

Parkhill Avenue, Crumpsall

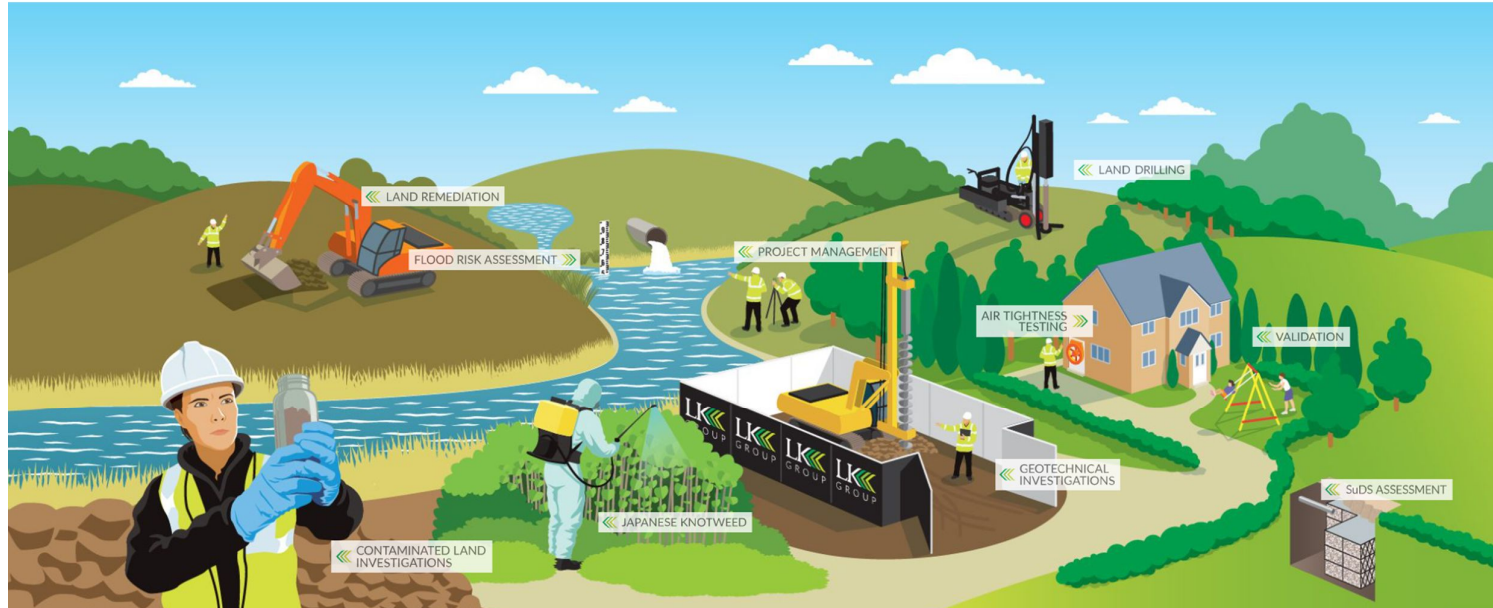
Phase 2 Geo-Environmental Investigation,
Risk Assessment and
Outline Remediation Strategy

Job Number: LKC 23 1405
Date: June 2024
Client: Great Places Housing Group



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EXECUTIVE SUMMARY

Site Details

Location	The site is located on land between Parkhill Avenue, Delaunays Road and Cleveland Road. Centred at approximate National Grid Reference 384950, 402730.
Area	3800m ² .
Topography	Flat area in the western corner of site (65mAOD) with a steep slope down to the east / south-east (54-57mAOD).
Current Site Use	Vacant land, heavily overgrown with trees and vegetation.
Proposed Development	Residential houses and apartments including soft landscaping and car parking.

Site Setting

Main Historical Features	Onsite: South / south-west area was developed as houses with gardens. The housing was demolished between 2006 and 2020. The northern area remained vacant (vegetated). Surrounding Area: Housing, reservoir (adj to east), chemical works, cotton mill, electrical cable manufacturing.
Geology / Hydrogeology	Superficial: Glacial Till (diamicton) / Secondary Undifferentiated Aquifer. Bedrock: Chester Pebble Beds Formation / Principal Aquifer.
Infilled Ground	No recorded landfills. Potentially infilled ground identified within 250m.
Site Reconnaissance	Site is accessed from Parkhill Avenue through locked double gates. The site consists of mature trees and overgrown vegetation. Japanese knotweed was noted in a number of areas across the site. Flat area in the western corner of site with a steep slope down to the east / south-east.
Recommendations	Site Investigation was recommended to further assess geo-environmental risk.

Ground Investigation Work Undertaken

Date of Investigation:	April to May 2024.
Intrusive Investigation Work Undertaken:	4no. window sample boreholes. Follow dynamic probing in WS104. 3no. mechanically excavated trial pits. 2no. cable percussion boreholes. Contamination and geotechnical testing. Gas monitoring. Groundwater monitoring.

Ground Conditions

Made Ground	Recorded in all boreholes to depths of 0.2-1.0mbgl. The made ground generally comprised gravelly sandy silt with frequent rootlets, occasional / rare brick, concrete, glass, plastic, timber, metal and ceramics.
Superficial	Horizons of natural cohesive and granular deposits of clay, silt, sand and gravel to the completion depths investigated (max. depth of 15.80mbgl).
Bedrock	Not encountered.
Groundwater	Not encountered.
Obstructions	Not encountered.

Geotechnical Assessment

Allowable Bearing Pressure	The natural strata returned low s_u values which are unsuitable for the application of shallow foundations. To be updated on receipt of geotechnical laboratory results.
Anticipated Foundation Type	Whilst a Ground Improvement solution is viable, low s_u values were obtained in pockets of the cohesive natural strata which may preclude this option, it is therefore considered that a piling solution will provide the most reliable and cost-effective option for the site. To be updated on receipt of geotechnical laboratory results.
Other Considerations	Consideration of effects of trees also needs to be considered. Temporary supports of excavations may be required. Detailed design should be carried out by structural engineer. Concrete Requirements DS1-AC-1s. A condition survey of the existing retaining wall forming the south-east boundary to Delaunays Road should be completed. The site slopes, from c.65m AOD in the west to c.54m AOD in the east and a slope stability assessment should be undertaken. To be updated on receipt of geotechnical laboratory results.

Contamination Risk Assessment

PL	Contaminant	Risk	Recommendations
1	PAHs	Moderate	Remediation required, subject to further investigation and assessment.
	Asbestos, metals, other inorganic / inorganic contaminants	Low	No remediation, subject to further investigation and assessment.
2	Volatile contaminants	Moderate / Low	No remediation, subject to further investigation and assessment.
3	Carbon dioxide	High	Gas protection measures, subject to further investigation and assessment.
3	Methane	Moderate / Low	No remediation, subject to further investigation and assessment.
4	PAHs, metals, other mobile contaminants	Low	No remediation, subject to further investigation and assessment.
5	Naphthalene and other organic contaminants	Moderate	Possible remediation, subject to further investigation and assessment and subject to proposed potable water pipe locations and depths.

PL	Recommendation (subject to further investigation and assessment)
1	Environmental cover system required in proposed soft landscaping and garden areas.
2	No remediation required.
3	Gas protection measures required.
4	No remediation required.
5	Potable water pipe assessment required.

Further Work Requirements
Final report (on completion of gas monitoring and receipt of geotechnical laboratory results).
Additional 2no. cable boreholes once enabling work undertaken to allow access.
Possible additional shallow soil samples to confirm the contamination risk and remediation requirements associated with PL1.
Slope stability assessment.
Waste disposal assessment.
Japanese Knotweed treatment work.
Build-Phase Remediation Strategy and Verification Plan.

