gas checked.
Geotech dipmeter	81070	Operating Normally

ATMOSPHERIC / GROUND CONDITIONS	
Atmospheric Pressure Trend on Site	Steady
Atmospheric Pressure (Prev 24hrs)	Steady
Weather Conditions	Sunny, cool, still
Ground Conditions	Dry

ABBREVIATIONS

*1	Refer to Note 1
ND	Not detected
NR	Not recorded
UR	Unable to record
OS	Off recordable scale
N/A	Not applicable
% v/v	Percentage volume by total volume

ppm	Parts per million
mb	Millibars
ltr/hr	Litres per hour
mbgl	Metres below ground level
LEL	Lower explosive limit in air
OEL	Occupational exposure limit

NOTES

1. Equipment is serviced and checked as recommended by the manufacturer. Refer to calibration records, and service certificates.
2. CH4 is explosive between the range of 5 - 15% v/v. 100% lower explosive limit is equal to 5% v/v CH4.
3. Flow readings are based on a 1 minute average value where flow is detected (equipment range of +/- 12 ltr/hr)
4. After CIRIA C665. GSV = gas concentration (%) x flow rate. Peak CH4 and Steady CO2 values used.
5. Monitoring is carried out in line with procedures set by LKC Ltd with reference to CIRIA C665. Refer to procedural documents



LK CONSULT LTD

GAS MONITORING RECORD

SITE	Gallery Gardens, Manchester
REF	LKC 17 1166
DATE	10-Oct-2018
STAFF	BR
VISIT	4 of 6

EQUIPMENT ^{*1}		
Instrument / Model Type	Serial Number	Comments
Geotechnical Instruments GA5000	G502417	Serviced, calibrated & gas checked.
Geotechnical Instruments GA5000	81070	Operating Normally

ATMOSPHERIC / GROUND CONDITIONS	
Atmospheric Pressure Trend on Site	Variable
Atmospheric Pressure (Prev 24hrs)	Falling
Weather Conditions	Warm, sunny
Ground Conditions	Dry

Borehole ID	Date/Time	CH4 (% v/v)	CO2 (% v/v)	O2 (% v/v)	Peak CH4 (% v/v)	Peak CO2 (% v/v)	% of Lower Explosive Limit ^{*2}	CO Pod (ppm)	H2S Pod (ppm)	Balance (%)	Barometric Pressure (mb)	Internal Flow ^{*3} (ltr/hr)	Standing Water Level (mbgl)	Installation Base Dip (mbgl)	Notes
WS01	10/10/2018 09:42	0.1	5.1	7.5	0.2	5.1	2.0	0.0	0.0	87.3	1007	0.0	Dry	5.02	Peak CO=1
WS02	10/10/2018 09:50	0.1	4.8	15.5	0.2	4.8	2.0	0.0	0.0	79.6	1008	0.0	Dry	4.07	Peak CO=1
WS03	10/10/2018 10:15	0.2	1.4	19.4	0.2	1.4	4.0	0.0	0.0	79.0	1009	0.0	Damp	4.80	Peak CO=1
WS04	10/10/2018 10:01	0.2	0.2	20.6	0.2	0.6	4.0	0.0	0.0	79.0	1008	0.0	Dry	2.89	Peak CO=1

ABBREVIATIONS	
^{*1}	Refer to Note 1
ND	Not detected
NR	Not recorded
UR	Unable to record
OS	Off recordable scale
N/A	Not applicable
% v/v	Percentage volume by total volume
ppm	Parts per million
mb	Millibars
ltr/hr	Litres per hour
mbgl	Metres below ground level
LEL	Lower explosive limit in air
OEL	Occupational exposure limit

NOTES	
1.	Equipment is serviced and checked as recommended by the manufacturer. Refer to calibration records. and service certificates.
2.	CH4 is explosive between the range of 5 - 15% v/v. 100% lower explosive limit is equal to 5% v/v CH4.
3.	Flow readings are based on a 1 minute average value where flow is detected (equipment range of +/- 12 ltr/hr)
4.	After CIRIA C665. GSV = gas concentration (%) x flow rate. Peak CH4 and Steady CO2 values used.
5.	Monitoring is carried out in line with procedures set by LKC Ltd with reference to CIRIA C665. Refer to procedural documents



ATMOSPHERIC / GROUND CONDITIONS	
Atmospheric Pressure Trend on Site	Steady
Atmospheric Pressure (Prev 24hrs)	Rising
Weather Conditions	Sunny, cool, breezy
Ground Conditions	Dry