TABLE OF CONTENTS

1.	INTRODUCTION	1
1.1.	Background	1
2.	PRELIMINARY RISK ASSESSMENT	2
2.1.	Summary of Site History, Environmental Settings and Site Reconnaissance	2
2.2.	Preliminary Geotechnical Constraints	2
2.3.	Conceptual Model	2
3.	GROUND INVESTIGATION	5
3.1.	Site Investigation Design and Methodology	5
3.2.	Well Installations	5
3.3.	Sampling Protocol	5
3.4.	In-situ Testing	8
3.5.	Gas Monitoring	8
4.	GROUND CONDITIONS	9
4.1.	Geology	9
4.2.	Groundwater	9
5.	GEOTECHNICAL ASSESSMENT	10
5.1.	Proposed Development	10
5.2.	Summary of Ground Conditions	10
5.3.	Site Preparation	10
5.4.	Foundation Conditions and Bearing Capacity	11
5.5.	Ground Floor Slabs	13
5.6.	Pavement Construction	14
5.7.	Drainage	14
5.8.	Concrete Durability	14
5.9.	Excavations	14
5.10.	Construction Activity and Inspection	15
6.	GENERIC RISK ASSESSMENT	16
6.1.	Introduction	16
6.2.	Soil Risk Assessment	16
6.3.	Gas Risk Assessment	18
6.4.	Controlled Water Assessment	19
6.5.	Potable Water Supply (Pollutant Linkage 5)	20
6.6.	Revised Contamination Conceptual Model	20
7.	SUMMARY CONCLUSIONS	22
7.1.	Ground Conditions	22
7.2.	Geotechnical	22
7.3.	Contamination Assessment	23
7.4.	Recommendations	23
7.5.	Further Work	24

FIGURES

Figure 1 – Site Location and Boundary Plan

Figure 2 – Proposed Development Plan

Figure 3 – Site Investigation Location Plan

APPENDICES

- Appendix A – Risk Matrix
- Appendix B – Profile Logs
- Appendix C – Certificates of Analysis (Soil)
- Appendix D – Certificates of Analysis (Geotechnical)
- Appendix E – Certificates of Analysis (Water)
- Appendix F – Gas Monitoring Results
- Appendix G – Generic Assessment Criteria Values
- Appendix H – References

1. Introduction

1.1. Background

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

The following work has previously been undertaken:

- Phase 1 Desk Study, undertaken by Sutcliffe (Ref: LG26934, dated August 2014).

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.

This is an interim report including all investigation work completed to date. A final report will be issued on completion of the geotechnical laboratory results, groundwater sampling and gas monitoring.

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

Location	The site is located on land between Parkhill Avenue, Delaunays Road and Cleveland Road. The site is approximately 3.3 miles northeast of Manchester City Centre. Centred at approximate National Grid Reference 384950, 402730.
Area	3,800m ² .
Topography	Flat area in the western corner of site (65mAOD) with a steep slope down to the east / south-east (54-57mAOD).
Current Site Use	Vacant land, heavily overgrown.
Proposed Development	Residential houses and apartments including soft landscaping and car parking.

Table 1-1: Summary of site details.

2. Preliminary Risk Assessment

As summary of Sutcliffe's Phase 1 Report (Ref: LG26934, dated August 2014) is included in the following section with an updated preliminary risk assessment.

2.1. Summary of Site History, Environmental Settings and Site Reconnaissance

Pertinent information has been summarised in Table 2-1.

Main Historical Features	Onsite: South / south-west area was developed as houses with gardens. The housing was demolished between 2006 and 2020. The northern area remained vacant (vegetated). Surrounding Area: Housing, reservoir (adj to east), chemical works, cotton mill, electrical cable manufacturing.
Geology / Hydrogeology	Artificial: None. Superficial: Glacial Till (diamicton) / Secondary Undifferentiated Aquifer. Bedrock: Chester Pebble Beds Formation / Principal Aquifer. The site is not within a Source Protection Zone. Nearby BGS logs: Made ground to 1.5m, firm light brown very silty very sandy CLAY with occasional lenses of sand and silt to 7.0-10.0mbgl.
Hydrology	Nearest surface water feature is the River Irk 42m north.
Infilled Ground	No recorded landfills. Potentially infilled ground identified within 250m.
Mining	Site is within coal mining reporting area but lies outside a Coal Mining Development High Risk Area.
Site Reconnaissance	Site is accessed from Parkhill Avenue through locked double gates. The site consists of mature trees and overgrown vegetation. Japanese knotweed was noted in a number of areas across the site. Flat area in the western corner of site with a steep slope down to the east / south-east.

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

2.2. Preliminary Geotechnical Constraints

Table 2-2 summarises the geotechnical constraints.

Coal Mining	The risk from shallow coal mining is considered to be low.
Slope Stability	Further assessment is required to confirm the instability risk.
Made Ground	Unknown depth and constituent of made ground across the site.
Superficial	Unknown strength of soils for foundation design.
Bedrock	Unknown depth to bedrock. Shallow bedrock not anticipated.
Groundwater	Unknown depth and variability of groundwater.
Plasticity	Plasticity of clay deposits should be confirmed.
Sulphate	Unknown sulphate content of the made ground and natural.
Road / Pavement Design	Unknown CBR values for footpath and road design should be calculated.

Table 2-2: Summary of geotechnical constraints.

2.3. Conceptual Model

The contamination conceptual model in the Sutcliffe's Phase 1 Report has been updated to be in line with LKC current risk assessment methodology (detailed below). Generic potential pollutant linkages are described along with an assessment of the risk based upon guidance on probabilities and consequences outlined in CIRIA C552¹.

In order to assess the potential risk for each pollutant linkage, an assessment of the magnitude of the potential consequence (severity) of the risk occurring and the magnitude of the probability (likelihood) of the risk occurring has been considered and classified. This is based on the guidance provided in CIRIA C552 and further details including a risk matrix is provided in Appendix A.

The probability is based on the site history, site reconnaissance, environmental setting, pathways, and receptors. Reasonable worst-case consequence has been assumed at this stage.

Where LKC identified a low to very low risk, targeted or low-density intrusive investigation work, a watching brief (during construction work) or no investigation work will be recommended. This will be dependent on the nature of the site and the proposed development.

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

The conceptual model is based on the future use of the site (post development), in line with proposed development scheme.

Due to the minor consequence associated with the phytotoxic effect to flora (i.e., loss of plants in a landscaping scheme), the overall risk for most sites will be very low to low. here soils contain significant concentrations of heavy metals, in general there will other pollutant linkages (i.e., the risk to human health) that will trigger the requirement for remediation (e.g., a clean environmental cover system). As such the risk to flora associated with phytotoxic contaminants will not be considered further.

The risk to buildings associated with elevated sulphate will be considered as part of the geotechnical assessment and will not be included in the contamination risk assessment.

PL	Contaminants of Concern (source)	Pathway	Receptor	Probability	Consequence	Risk
1	Made ground / former development (housing). PAHs, metals, asbestos, other organic / inorganic contaminants subject to made ground constituents.	Dermal contact. Inhalation of soil, fibres, and dust. Ingestion of soils, dust, home-grown produce, soil attached to home-grown produce. Windblown dust.	Future site users. Offsite receptors.	Low Likelihood	Medium	Moderate / Low
	Offsite sources – chemical works. PAHs, metals, other organic and inorganic contaminants.	Dermal contact. Inhalation of soil, fibres, and dust. Ingestion of soils, dust, home-grown produce, soil attached to home-grown produce. Windblown dust.	Future site users. Offsite receptors.	Unlikely	Medium	Low
2	Made ground / former development (housing), offsite sources (chemical works). Naphthalene and other volatile contaminants subject to made ground constituents and migration from chemical works.	Inhalation of vapours. Migration via permeable strata and preferential pathways.	Future site users. Offsite receptors.	Unlikely	Medium	Low
3	Hazardous / ground gas: methane, carbon dioxide from made ground and infilled land.	Migration via permeable strata and preferential pathways. Inhalation of gas. Explosion in confined spaces.	Future site users. Buildings. Offsite receptors.	Low Likelihood	Severe	Moderate
4	Made ground / former development (housing). PAHs, metals, other mobile contaminants subject to made ground constituents.	Surface run-off. Migration via permeable strata and preferential pathways. Perched waters migration.	Groundwater Surface water	Low Likelihood	Medium	Moderate / Low
5	Made ground / former development (housing), offsite sources (chemical works). Naphthalene and other organic contaminants subject to made ground constituents and migration from chemical works.	Permeation of pipes. Ingestion of tainted water supply.	Future site users. Water pipes.	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 in 29th April to 2nd May 2024 and comprised the following:

- 4no. window sample boreholes drilled to 5.45-6.43mbgl (WS101-WS104). Follow-on dynamic probing to 10.00mbgl in WS104.
- 2no. cable percussion boreholes drilled to 15.00-15.80mbgl (CP101-CP102).
- 3no. trial pits (using 5t tracked machine) excavated to 2.00mbgl (TP101-TP103).

All site investigation locations are shown in Figure 3.

Due to the slope of the site and heavy vegetation, the access was limited. Investigation locations targeted proposed buildings and to allow adequate assessment of ground conditions across the site where access permitted.