1. Equipment is serviced and checked as recommended by the manufacturer. Refer to calibration records, and service certificates.
2. CH4 is explosive between the range of 5 - 15% v/v. 100% lower explosive limit is equal to 5% v/v CH4.
3. Flow readings are based on a 1 minute average value where flow is detected (equipment range of +/- 12 ltr/hr)
4. After CIRIA C665. GSV = gas concentration (%) x flow rate. Peak CH4 and Steady CO2 values used.
5. Monitoring is carried out in line with procedures set by LKC Ltd with reference to CIRIA C665. Refer to procedural documents



ATMOSPHERIC / GROUND CONDITIONS	
Atmospheric Pressure Trend on Site	Steady
Atmospheric Pressure (Prev 24hrs)	Rising
Weather Conditions	Overcast, mild, windy
Ground Conditions	Damp (dry for WS103)

1. Equipment is serviced and checked as recommended by the manufacturer. Refer to calibration records, and service certificates.
2. CH4 is explosive between the range of 5 - 15% v/v. 100% lower explosive limit is equal to 5% v/v CH4.
3. Flow readings are based on a 1 minute average value where flow is detected (equipment range of +/- 12 ltr/hr)
4. After CIRA C665. GSV = gas concentration (%) x flow rate. Peak CH4 and Steady CO2 values used.
5. Monitoring is carried out in line with procedures set by LKC Ltd with reference to CIRA C665. Refer to procedural documents



EQUIPMENT* ¹		
Instrument / Model Type	Serial Number	Comments
Geotechnical Instruments GA5000	G502417	Serviced, calibrated & gas checked.
Solinst Interface Meter	122008632	Operating Normally

[illegible]

*1	Refer to Note 1
ND	Not detected
NR	Not recorded
UR	Unable to record
OS	Off recordable scale
N/A	Not applicable
% v/v	Percentage volume by total volume

ppm	Parts per million
mb	Millibars
ltr/hr	Litres per hour
mbgl	Metres below ground level
LEL	Lower explosive limit in air
OEL	Occupational exposure limit

1. Equipment is serviced and checked as recommended by the manufacturer. Refer to calibration records, and service certificates.
2. CH4 is explosive between the range of 5 - 15% v/v. 100% lower explosive limit is equal to 5% v/v CH4.
3. Flow readings are based on a 1 minute average value where flow is detected (equipment range of +/- 12 ltr/hr)
4. After CIRIA C665, GSV = gas concentration (%) x flow rate. Peak CH4 and Steady CO2 values used.
5. Monitoring is carried out in line with procedures set by LKC Ltd with reference to CIRIA C665. Refer to procedural documents

Appendix G – Generic Assessment Criteria Values

Generic Assessment Criteria Values

Contaminant		SOM	Res +	Res -	Allot.	Comm.	POS ^{resi}	POS ^{park}	Source
Metals	Inorganic Arsenic	N/A	37	40	49	640	79	168	DEFRA C4SL
	Beryllium	N/A	1.7	1.7	35	12	2.2	63	LQM S4UL
	Boron	N/A	290	11,000	45	240,000	21,000	46,000	LQM S4UL
	Cadmium	N/A	26	149	4.9	410	220	880	DEFRA C4SL
	Chromium (III)	N/A	910	910	18,000	8,600	1,500	33,000	LQM S4UL
	Chromium (VI)	N/A	21.0	21.0	170.0	49	23.0	250	DEFRA C4SL
	Copper	N/A	2,400	7,100	520	68,000	12,000	44,000	LQM S4UL
	Lead	N/A	200	310	80	2,330	630	1,300	DEFRA C4SL
	Elemental Mercury	N/A	1.2	1.2	21	58 (25.8) ^{vap}	16	30 (25.8) ^{vap}	LQM S4UL
	Inorganic Mercury	N/A	40	56	19	1,100	120	240	LQM S4UL
	Methylmercury	N/A	11	15	6.0	320	40	68	LQM S4UL
	Nickel (2015 update)	N/A	130	180	53	980	230	800	LQM S4UL
	Selenium	N/A	250	430	88	12,000	1,100	1,800	LQM S4UL
	Vanadium	N/A	410	1,200	91	9,000	2,000	5,000	LQM S4UL
Zinc	N/A	3,700	40,000	620	730,000	81,000	170,000	LQM S4UL	
Polycyclic Aromatic Hydrocarbons (PAHs)	Acenaphthene	1%	210	3,000 (57.1) ^{sol}	34	84,000 (57.0) ^{sol}	15,000	29,000	LQM S4UL
		2.5%	510	4,700 (141) ^{sol}	85	97,000 (141) ^{sol}	15,000	30,000	LQM S4UL
		6%	1,100	6,000 (336) ^{sol}	200	100,000	15,000	30,000	LQM S4UL
	Acenaphthylene	1%	170	2,900 (86.1) ^{sol}	28	83,000 (86.1) ^{sol}	15,000	29,000	LQM S4UL
		2.5%	420	4,600 (212) ^{sol}	69	97,000 (212) ^{sol}	15,000	30,000	LQM S4UL
		6%	920	6,000 (506) ^{sol}	160	100,000	15,000	30,000	LQM S4UL
	Anthracene	1%	2,400	31,000 (1.17) ^{vap}	380	520,000	74,000	150,000	LQM S4UL
		2.5%	5,400	35,000	950	540,000	74,000	150,000	LQM S4UL
		6%	11,000	37,000	2,200	540,000	74,000	150,000	LQM S4UL
	Benz(a)anthracene	1%	7.2	11	2.9	170	29	49	LQM S4UL
		2.5%	11	14	6.5	170	29	56	LQM S4UL
		6%	13	15	13	180	29	62	LQM S4UL
	Benzo(a)pyrene (only)	1%	5.0	5.3	5.70	77	10.0	21	DEFRA C4SL
		2.5%	5.0	5.3	5.70	77	10.0	21	DEFRA C4SL
		6%	5.0	5.3	5.70	77	10.0	21	DEFRA C4SL
	Benzo(a)pyrene (surrogate marker Coal Tar)	1%	0.8	1.2	0.32	15	2.2	4	LQM S4UL
		2.5%	1.0	1.2	0.67	15	2.2	5	LQM S4UL
		6%	1.1	1.2	1.20	15	2.2	5	LQM S4UL
	Benzo(b)fluoranthene	1%	2.6	3.9	0.99	44	7.1	13	LQM S4UL
		2.5%	3.3	4.0	2.1	44	7.2	15	LQM S4UL
		6%	3.7	4.0	3.9	45	7.2	16	LQM S4UL
	Benzo(ghi)perylene	1%	320	360	290	3,900	640	1,400	LQM S4UL
		2.5%	340	360	470	4,000	640	1,500	LQM S4UL
		6%	350	360	640	4,000	640	1,600	LQM S4UL
	Benzo(k)fluoranthene	1%	77	110	37	1,200	190	370	LQM S4UL
		2.5%	93	110	75	1,200	190	410	LQM S4UL
		6%	100	110	130	1,200	190	440	LQM S4UL
	Chrysene	1%	15	30	4.1	350	57	93	LQM S4UL
		2.5%	22	31	9.4	350	57	110	LQM S4UL
		6%	27	32	19	350	57	120	LQM S4UL
	Dibenzo(ah)anthracene	1%	0.24	0.31	0.14	3.5	0.57	1.1	LQM S4UL
		2.5%	0.28	0.32	0.27	3.6	0.58	1.3	LQM S4UL
		6%	0.3	0.32	0.43	3.6	0.58	1.4	LQM S4UL
	Fluoranthene	1%	280	1,500	52	23,000	3,100	6,300	LQM S4UL
		2.5%	560	1,600	130	23,000	3,100	6,300	LQM S4UL
		6%	890	1,600	290	23,000	3,100	6,400	LQM S4UL
	Fluorene	1%	170	2,800 (36.0) ^{sol}	27	63,000 (30.9) ^{sol}	9,900	20,000	LQM S4UL
		2.5%	400	3,800 (76.5) ^{sol}	67	68,000	9,900	20,000	LQM S4UL
		6%	860	4,500 (183) ^{sol}	160	71,000	9,900	20,000	LQM S4UL
	Indeno(123-cd)pyrene	1%	27	45	9.5	500	82	150	LQM S4UL
		2.5%	36	46	21	510	82	170	LQM S4UL
		6%	41	46	39	510	82	180	LQM S4UL
	Naphthalene	1%	2.3 ^f	2.3 ^f	4.1 ^f	190 ^f (76.4) ^{sol}	4,900 ^f	1,200 ^f (76.4) ^{sol}	LQM S4UL
		2.5%	5.6 ^f	5.6 ^f	10 ^f	460 ^f (183) ^{sol}	4,900 ^f	1,900 ^f (183) ^{sol}	LQM S4UL
		6%	13 ^f	13 ^f	24 ^f	1,100 ^f (432) ^{sol}	4,900 ^f	3,000	LQM S4UL
	Phenanthrene	1%	95	1,300 (36.0) ^{sol}	15	22,000	3,100	6,200	LQM S4UL
		2.5%	220	1,500	38	22,000	3,100	6,200	LQM S4UL
		6%	440	1,500	90	22,000	3,100	6,300	LQM S4UL
	Pyrene	1%	620	3,700	110	54,000	7,400	15,000	LQM S4UL
		2.5%	1,200	3,800	270	54,000	7,400	15,000	LQM S4UL
		6%	2,000	3,800	620	54,000	7,400	15,000	LQM S4UL
	Coal Tar (B(a)P as surrogate marker)	1%	0.79	1.2	0.32	15	2.2	4.4	LQM S4UL
		2.5%	0.98	1.2	0.67	15	2.2	4.7	LQM S4UL
		6%	1.1	1.2	1.2	15	2.2	4.8	LQM S4UL