A further 2no. cable percussive boreholes were proposed in the north-east area of the site however were not completed due to access restrictions. It is recommended that these are completed once site enabling works have commenced to allow safe access.

Investigation work was carried out under the supervision of a Japanese Knotweed specialist to ensure that Japanese Knotweed was not spread across the site or off site.

All profile logs are provided in Appendix B and are in line with BS14688-1⁵ and BS5930⁶.

3.2. Well Installations

All window sample boreholes (WS101-WS104) and cable percussive borehole CP101 were installed with monitoring wells for gas and groundwater monitoring / sampling. Monitoring wells were installed in accordance with BS10175 and CIRIA C665⁷ and generally comprised approximately 1m plain pipe over a length of slotted pipe surrounded by pea gravel and sealed at the top with bentonite and concrete.

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 investigation⁸.

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 on-site monitoring was carried out in line CIRIA C665⁹ 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, sulphate, speciated PAH, asbestos screen, SOM.	5	A basic suite with a broad selection of contaminants where no significant evidence of contamination was identified.
Metals / metalloids, pH, sulphate, cyanide suite, TPHCWG, BTEX, MTBE, speciated PAHs, phenol, asbestos screen, SOM.	5	A more detailed suite to confirm the absence of contamination and to provide data for waste assessment.
Waste Acceptance Criteria (WAC)	3	Samples of representative material which may be earmarked for disposal.

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 and sent to Murray Rix Laboratories for geotechnical testing.

Many of the tests are UKAS accredited and further details are given in the laboratory report presented in Appendix D (to be included in final report). Table 3-2 shows the geotechnical testing undertaken.

Testing	No. Samples
pH and water-soluble sulphate	(see Table 3-2)
Atterberg Limits (plasticity testing)	5
Shear box	1
Particle Size Distribution (PSD) - wet sieve	5
Particle Size Distribution (PSD) - sedimentation	1

Table 3-2: Summary of Geotechnical Testing Undertaken.

3.3.3. Water Sampling

To establish the condition of groundwater LKC undertook 3no. groundwater samples.

Sampling was carried out in accordance with BS5930¹⁰ and BS5667-11¹¹.

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 BS10175¹² 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.

Testing	No. Samples	Justification
Metals / metalloids, pH, sulphate, cyanide suite, TPHCWG, BTEX, MTBE, speciated PAHs, phenol, and hardness.	3	Detailed suite undertaken across the site to confirm the absence of contamination.

Table 3-3: 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 and cable percussion boreholes at approximately 1m intervals.
- Shear vane tests / pocket penetrometer tests (giving undrained shear strength) were performed within cohesive strata.

The results are provided within Appendix B.

3.5. Gas Monitoring

All the installed boreholes are currently being monitored for gas. To date, two gas monitoring visits have been undertaken. A further four visits are proposed.

Monitoring is being undertaken using a Geotechnical Instruments GA5000 in accordance with the monitoring protocol outlined in CIRIA C665¹⁴ (flow rate measured first). The monitoring will aim to be 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 to date, 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 in all boreholes to depths of 0.2-1.0mbgl. The made ground generally comprised gravelly sandy silt with frequent rootlets, occasional / rare brick, concrete, glass, plastic, timber, metal and ceramics.

4.1.2. Natural Strata

Superficial strata comprised horizons of natural cohesive and granular superficial deposits of clay, silt, sand and gravel to the completion depths investigated (maximum depth of 15.80mbgl (CP102)).

4.1.3. Contamination

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

There was no visual / olfactory evidence of hydrocarbons or volatile contaminants in any locations. The PID recorded a maximum of 1.0ppm TVOC in the samples.

4.1.4. Obstructions

No obstructions were identified within any investigation location.

4.2. Groundwater

4.2.1. Groundwater Levels

No groundwater strikes were recorded during the investigation in trial pits and boreholes.

Groundwater monitoring within the borehole wells has been undertaken on two occasions to date. This data is provided in Appendix F. Monitoring levels were recorded between 3.1mbgl and 3.39mbgl in WS103-WS104 and at 7.2-7.24mbgl in CP101. No groundwater was encountered in WS101 and WS102.

4.2.2. Contamination

No evidence of contamination was identified in the groundwater during investigation work or monitoring. No free phase hydrocarbons were detected.

5. Geotechnical Assessment

5.1. Proposed Development

It is understood that the proposed development will comprise low rise residential housing and apartments with associated landscaping and infrastructure. Details of the proposed loadings are not known and therefore a line loading of 75kN/m has been assumed for preliminary assessment purposes only.

The finished ground levels have not been provided and it is therefore anticipated that they will not vary significantly from current levels. However, should the development proposals or finished levels be altered then the comments/recommendations in this section may require revising.

The depths of any underground engineering works (sewers etc.) are unknown and therefore have not been considered in the following assessment. Any such works should be designed so as not to influence, or compromise, proposed or existing foundations or ground stability.

It is anticipated that some enabling works and retaining structures may be required to create level developable platforms.

Given the nature of the proposed development the structure meets the criteria of Geotechnical Category 2 of Eurocode 7²⁰.

5.2. Summary of Ground Conditions

Ground conditions identified at the site are detailed in Section 4.1, and typically comprises made ground up to 1.00mbgl over horizons of natural cohesive and granular superficial deposits of clay, silt, sand and gravel to the completion depths investigated (maximum depth of 15.80mbgl (CP102)).

5.3. Site Preparation

The site should be cleared and any vegetation below areas of proposed development stripped in accordance with Series 200 of the Specification for Highway Works²¹. This should include:

- Roots present below the footprint of proposed structures and infrastructure should be grubbed out and the resulting void infilled with suitable compacted engineered fill.
- Redundant services should be sealed off and grubbed out and replaced with suitable compacted engineered fill; and,
- Buried structures and old foundations may be encountered on site from terrace housing identified in the Phase I PRA (Curtins Report). These should be excavated from below the proposed development footprint with the resulting void backfilled.

The near surface soils may potentially be disturbed by weathering and site traffic. Precautions should be taken to avoid this, as excessive disturbance may result in more onerous floor slab design, road cap thickness and increased amount of site disposal etc.

A brick retaining wall forms the south-east boundary with Delauneys Road, reducing in height as it heads north-east to the junction with Cleveland Road. The bricks visually appear in good condition, however, vegetation is overgrowing the wall and in places

obscures the wall. Some of the coping stones are loose or missing and there does not appear to be any signs of drainage/weep holes visible within the wall. A condition survey of the wall should be undertaken prior to starting the development.

The site slopes downwards from south-west (c.65m AOD) to north-east (c.54m AOD) and an assessment of the slope stability has not been undertaken as part of this study. Trees were noted to have been affected by geotropism, indicative of slope movement and it is recommended that further consideration is given to the stability of the slope.

5.4. Foundation Conditions and Bearing Capacity

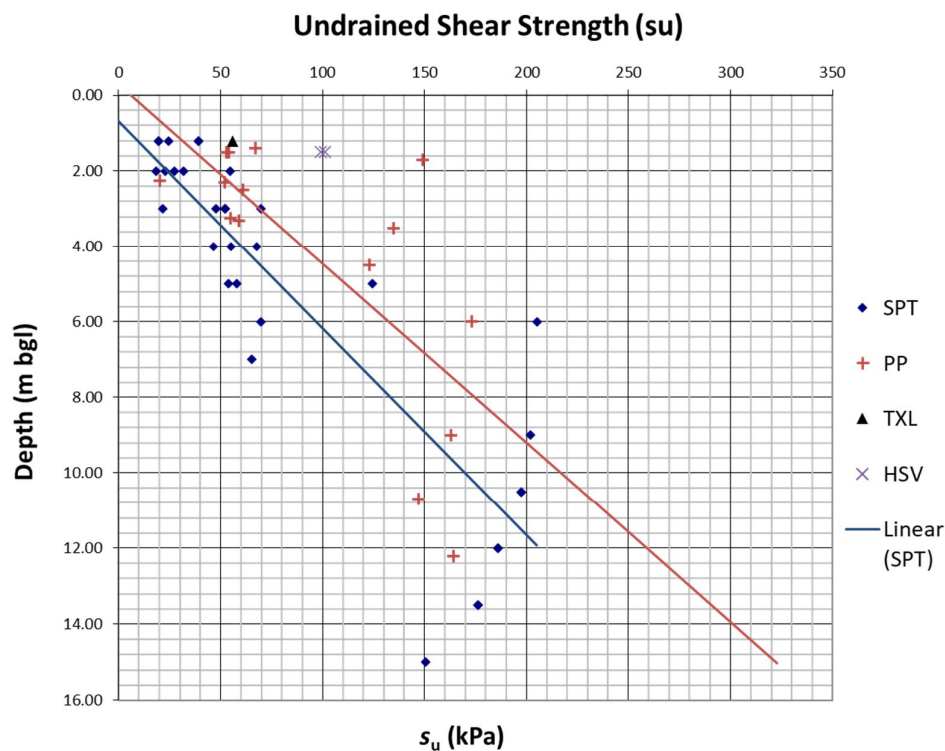
5.4.1. General

It is considered that the Made Ground is not suitable for a founding material due to the inherent variability of the material. The variable interbedded nature of the underlying cohesive and granular superficial deposits will further preclude the application of shallow foundations due to the potential for differential settlements to occur. Foundation options are therefore:

- Conventional strip footings on vibro granular columns; or,
- Deeper pile foundations.