Generic Assessment Criteria Values

Contaminant		SOM	Res +	Res -	Allot.	Comm.	POS ^{res} i	POS ^{park}	Source
BTEX Compounds	Benzene	1%	0.087	0.38	0.017	27	72	90	LQM S4UL
		2.5%	0.17	0.70	0.034	47	72	100	LQM S4UL
		6%	0.37	1.4	0.075	90	73	110	LQM S4UL
	Toluene	1%	130	880 (869) ^{vap}	22	56,000 (869) ^{vap}	56,000	87,000 (869) ^{vap}	LQM S4UL
		2.5%	290	1,900	51	110,000 (1,920) ^{vap}	56,000	95,000 (1,920) ^{vap}	LQM S4UL
		6%	660	3,900	120	180,000 (4,360) ^{vap}	56,000	100,000 (4,360) ^{vap}	LQM S4UL
	Ethylbenzene	1%	47	83	16	5,700 (518) ^{vap}	24,000	17,000 (518) ^{vap}	LQM S4UL
		2.5%	110	190	39	13,000 (1,220) ^{vap}	24,000	22,000 (1,220) ^{vap}	LQM S4UL
		6%	260	440	91	27,000 (2,840) ^{vap}	25,000	27,000 (2,840) ^{vap}	LQM S4UL
	o-xylene	1%	60	88	28	6,600 (478) ^{sol}	41,000	17,000 (478) ^{sol}	LQM S4UL
		2.5%	140	210	67	15,000 (1,120) ^{sol}	42,000	24,000 (1,120) ^{sol}	LQM S4UL
		6%	330	480	160	33,000 (2,620) ^{sol}	43,000	33,000 (2,620) ^{sol}	LQM S4UL
	m-xylene	1%	59	82	31	6,200 (625) ^{vap}	41,000	17,000 (625) ^{vap}	LQM S4UL
		2.5%	140	190	74	14,000 (1,470) ^{vap}	42,000	24,000 (1,470) ^{vap}	LQM S4UL
		6%	320	450	170	31,000 (3,460) ^{vap}	43,000	32,000 (3,460) ^{vap}	LQM S4UL
	p-xylene	1%	56	79	29	5,900 (576) ^{sol}	41,000	17,000 (576) ^{sol}	LQM S4UL
		2.5%	130	180	69	14,000 (1,350) ^{sol}	42,000	23,000 (1,350) ^{sol}	LQM S4UL
		6%	310	430	160	30,000 (3,170) ^{sol}	43,000	31,000 (3,170) ^{sol}	LQM S4UL
Petroleum Hydroc	Aliphatic								
	EC 5-6	1%	42	42	730	3,200 (304) ^{sol}	570,000(304) ^{sol}	95,000 (304) ^{sol}	LQM S4UL
	EC>6-8	1%	100	100	2,300	7,800 (144) ^{sol}	600,000	150,000 (144) ^{sol}	LQM S4UL
	EC>8-10	1%	27	27	320	2,000 (78) ^{sol}	13,000	14,000 (78) ^{vap}	LQM S4UL
	EC>10-12	1%	130 (48) ^{vap}	130 (48) ^{vap}	2,200	9,700 (48) ^{sol}	13,000	21,000 (48) ^{vap}	LQM S4UL
	EC>12-16	1%	1,100 (24) ^{sol}	1,100 (24) ^{sol}	11,000	59,000 (24) ^{sol}	13,000	25,000 (24) ^{sol}	LQM S4UL
	EC>16-35	1%	65,000 (8.48)	65,000 (8.48) ^{f, sol}	260,000 ^f	160,000 ^f	250,000 ^f	450,000 ^f	LQM S4UL
	EC>35-44	1%	65,000 (8.48)	65,000 (8.48) ^{f, sol}	260,000 ^f	160,000 ^f	250,000 ^f	450,000 ^f	LQM S4UL
	Aliphatic								
	EC 5-6	2.5%	78	78	1,700	5,900 (558) ^{sol}	590,000	130,000 (558) ^{sol}	LQM S4UL
	EC>6-8	2.5%	230	230	5,600	17,000 (322) ^{sol}	610,000	220,000 (322) ^{sol}	LQM S4UL
	EC>8-10	2.5%	65	65	770	4,800 (190) ^{vap}	13,000	18,000 (190) ^{vap}	LQM S4UL
	EC>10-12	2.5%	330 (118) ^{vap}	330 (118) ^{vap}	4,400	23,000 (118) ^{vap}	13,000	23,000 (118) ^{vap}	LQM S4UL
	EC>12-16	2.5%	2,400 (59) ^{sol}	2,400 (59) ^{sol}	13,000	82,000 (59) ^{sol}	13,000	25,000 (59) ^{sol}	LQM S4UL
	EC>16-35	2.5%	92,000 (21)	92,000 (21) ^{f, sol}	270,000 ^f	1,700,000 ^f	250,000 ^f	480,000 ^f	LQM S4UL
	EC>35-44	2.5%	92,000 (21)	92,000 (21) ^{f, sol}	270,000 ^f	1,700,000 ^f	250,000 ^f	480,000 ^f	LQM S4UL
	Aliphatic								
	EC 5-6	6%	160	160	3,900	12,000 (1,150) ^{sol}	600,000	180,000 (1,150)	LQM S4UL
	EC>6-8	6%	530	530	13,000	40,000 (736) ^{sol}	620,000	320,000 (736) ^{sol}	LQM S4UL
	EC>8-10	6%	150	150	1,700	11,000 (451) ^{vap}	13,000	21,000 (451) ^{vap}	LQM S4UL
	EC>10-12	6%	760 (283) ^{vap}	760 (283) ^{vap}	7,300	47,000 (283) ^{vap}	13,000	24,000 (283) ^{vap}	LQM S4UL
	EC>12-16	6%	4,300 (142) ^{sol}	4,400 (142) ^{sol}	13,000	90,000 (142) ^{sol}	13,000	26,000 (142) ^{sol}	LQM S4UL
	EC>16-35	6%	110,000 ^f	110,000 ^f	270,000 ^f	1,800,000 ^f	250,000 ^f	490,000 ^f	LQM S4UL
	EC>35-44	6%	110,000 ^f	110,000 ^f	270,000 ^f	1,800,000 ^f	250,000 ^f	490,000 ^f	LQM S4UL
	Aromatic								
	EC5-7(benzene as non-	1%	70	370	13	26,000 (1,220) ^{sol}	56,000	76,000 (1,220) ^{sol}	LQM S4UL
	EC>7-8(toluene)	1%	130	860	22	56,000 (869) ^{vap}	56,000	87,000 (869) ^{vap}	LQM S4UL
	EC>8-10	1%	34	47	8.6	3,500 (613) ^{vap}	5,000	7,200 (613) ^{vap}	LQM S4UL
	EC>10-12	1%	74	250	13	16,000 (364) ^{sol}	5,000	9,200 (364) ^{sol}	LQM S4UL
	EC>12-16	1%	140	1,800	23	36,000 (169) ^{sol}	5,100	10,000	LQM S4UL
	EC>16-21	1%	260 ^f	1,900 ^f	46 ^f	28,000 ^f	3,800 ^f	7,600 ^f	LQM S4UL
	EC>21-35	1%	1,100 ^f	1,900 ^f	370 ^f	28,000 ^f	3,800 ^f	7,800 ^f	LQM S4UL
	EC>35-44	1%	1,100 ^f	1,900 ^f	370 ^f	28,000 ^f	3,800 ^f	7,800 ^f	LQM S4UL
	Aromatic								
	EC5-7(benzene as non-	2.5%	140	690	27	46,000 (2,260) ^{sol}	56,000	84,000 (2,260) ^{sol}	LQM S4UL
	EC>7-8(toluene)	2.5%	290	1,800	51	110,000 (1,920) ^{sol}	56,000	95,000 (1,920) ^{sol}	LQM S4UL
	EC>8-10	2.5%	83	110	21	8,100 (1,500) ^{vap}	5,000	8,500 (1,500) ^{vap}	LQM S4UL
	EC>10-12	2.5%	180	590	31	28,000 (899) ^{sol}	5,000	9,700 (899) ^{sol}	LQM S4UL
	EC>12-16	2.5%	330	2,300 (419) ^{sol}	57	37,000	5,100	10,000	LQM S4UL
	EC>16-21	2.5%	540 ^f	1,900 ^f	110 ^f	28,000 ^f	3,800 ^f	7,700 ^f	LQM S4UL
	EC>21-35	2.5%	1,500 ^f	1,900 ^f	820 ^f	28,000 ^f	3,800 ^f	7,800 ^f	LQM S4UL
	EC>35-44	2.5%	1,500 ^f	1,900 ^f	820 ^f	28,000 ^f	3,800 ^f	7,800 ^f	LQM S4UL
	Aromatic								
	EC5-7(benzene as non-	6%	300	1,400	57	86,000 (4,710) ^{sol}	56,000	92,000 (4,710) ^{sol}	LQM S4UL
	EC>7-8(toluene)	6%	660	3,900	120	180,000 (4,360) ^{vap}	56,000	100,000 (4,360)	LQM S4UL
	EC>8-10	6%	190	270	51	17,000 (3,580) ^{vap}	5,000	9,300 (3,580) ^{vap}	LQM S4UL
	EC>10-12	6%	380	1,200	4	34,000 (2,150) ^{sol}	5,000	10,000	LQM S4UL
	EC>12-16	6%	660	2,500	130	38,000	5,100	10,000	LQM S4UL
	EC>16-21	6%	930 ^f	1,900 ^f	260 ^f	28,000 ^f	3,800 ^f	7,800 ^f	LQM S4UL
	EC>21-35	6%	1,700 ^f	1,900 ^f	1,600 ^f	28,000 ^f	3,800 ^f	7,900 ^f	LQM S4UL
	EC>35-44	6%	1,700 ^f	1,900 ^f	1,600 ^f	28,000 ^f	3,800 ^f	7,900 ^f	LQM S4UL
	Aliphatic +Aromatic >EC44	1%	1,600 ^f	1,900 ^f	1,200 ^f	28,000 ^f	3,800 ^f	7,800 ^f	LQM S4UL
		2.5%	1,800 ^f	1,900 ^f	2,100 ^f	28,000 ^f	3,800 ^f	7,800 ^f	LQM S4UL
		6%	1,900 ^f	1,900 ^f	3,000 ^f	28,000 ^f	3,800 ^f	7,900 ^f	LQM S4UL