These options are discussed below:

Strength of the natural cohesive material has been assessed using in-situ testing by SPT, Hand Shear Vane (HSV) and Pocket Penetrometer (PP) along with laboratory testing by quick undrained Triaxial, to obtain the undrained shear strength (s_u) of the cohesive material. The results of the testing have been plotted against depth as is shown in Graph 5-1 below:

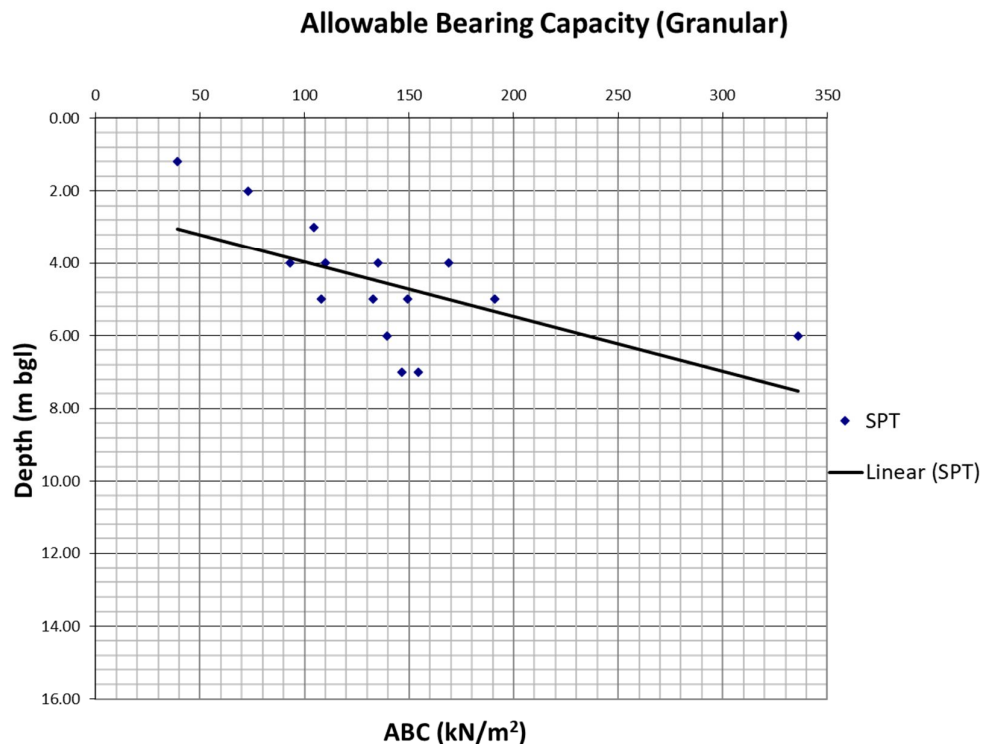


Graph 5-1: Summary of s_u vs depth from in-situ SPT, HSV and PP testing along with laboratory TXL.

From Graph 5-1 it can be seen that the strength of the cohesive deposits is initially low, typically between 18 and 67kPa between c. 1.20 – 3.00mbgl, increasing with depth below 4.00mbgl from 47 to 205kPa.

A conservative s_u of 50kPa is assigned to the cohesive material from a depth of c. 4mbgl for the natural cohesive superficial deposits.

The natural granular material encountered at various depths between 0.50m and >15.80mbgl in the exploratory holes, has been assessed using in-situ testing by SPT to obtain the Allowable Bearing Capacity (ABC) of the granular strata although no SPTs were carried out in the granular strata below 15.60m in CP102. The results of the testing have been plotted against depth and are shown in Graph 5-2 below.



Graph 5-2: Summary of ABC Vs. Depth from In-Situ SPT.

An ABC of between 39 and 336kN/m² is obtained at depths of between 1.20m and 7.00mbgl, ranging from loose to dense (averaging medium dense), with a conservative ABC of 100kN/m² from 4.00m onwards, equating to an average angle of internal friction (ϕ') of 31°.

Groundwater was not recorded in any of the exploratory holes during the site investigation works. Subsequent monitoring for presence of groundwater is ongoing and will be reported upon completion. The presence of the groundwater has the potential to reduce the bearing capacity of a granular strata by as much as 50%. The effect that the groundwater may have should also be considered when assessing the bulb of pressure exerted by foundations.

5.4.2. Plasticity

Clay samples were subjected to Atterberg Limits (plasticity) and Moisture Content testing. Results are provided in Appendix D (to be included in final report).

The plasticity will be confirmed on receipt of the laboratory results.

5.4.3. Ground Improvement

The use of ground improvement techniques such as vibro granular columns will allow shallow foundations to be utilised with the made ground and remove variability between the natural cohesive and granular strata. The vibro granular columns should provide an Allowable Bearing Capacity of around 150kN/m². Specialist advice should be sought from a suitably experienced contractor regarding Allowable Bearing Capacity and settlements.

It should be noted that vibro stone columns are not suitable in clays with a Plasticity Index greater than 40% or with an undrained shear strength of less than 30kPa. Results of PP tests indicate soft pockets at shallow depths within the Clay (<30kPa) may prevent the use of this technique. The plasticity will be confirmed in the final report.

It should be noted that the stone columns provide a pathway for gas and vapour migration, and additional mitigation measures may be required to help prevent the ingress into properties.

5.4.4. Piled Foundations

Consideration may be given to the use of piled foundations to transfer loadings through poor ground conditions and bear within the underlying stiff and very stiff natural clays encountered from depths of between 7.70m and 8.00mbgl.

Up to 1.00m of made ground has been recorded within the exploratory holes and consideration must be given to the potential for negative skin friction to influence the piles.

Pile design should be undertaken by a specialist contractor to allow them to reduce the Factor of Safety based on their extensive pile testing data.

Should a pile foundation solution be the preferred option, then warranty providers may require further information on ground conditions to a minimum of 5m below the base of the pile.

Casing is required while drilling the piles due to the presence of granular strata. This will help minimise ground disturbance and prevent collapse into the borehole causing areas of weakness.

5.4.5. Foundation Recommendations

Whilst a Ground Improvement solution is viable, low s_u values were obtained in pockets of the cohesive made ground and natural strata which may preclude this option, it is therefore considered that a piling solution will provide the most reliable and cost-effective option for the site.

5.5. Ground Floor Slabs

Warranty providers such as NHBC will require suspended floor slabs where Made Ground is in excess of 600mm. Due to the presence of varying thickness' upto 1.00m

depth of Made Ground across the site, it is considered that a suspended floor slab will be required for the proposed low rise residential houses.

In the location of the proposed apartment block, suitable preparation of the sub-grade, by a combination of excavation and re-compaction, a ground bearing floor slab should prove suitable for the proposed buildings.

If vibro granular columns are used for the foundations, then this could be extended to the floor slab to improve formation conditions and reduce the risk of damage from settlement. However, it may be more reliable to opt for suspended floor slabs.

Should a piled foundation solution be selected then a piled structure will generally have a suspended or piled floor due to potential differential settlement between the floor and the shell.

5.6. Pavement Construction

Topsoil is not suitable for use as a sub-grade. Untreated made ground is considered unsuitable as a sub-grade due to its potential variability and potentially low strength/high compressibility. It should be removed to a depth of 0.5m below formation level and sorted to remove any unsuitable or deleterious materials. The sub formation should be rolled, and suitable excavated material can then be replaced, up to formation level, in fully compacted thin layers. Any deficit should be made up with suitable imported fill compacted as above. Following this treatment an overall design CBR of 2-5% should be available, although this will require confirmation through in-situ CBR tests.