Generic Assessment Criteria Values

Contaminant		SOM	Res +	Res -	Allot.	Comm.	POS ^{res} i	POS ^{park}	Source
Chloroalkanes and Alkenes & Explosives	1,2 Dichloroethane (DCA)	1%	0.0071	0.0092	0.0046	0.67	29	21	LQM S4UL
		2.5%	0.0110	0.0130	0.0083	0.97	29	24	LQM S4UL
		6%	0.0190	0.0230	0.0160	1.7	29	28	LQM S4UL
	1,1,1 Trichloroethane (TCA)	1%	8.8	9.0	48	660	140,000	57,000 (1,425) ^{vap}	LQM S4UL
		2.5%	18	18	110	1,300	140,000	76,000 (2,915) ^{vap}	LQM S4UL
		6%	39	40	240	3,000	140,000	100,000 (6,392)	LQM S4UL
	1,1,2,2-Tetrachloroethanes (PCA)	1%	1.6	3.9	0.41	270	1,400	1,800	LQM S4UL
		2.5%	3.4	8.0	0.89	550	1,400	2,100	LQM S4UL
		6%	7.5	17	2.0	1,100	1,400	2,300	LQM S4UL
	1,1,1,2-Tetrachloroethanes (PCA)	1%	1.2	1.5	0.79	110	1,400	1,500	LQM S4UL
		2.5%	2.8	3.5	1.9	250	1,400	1,800	LQM S4UL
		6%	6.4	8.2	4.4	560	1,400	2,100	LQM S4UL
	Tetrachloroethene (PCE)	1%	0.31	0.32	2.00	24	3,200	1400	DEFRA C4SL
		2.5%	0.70	0.71	4.8	55	3,300	1900	DEFRA C4SL
		6%	1.60	1.60	11.0	130	3,400	2,500	DEFRA C4SL
	Tetrachloromethane (carbon tetrachloride)	1%	0.03	0.03	0.45	2.9	890	190	LQM S4UL
		2.5%	0.06	0.06	1.0	6.3	920	270	LQM S4UL
		6%	0.13	0.13	2.4	14	950	400	LQM S4UL
	Trichloroethene (TCE)	1%	0.009	0.010	0.032	0.7	76.0	41.0	DEFRA C4SL
		2.5%	0.020	0.020	0.072	1.5	78.0	51.0	DEFRA C4SL
		6%	0.043	0.045	0.160	3.4	79.0	69.0	DEFRA C4SL
	cis 1,2-dichloroethene	1%	0.46	0.50	0.890	38	3,800	2,000	DEFRA C4SL
		2.5%	0.78	0.84	1.70	64	3,800	2,400	DEFRA C4SL
		6%	1.50	1.60	3.60	120	3,900	3,100	DEFRA C4SL
	Trichloromethane (chloroform)	1%	0.91	1.2	0.42	99	2,500	2,600	LQM S4UL
		2.5%	1.7	2.1	0.83	170	2,500	2,800	LQM S4UL
		6%	3.4	4.2	1.7	350	2,500	3,100	LQM S4UL
	Trans-1,2 Dichloroethene	1%	0.9	0.9	3.7	69	13,000	5,600	DEFRA C4SL
		2.5%	1.6	1.7	7.5	120	13,000	7,000	DEFRA C4SL
		6%	3.3	3.4	16.0	260	13,000	9,100	DEFRA C4SL
	Chloroethene (vinyl chloride)	1%	0.006	0.015	0.0017	1.1E+00	7.8	18.0	DEFRA C4SL
		2.5%	0.010	0.019	0.0031	1.4E+00	7.8	19.0	DEFRA C4SL
		6%	0.017	0.029	0.0058	2.20	7.8	19.0	DEFRA C4SL
	2,4,6-Trinitrotoluene (TNT)	1%	1.6	65	0.24	1,000	130	260	LQM S4UL
		2.5%	3.7	66	0.58	1,000	130	270	LQM S4UL
		6%	8.1	66	1.4	1,000	130	270	LQM S4UL
	RDX	1%	120	13,000	17	210,000	26,000	49,000 (18.7) ^{sol}	LQM S4UL
		2.5%	250	13,000	38	210,000	26,000	51,000	LQM S4UL
		6%	540	13,000	85	210,000	27,000	53,000	LQM S4UL