Frost susceptibility will be confirmed on receipt of the plasticity results.

Following excavation, the sub formation should be proof rolled and any soft material inspected and removed.

5.7. Drainage

Due to the current sloping ground and the poor permeability of the soils along with the presence of up to 1.00m thickness of made ground across the site, conventional soakaway drainage is unlikely to be suitable.

5.8. Concrete Durability

Based upon the results of the chemical analyses (Appendix D), subsurface concrete can be designed in accordance with Design Sulphate Class DS-1, Aggressive Chemical Environment for Concrete Classification (ACEC) AC-1s in accordance with the recommendations provided in BRE Special Digest 1 (2005).

5.9. Excavations

The shallow superficial deposits included made ground and granular strata. The short- and long-term stability of near vertically sided excavations can therefore not be guaranteed and random and sudden instability within these soils should be anticipated.

Due to the variability of the made ground all excavations should be supported or battered back in accordance with guidance contained in CIRIA R97²².

5.10. Construction Activity and Inspection

The following activities and inspections should be incorporated into the site works:

- Due to the variability of the soils at the site it is recommended that sufficient allowance is made for the inspection of formation and sub formations to foundations and pavement construction.
- Excavations where access is required should be subject to a risk assessment from a competent person and where appropriate mitigation measures such as benching back the sides or use of support systems in accordance with CIRIA R97²³ utilised.
- De-watering may be required, especially following periods of heavy rainfall. Removal of surface water and water within trenches should be possible with conventional sump pumping. Discharge of any water should be agreed with the relevant regulatory body and be undertaken under a trade effluent discharge, where required. Measures to remove silt and suspended solids may be required and consideration should be given to provision of space for settling tanks or an attenuation pond.
- Where access to confined spaces is required appropriate mitigation measures should be addressed within the Construction Stage Health and Safety Plan. Particular account should be taken of the gas results.

The presence of potential contamination and mitigation measures should be addressed as part of the Construction Stage Health and Safety Plan and should include measures to design out the risks, reduce their impact and finally the use of Personnel Protective Equipment (PPE).

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 (LCRM²⁴). 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)^{25, 26}.
- LQM Suitable 4 Use Levels (S4ULs)^{27, 28, 29, 30}.

The proposed development is for residential houses with gardens and apartments, therefore the assessment criteria for residential with plant uptake has been used.

All criteria have been generated using the CLEA V1.06 model³¹ based either on 1%, 2.5% and 6% Soil Organic matter (SOM). Results will be compared to the nearest appropriate SOM.

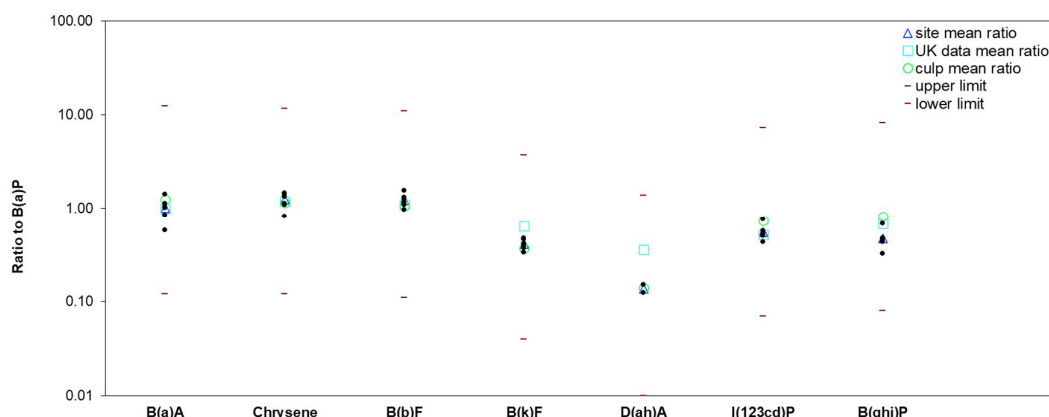
A summary of the generic assessment criteria used in this assessment is provided in Appendix G.

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^{32,33} and naphthalene the most volatile and soluble³⁴. 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 negligible³⁵. For B(a)P to be used as a surrogate marker it should follow the profile described by the HPA (2008)³⁶ 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.*³⁷, 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 9 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.

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.

Sample Location / Depth (mbgl)	Contaminant	Total No. of Samples Tested	Criteria	Sample Result > Criteria
TP102 / 0.00-0.50	Benzo(a)pyrene	10	5.0	11.50

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.

No asbestos was identified in any soil samples analysed.

6.2.3. Direct Contact Risk – Pollutant Linkage 1

Elevated PAHs have been identified in the made ground in TP102 (0-0.5mbgl). The made ground in this location was described as gravelly sandy silt with occasional brick, concrete, rare glass, plastic, metal and ceramic fragments. The made ground in TP102 is considered to be typical of the made ground across the site.

Given the similar nature of the made ground, at this stage, there is considered to be a potential site wide risk of PAH contamination within the made ground (recorded to depths of 0.20-1.00mbgl).

At the concentrations identified, the contaminants are considered to pose a potential risk to future site users (residents) in gardens and soft landscaped areas, where made ground may be exposed / in contact with homegrown produce. The principal pathways are the ingestion pathways (soil, dust, and homegrown produce) and dermal contact.

The probability of PAH contamination affecting site users is likely. With a medium consequence, the risk is considered to be moderate, and remediation is recommended. This should be updated following completion of the proposed investigation work.

Further investigation of the shallow made ground, particularly in the areas of proposed gardens and proposed soft landscaping, may allow the assessment to be updated and areas requiring remediation to be reduced / zoned.

No further contamination was identified (metals, asbestos, other inorganic / organic contaminants); therefore, the probability of these contaminants affecting site users is considered to be unlikely. With a moderate consequence, the risk is low.

This risk assessment should be updated following the completion of the proposed investigation work.

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 significant TVOCs. Confirmatory soil analysis did not detect any VOCs / SVOCs above assessment criteria.

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.

This risk assessment should be updated following the completion of the proposed investigation work.

6.3. Gas Risk Assessment

2no. gas monitoring visits have been undertaken on the study site. Gas monitoring results in full are presented in Appendix F and summarised in Table 6-2. Following guidance set out in CIRIA C665⁴² and BS8485⁴³ 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.

Borehole Ref.	Visit	Peak CH ₄ (%v/v)	Peak CO ₂ (%v/v)	Min O ₂ (%v/v)	Flow (l/h)	Groundwater Level (mbgl)	Pressure (mb)	Prev 24hr Pressure Trend
CP101	1	<0.1	1.9	17.5	<0.1	7.2	1015	Steady
	2	0.1	5.6	16.1	<0.1	7.24	996	Falling
WS101	1	<0.1	1.6	18.3	<0.1	Dry	1015	Steady
	2	0.1	2.7	18.7	<0.1	Dry	996	Falling
WS102	1	<0.1	2.8	17.3	<0.1	Dry	1016	Steady
	2	<0.1	6.6	15.2	<0.1	Dry	996	Falling
WS103	1	<0.1	6.6	11.2	<0.1	3.18	1016	Steady
	2	0.1	6.4	11	<0.1	3.28	996	Falling
WS104	1	<0.1	3.4	13.3	<0.1	3.1	1017	Steady
	2	0.1	11	4.8	<0.1	3.39	996	Falling

Table 6-2: Gas Monitoring Assessment.

Gas Screening Value

In accordance with CIRIA C665⁴⁴, 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 (All boreholes) has also been included (worst case values across the site).

Boreholes	Max GSV (l/hr)	CS	TL
CP101	0.0056	CS1	Green
WS101	0.0027	CS1	Green
WS102	0.0066	CS1	Green
WS103	0.0066	CS1	Green
WS104	0.011	CS1	Green
All boreholes	0.0001 (CH ₄) 0.011 (CO ₂)	CS1	Green

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

Notes:

CS = Characteristic Situation; TL= Traffic Light.

In addition, in accordance with CIRIA C665⁴⁵, 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.

Carbon dioxide was recorded above 6% in the majority of boreholes with a maximum concentration of 11%v/v.

At this stage (based on 2no. visits), LKC consider that the site should be treated as CS2.

The gas can potentially migrate into buildings, accumulate in confined spaces, and cause explosions (methane) and asphyxiation. The gas risk is principally from carbon dioxide. LKC consider the probability of carbon dioxide affecting site users as likely. Assuming a severe consequence, there is a high risk and remediation is required associated with the carbon dioxide.

Minimal methane was recorded; therefore, LKC consider the probability of methane gas affecting site users and buildings as unlikely. Assuming a severe consequence, there is a moderate / low risk. Given the minimal methane concentrations and flow, no remediation is required associated with methane.

This risk assessment should be updated on completion of the gas monitoring.

6.4. Controlled Water Assessment

LKC considers the River Irk and the Principal Aquifer as the primary receptors.

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 Standards⁴⁶ and updated Water Framework Directive⁴⁷ for Annual Average / Maximum Allowable Concentration Environmental Quality Standards (AA-MAC-EQS) for priority substances (surface water risk) and 2016 private water supply standards (UKDWS potable)⁴⁸.
- 2001 Environment Agency Values for Environmental Quality Standards (EQS) and UK Drinking Water Standard (UKDWS)⁴⁹.
- Resource Protection Values (RPVs)⁵⁰.

With regards to hydrocarbon mixtures (TPHCWG) for UKDWS, LKC will use the CL:AIRE guidance on petroleum hydrocarbons in groundwater⁵¹ based on WHO guidelines.

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 River Irk and Principal Aquifer as unlikely. Given the medium consequence, a low risk is anticipated (Pollutant Linkage 4) and no remediation is required.

This risk assessment should be updated following the completion of the proposed investigation work.

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.

Elevated TPH EC10-16 has been identified in TP103 (0.00-1.00mbgl). Made ground was relatively consistent across the site; therefore, it is considered possible that low-level TPHs could be present in other area of the site which could pose a risk to potable water pipes. However, given the depth of made ground is relatively shallow across the majority of the site, it is assumed that potable water pipes will be installed in natural strata rather than made ground.

At this stage, the probability of organic contaminants affecting potable water pipes is a low likelihood. Given the consequence is considered to be moderate, the risk (Pollutant Linkage 5) is anticipated to be low / moderate and remediation may be required subject to the depth and location of proposed pipelines.

This risk assessment should be updated following the completion of the proposed investigation work.

Once details of the pipeline location and depths are known a UU Water Pipe Risk Assessment in line with the utility provider should be undertaken to confirm the most appropriate pipework for potable water.

6.6. Revised Contamination Conceptual Model

The preliminary contamination conceptual model (Table 2-3) 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	Contaminants	Pathway	Receptor	Probability	Consequence	Risk	Recommendations
1	PAHs	Dermal contact. Inhalation of soil, fibres, and dust. Ingestion of soils, dust, home-grown produce, soil attached to home-grown produce. Windblown dust.	Future site users. Offsite receptors.	Likely	Medium	Moderate	Remediation required, subject to further investigation and assessment.
	Metals, asbestos, other organic / inorganic contaminants	Dermal contact. Inhalation of soil, fibres, and dust. Ingestion of soils, dust, home-grown produce, soil attached to home-grown produce. Windblown dust.	Future site users. Offsite receptors.	Unlikely	Medium	Low	No remediation, subject to further investigation and assessment.
2	Volatile Contaminants	Inhalation of vapours. Migration via permeable strata and preferential pathways.	Future site users. Offsite receptors.	Unlikely	Medium	Low	No remediation, subject to further investigation and assessment.
3	Carbon dioxide	Migration via permeable strata and preferential pathways. Inhalation of gas.	Future site users. Buildings. Offsite receptors.	Likely	Severe	High	Gas protection measures, subject to further investigation and assessment.
	Methane	Migration via permeable strata and preferential pathways. Inhalation of gas. Explosion in confined spaces.	Future site users. Buildings. Offsite receptors.	Unlikely	Severe	Moderate / Low	No remediation, subject to further investigation and assessment.
4	PAHs, metals, other mobile contaminants	Surface run-off. Migration via permeable strata and preferential pathways. Perched waters migration.	Groundwater. Surface water.	Unlikely	Medium	Low	No remediation, subject to further investigation and assessment.
5	Naphthalene and other organic contaminants	Permeation of pipes. Ingestion of tainted water supply.	Future site users. Water pipes.	Low Likelihood	Medium	Moderate / Low	Possible remediation, subject to further investigation and assessment and subject to proposed potable water pipe locations and depths.

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	Recorded in all boreholes to depths of 0.2-1.0mbgl. The made ground generally comprised gravelly sandy silt with frequent rootlets, occasional / rare brick, concrete, glass, plastic, timber, metal and ceramics.
Superficial	Horizons of natural cohesive and granular deposits of clay, silt, sand and gravel to the completion depths investigated (max. depth of 15.80mbgl).
Bedrock	Not encountered.
Groundwater	Not encountered.
Obstructions	Not encountered.

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.

Allowable Bearing Pressure	The natural cohesive strata returned s_u values of between 18 and 67kPa between 1.20-3.00mbgl, with a conservative s_u of 50kPa being returned from 4.00m. The granular strata returned an ABC of between 39 and 336kN/m ² at depths of between 1.20m and 7.00mbgl, ranging from Loose to Dense (averaging Medium Dense), with a conservative ABC of 100kN/m ² from 4.00m onwards, equating to an average angle of internal friction (ϕ') of 31°.
Anticipated Foundation Type	Whilst a Ground Improvement solution is viable, low s_u values were obtained in pockets of the cohesive natural strata which may preclude this option, it is therefore considered that a piling solution will provide the most reliable and cost-effective option for the site.
Shallow Groundwater	Shallow groundwater was not identified on the site during the intrusive investigation works.
Concrete Requirements	Based on BRE Digest 2005 ⁵² – DS-1 AC-1s recommended.
Services	Consideration to the presence of services running through the site. Services may need to be re-routed.
Temporary support of excavation	The exploratory holes included granular strata. The short- and long-term stability of near vertically sided excavations can therefore not be guaranteed and random and sudden instability within these soils should be anticipated. All excavations should be supported or battered back in accordance with guidance contained in CIRIA R97.
Plasticity	To be confirmed on receipt of the geotechnical laboratory results.
Road / Pavement Design	Topsoil is not suitable for use as a sub-grade. Untreated made ground is considered unsuitable as a sub-grade due to its potential variability and potentially low strength/high compressibility. It should be removed to a depth of 0.5m below formation level and sorted to remove any unsuitable or deleterious materials. The sub formation should be rolled, and suitable excavated material can then be replaced, up to formation level, in fully compacted thin layers. Any deficit should be made up with suitable imported fill compacted as above. Following this treatment an overall design CBR of 2-5% should be available, although this will require confirmation through in-situ CBR tests.
Retaining Walls	A brick retaining wall forms the south-east boundary with Delaunays Road, reducing in height as it heads north-east to the junction with Cleveland Road. The bricks visually appear in good condition however vegetation is

	overgrowing the wall and in places obscures the wall. Some of the coping stones are loose or missing and there does not appear to be any signs of drainage/weep holes visible within the wall. A condition survey of the wall should be undertaken prior to starting the development.
Slope Stability	An assessment of the slope stability has not been undertaken as part of this study. Trees were noted to have been affected by geotropism, indicative of slope movement and it is recommended that further consideration is given to the stability of the slope.

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	PAHs	Moderate	Remediation required, subject to further investigation and assessment.
	Asbestos, metals, other inorganic / inorganic contaminants	Low	No remediation, subject to further investigation and assessment.
2	Volatile contaminants	Moderate / Low	No remediation, subject to further investigation and assessment.
3	Carbon dioxide	High	Gas protection measures, subject to further investigation and assessment.
3	Methane	Moderate / Low	No remediation, subject to further investigation and assessment.
4	PAHs, metals, other mobile contaminants	Low	No remediation, subject to further investigation and assessment.
5	Naphthalene and other organic contaminants	Moderate	Possible remediation, subject to further investigation and assessment and subject to proposed potable water pipe locations and depths.

Table 7-3: Summary Risk Table.

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

7.4. Recommendations

The recommendations provided below are considered appropriate for the site based on the site investigation work undertaken to date. The recommendations will be updated once all investigation work has been completed.

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 7-4.

PL	Recommendation
1	Environmental cover system required in proposed soft landscaping and garden areas.
2	No remediation required.
3	Gas protection measures required.
4	No remediation required.
5	Potable water pipe assessment required.

Table 7-4: 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 verification⁵³. This should be produced once details of design, contractors and installation are known.

All the remediation and validation work should be documented in a Site Completion Report. The Completion Report will be provided to satisfy the outstanding contaminated land planning condition.

7.5. Further Work

Only 2 out of 6 gas monitoring visits have been completed to date. A final report will be issued once the gas monitoring has been completed.