	HMX	1%	5.7	6,700	0.86	110,000	13,000	23,000 (0.35) ^{vap}	LQM S4UL
		2.5%	13	6,700	1.9	110,000	13,000	23,000 (0.39) ^{vap}	LQM S4UL
		6%	26	6,700	3.9	110,000	13,000	24,000 (0.48) ^{vap}	LQM S4UL
Pesticides	Aldrin	1%	5.7	7.3	3.2	170	18	30	LQM S4UL
		2.5%	6.6	7.4	6.1	170	18	31	LQM S4UL
		6%	7.1	7.5	9.8	170	18	31	LQM S4UL
	Dieldrin	1%	0.97	7.0	0.17	170	18	30	LQM S4UL
		2.5%	2.0	7.3	0.41	170	18	30	LQM S4UL
		6%	3.5	7.4	0.96	170	18	31	LQM S4UL
	Atrazine	1%	3.3	610	0.5	9,300	1,200	2,300	LQM S4UL
		2.5%	7.8	620	1.2	9,400	1,200	2,400	LQM S4UL
		6%	17.4	620	2.7	9,400	1,200	2,400	LQM S4UL
	Dichlorvos	1%	3.2E-02	6.4	4.9E-03	140	16	26	LQM S4UL
		2.5%	6.6E-02	6.5	1.0E-02	140	16	26	LQM S4UL
		6%	0.14	6.6	2.2E-02	140	16	27	LQM S4UL
	Endosulfans (2 isomers)	1%	7.4	160 (3.0E-03) ^{vap}	1.2	5,600 (3.0E-03) ^{vap}	1,200	2,300	LQM S4UL
		2.5%	18	280 (7.0E-03) ^{vap}	2.9	7,400 (7.0E-03) ^{vap}	1,200	2,400	LQM S4UL
		6%	41	410 (1.6E-02) ^{vap}	6.8	8,400 (1.6E-02) ^{vap}	1,200	2,500	LQM S4UL
	Hexachlorocyclohexane (3 isomers), inc Lindane	1%	8.5E-02	3.7	1.3E-02	65	8.1	15	LQM S4UL
		2.5%	0.2	3.8	3.2E-02	65	8.1	15	LQM S4UL
		6%	0.46	3.8	7.7E-02	65	8.1	16	LQM S4UL
Chlorobenzenes	Chlorobenzene	1%	0.46	0.46	5.9	56	11,000	1,300 (675) ^{sol}	LQM S4UL
		2.5%	1.0	1.0	14	130	13,000	2,000 (1,520) ^{sol}	LQM S4UL
		6%	2.4	2.4	32	290	14,000	2,900	LQM S4UL
	Dichlorobenzenes (3 isomers)	1%	23	24	94	2,000 (571) ^{sol}	90,000	24,000 (571) ^{sol}	LQM S4UL
		2.5%	55	57	230	4,800 (1,370) ^{sol}	95,000	36,000 (1,370) ^{sol}	LQM S4UL
		6%	130	130	540	11,000 (3,240) ^{sol}	98,000	51,000 (3,270) ^{sol}	LQM S4UL
	Trichlorobenzenes (3 isomers)	1%	2.6	2.6	55	220	15,000	1,700 (318) ^{vap}	LQM S4UL
		2.5%	6.4	6.4	140	530	17,000	2,600 (786) ^{vap}	LQM S4UL
		6%	15	15	320	1,300	19,000	4,000 (1,880) ^{vap}	LQM S4UL
	Tetrachlorobenzenes (3 isomers)	1%	0.66	0.75	0.38	49 (39.4) ^{vap}	78	110 (39) ^{vap}	LQM S4UL
		2.5%	1.6	1.9	0.90	120 (98.1) ^{vap}	79	120	LQM S4UL
		6%	3.7	4.3	2.2	240 (235) ^{vap}	79	130	LQM S4UL
	Pentachlorobenzene	1%	5.8	19	1.2	640 (43.0) ^{sol}	100	190	LQM S4UL
		2.5%	12	30	3.1	770 (107) ^{sol}	100	190	LQM S4UL
		6%	22	38	7.0	830	100	190	LQM S4UL
	Hexachlorobenzene	1%	1.8 (0.20) ^{vap}	4.1 (0.20) ^{vap}	0.47	110 (0.20) ^{vap}	16	30	LQM S4UL
		2.5%	3.3 (0.50) ^{vap}	5.7 (0.50) ^{vap}	1.1	120	16	30	LQM S4UL
		6%	4.9	6.7 (1.2) ^{vap}	2.5	120	16	30	LQM S4UL