An additional 2no. cable percussion boreholes for foundation design are proposed once enabling works have been undertaken to allow access for the rig.

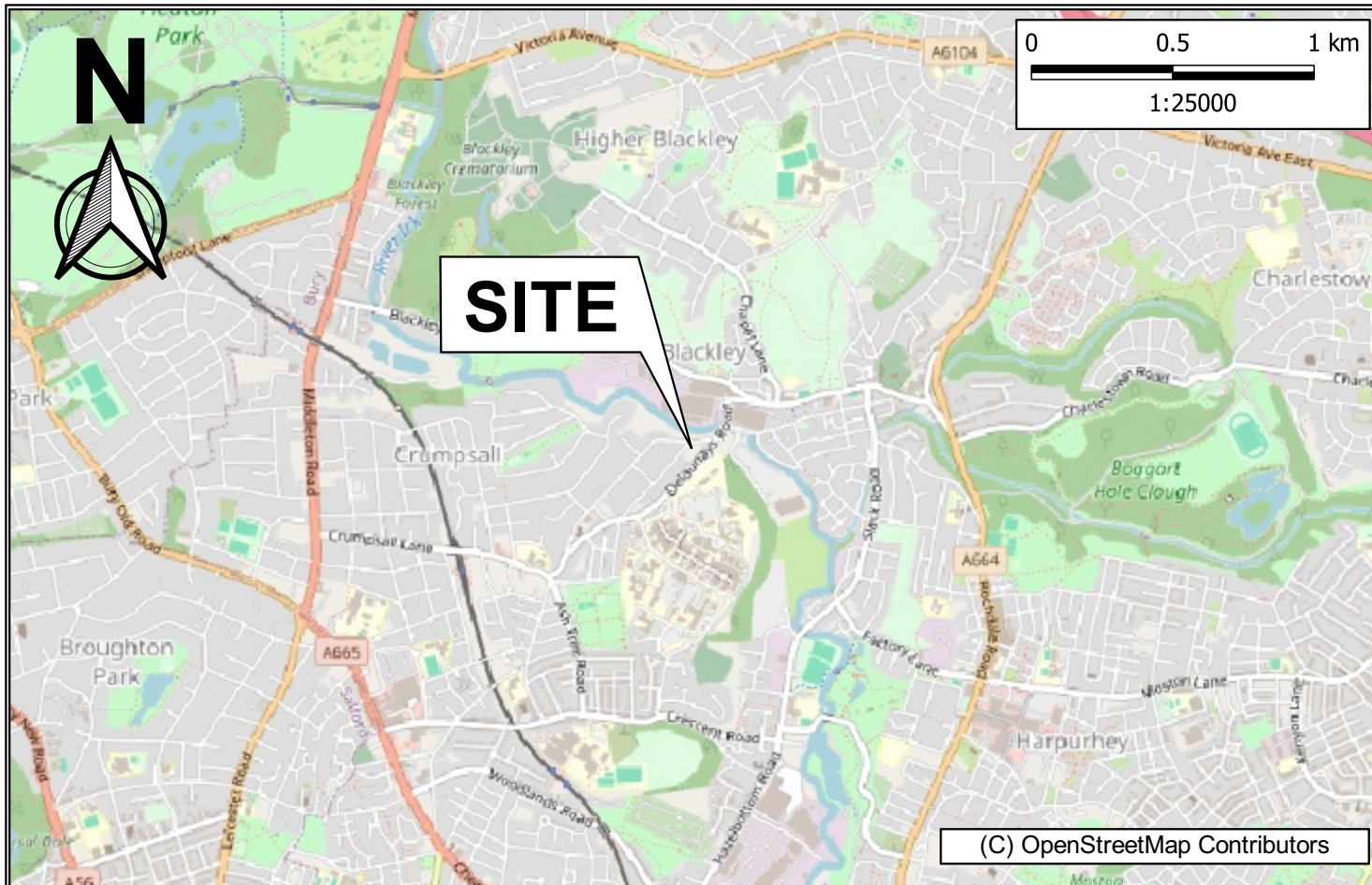
It may also be advisable to carry out additional shallow soil samples to confirm the contamination risk and remediation requirements associated with PL1.

It is recommended that a slope stability assessment is undertaken.

Once details of the cut and fill and requirements for removal of soils are known a waste disposal assessment can be undertaken.

Japanese Knotweed has been identified on site which will require suitable treatment and eradication prior to the development of the site.

Figures



Client: <div>Great Places Housing Group</div>				Title: <div>Site Location & Boundary Plan</div>		<div><div>LK</div><div>CONSULT</div></div>	
Site: <div>Parkhill Avenue, Crumpsall</div>				Scale (see scale bar): <div>1:25,000 & 1:2,000 @ A4</div>			
Job No.: <div>LKC 23 1405</div>	Drawn By: <div>CB</div>	Checked By: <div>CB</div>	Drawn: <div>June 2024</div>	Figure: <div>1</div>	Revision:		



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.



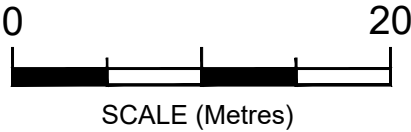
Client:
Great Places Housing Group

Site:
Park Hill Avenue, Crumpsall

Title:
Proposed Development Plan

Job No.:	Scale (See Scale Bar):	Figure:	Revision:
LKC 23 1405	See Scale Bar	2	
Drawn By:	Checked By:	Drawn:	
AC	CB	Jun 2024	

Extract From: Triangle Architects
Drawing Ref: Proposed Site Layout OPTION 3, No.SK06 (September 2023)





KEY

- Site Boundary
- Window Sample Borehole (WS)
- Trial Pit (TP)
- Cable Percussive Borehole (CP)

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.



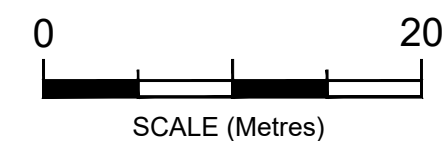
Client:
Great Places Housing Group

Site:
Park Hill Avenue, Crumpsall

Title:
Site Investigation Location Plan

Job No.: LKC 23 1405	Scale (See Scale Bar): See Scale Bar	Figure: 3	Revision:
Drawn By: AC	Checked By: LD	Drawn: May 2024	

Extract From: Triangle Architects
Drawing Ref: Proposed Site Layout OPTION 3, No.SK06 (September 2023)



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 552⁵⁴. 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.

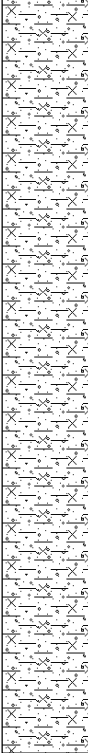
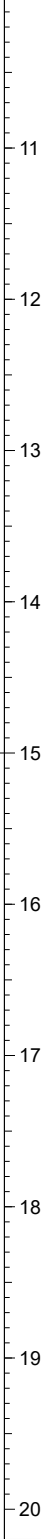
Where a low risk is identified, some form of remediation may be required depending on the pollutant linkage, the type and concentration of contaminants present and the proposed development.

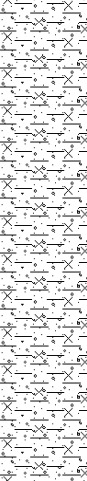
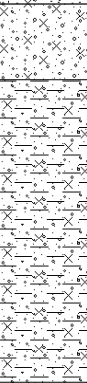
Where there is a moderate/low risk is identified, an assessment will be undertaken to establish what category the pollutant linkage will fall into.

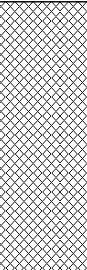
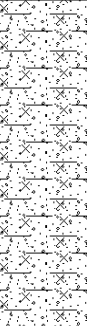
Where LKC identifies a moderate or higher risk, remediation or further investigation work is recommended.