Generic Assessment Criteria Values

Contaminant		SOM	Res +	Res -	Allot.	Comm.	^{POS} resi	^{POS} park	Source
Chlorophenol	Chlorophenols (4 congeners)	1%	0.87 ^B	94	0.13 ^B	3,500	620	1,100	LQM S4UL
		2.5%	2.0	150	0.30	4,000	620	1,100	LQM S4UL
		6%	4.5	210	0.70	4,300	620	1,100	LQM S4UL
	Pentachlorophenol	1%	0.22	27 (16.4) ^{vap}	3.0E-02	400	60	110	LQM S4UL
		2.5%	0.52	29	8.0E-02	400	60	120	LQM S4UL
		6%	1.2	31	0.19	400	60	120	LQM S4UL
Others	Carbon Disulphide	1%	0.14	0.14	4.8	11	11,000	1,300	LQM S4UL
		2.5%	0.29	0.29	10	22	11,000	1,900	LQM S4UL
		6%	0.62	0.62	23	47	11,000	2,700	LQM S4UL
	Hexachlorobutadiene	1%	0.29	0.32	0.25	31	25	48	LQM S4UL
		2.5%	0.7	0.78	0.61	66	25	50	LQM S4UL
		6%	1.6	1.8	1.4	120	25	51	LQM S4UL
	Phenol	1%	120	440 (460)	23	440 ^{dir} (26,000)	440 ^{dir} (10,000)	440 ^{dir} (7,600)	LQM S4UL
		2.5%	200	690	42	690 ^{dir} (30,000)	690 ^{dir} (10,000)	690 ^{dir} (8,300)	LQM S4UL
		6%	380	1,200	83	1,300 ^{dir} (34,000)	1,300 ^{dir} (10,000)	1,300 ^{dir} (9,300)	LQM S4UL

sol/vap = solubility/vapour limit (potentially use if free product identified, although highly conservative)
f=naphthalene is based on comparison of inhalation exposure with TDI(inhal) for localised effect
f = oral, dermal and inhalation exposures compared to oral HCV
dir = S4ULs based on threshold protective of direct skin contact with phenol)brackets long term exposure for illustration purposes)
g = derived based on 2,3,4-tetrachlorophenol

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