Appendix B – Profile Logs

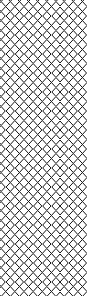
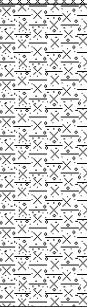
		<h1>Cable Percussion Drilling Log</h1>				Location Number: CP101		
Project Name: Parkhill Avenue, Crumpsall			Client: Great Places Housing Group			Date: 01/05/2024		
Project ID:LKC 23 1405			Contractor: VC Drilling Ltd			Co-ords: E384911.42 N402722.23		
Equipment: Cable Percussive Drilling Rig / Shell and Auger Rig			Level 64.86m AOD	Logged By LGD	Scale 1:50	Page Number Sheet 1 of 2		
Depth (m)	Samples / Tests	Depth (m)	Legend	Stratum Description				Level (m)
0.00 - 0.40 0.00 - 0.50 0.00 - 0.50 0.00 - 0.50 0.40 - 1.00 0.50 - 1.00 0.50 - 1.00 0.50 - 1.00 1.20 - 1.65 1.20 - 1.65 1.20	B D ES PID=0.2ppm B D ES PID=0.1ppm B D N=5 (1,1/1,1,2,1)	0.50		MADE GROUND: Dark brown gravelly sandy SILT with frequent rootlets, occasional brick and concrete and rare glass, ceramic fragments. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded comprising sandstone.				64.36
0.40 - 1.00 0.50 - 1.00 0.50 - 1.00 0.50 - 1.00 1.20 - 1.65 1.20 - 1.65 1.20	B D ES PID=0.1ppm B D N=7 (1,2/1,2,1,3)	1.00		Light brown slightly gravelly silty SAND with rare coal fragments and clay pockets. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded comprising sandstone.			1	63.86
2.00 - 2.45 2.00 - 2.45 2.00	B D N=7 (1,2/1,2,1,3)						2	
3.00 - 3.45 3.00	D N=12 (1,2/2,3,3,4)	3.30		Medium dense slightly gravelly silty SAND. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded comprising sandstone.			3	61.56
4.00 - 4.45 4.00 - 4.45 4.00	B D N=20 (3,4/5,5,5,5)						4	
5.00 - 5.45 5.00	D N=23 (3,4/5,6,6,6)	5.80					5	
6.00 - 6.45 6.00	B N=41 (7,10/11,12,10,8)			Medium dense light brown sandy silty GRAVEL. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded comprising sandstone.			6	59.06
7.00 - 7.45 7.00	D N=19 (3,4/4,5,5,5)	7.70					7	
9.00 - 9.45 9.00 9.00	D PP=163.3kPa N=50 (8,10/50 for 235mm)			Stiff to very stiff consistency high strength brown slightly gravelly sandy silty CLAY. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded comprising mudstone.			8	57.16
							9	
							10	
Hole Diameter		Casing Diameter		Water Strike Details		Chiselling		
Depth Base (m)	Diameter (mm)	Depth Base (m)	Diameter (mm)	Time Elapsed (mins)	Depth Water (m)	Depth Top (m)	Depth Base (m)	Duration (hh:mm)
		9.00	150					
Remarks: Hand excavated trial pit to 1.20mbgl with follow on cable percussive to 15.00mbgl. Borehole dry and stable.								

		<h1>Cable Percussion Drilling Log</h1>				Location Number: CP101	
Project Name: Parkhill Avenue, Crumpsall		Client: Great Places Housing Group			Date: 01/05/2024		
Project ID:LKC 23 1405		Contractor: VC Drilling Ltd			Co-ords: E384911.42 N402722.23		
Equipment: Cable Percussive Drilling Rig / Shell and Auger Rig		Level 64.86m AOD	Logged By LGD	Scale 1:50	Page Number Sheet 2 of 2		
Depth (m)	Samples / Tests	Depth (m)	Legend	Stratum Description			Level (m)
10.50 - 10.95 10.50	D N=50 (7,11/50 for 235mm)	15.00		Stiff to very stiff consistency high strength brown slightly gravelly sandy silty CLAY. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded comprising mudstone.			49.86
12.00 - 12.45 12.00	D 50 (10,15/50 for 170mm)						
13.50 - 13.95 13.50	D 50 (10,15/50 for 210mm)						
15.00 - 15.45 15.00	D 45 (20,5/45 for 135mm)			End of Borehole at 15.00m			
Hole Diameter		Casing Diameter		Water Strike Details		Chiselling	
Depth Base (m)	Diameter (mm)	Depth Base (m)	Diameter (mm)	Time Elapsed (mins)	Depth Water (m)	Depth Top (m)	Duration (hh:mm)
		9.00	150				
Remarks: Hand excavated trial pit to 1.20mbgl with follow on cable percussive to 15.00mbgl. Borehole dry and stable.							

		<h1>Cable Percussion Drilling Log</h1>				Location Number: CP102	
Project Name: Parkhill Avenue, Crumpsall		Client: Great Places Housing Group			Date: 30/04/2024		
Project ID:LKC 23 1405		Contractor: VC Drilling Ltd			Co-ords: E384925.93 N402740.93		
Equipment: Cable Percussive Drilling Rig / Shell and Auger Rig		Level 63.84m AOD	Logged By LGD	Scale 1:50	Page Number Sheet 1 of 2		
Depth (m)	Samples / Tests	Depth (m)	Legend	Stratum Description		Level (m)	Water Strikes
0.00 - 0.30 0.00 - 0.30 0.00 - 0.30 0.00 - 0.30 0.30 - 1.00 0.30 - 1.00 0.30 - 1.20 0.30 - 1.00 0.40 - 1.00 1.20 - 1.65 1.20 - 1.65 1.20 - 1.65 1.50 2.00 - 2.45 2.00 - 2.45 2.00 2.30	B D ES PID=0.1ppm B D ES PID=0.0ppm PID=1.0ppm B D N=4 (1,1/1,1,1,1) PP=54.0kPa B D N=6 (1,1/1,1,2,2) PP=51.5kPa	0.30		MADE GROUND: Dark brown slightly gravelly sandy SILT with frequent rootlets, occasional brick and rare glass, ceramic, plastic fragments. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded comprising sandstone. Soft to firm consistency medium strength light brown slightly gravelly sandy silty CLAY. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded comprising mudstone.	1	63.54	
3.00 - 3.45 3.00 - 3.45 3.00 - 3.45 3.30	B D N=11 (1,1/2,3,3,3) PP=58.9kPa	3.80		Medium dense orange loose to medium dense slightly gravelly silty SAND. Sand is fine to coarse. Gravel is fine to coarse comprising mudstone and sandstone.	4	60.04	
5.00 - 5.45 5.00 - 5.45 5.00 - 5.45	B D N=16 (3,4/4,4,4,4)			Orange brownish sandy silty GRAVEL. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded comprising sandstone.	5	56.34	
6.00 - 6.45 6.00 - 6.45	D N=17 (3,4/4,5,4,4)			Stiff to very stiff high strength greyish brown slightly gravelly sandy silty CLAY. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded comprising sandstone and mudstone.	8	55.84	
7.00 - 7.45 7.00 - 7.45	D N=18 (3,4/5,4,5,4)	7.50			7		
7.50 - 7.95	D	8.00			8		
9.00 - 9.45	U				9		
9.50	D				10		
Hole Diameter		Casing Diameter		Water Strike Details		Chiselling	
Depth Base (m)	Diameter (mm)	Depth Base (m)	Diameter (mm)	Time Elapsed (mins)	Depth Water (m)	Depth Top (m)	Duration (hh:mm)
		9.00	150				
Remarks: Hand excavated trial pit to 1.20mbgl with follow on cable percussive drilling to 15.80mbgl. Borehole dry and stable.							

		<h1>Trial Pit Log</h1>				Location Number: TP101								
Project: Parkhill Avenue, Crumpsall			Client: Great Places Housing Group			Date: 29/04/2024								
Project No. : LKC 23 1405			Contractor: H & C Plant Hire			Co-ords: E384913.51 N402714.95								
Equipment: Excavator: 5 Tonne Tracked			Level 64.60m AOD		Logged By LGD		Scale 1:25		Page Number Sheet 1 of 1					
Depth (m)		Samples / Tests		Depth (m)		Legend		Stratum Description					Level (m)	
0.00 - 0.50 0.00 - 0.50 0.00 - 0.50		D ES PID=0.2ppm		0.90				MADE GROUND: Dark brown gravelly sandy SILT with frequent rootlets, occasional brick and rare concrete, glass, timber, ceramic fragments. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded comprising sandstone.			0.5		63.70	
0.90 - 1.50 0.90 - 1.50 0.90 - 1.90 0.90 - 1.50		B D ES PID=0.0ppm		2.00				Light brown gravelly silty clayey SAND with clay pockets. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded comprising sandstone.			1.0 1.5			
								End of Trial Pit at 2.00m			2.0		62.60	
											2.5 3.0 3.5 4.0 4.5 5.0			
		Pit Dimensions						Pit Stability						
		Length (m)		Width (m)		Depth (m)		Stable						
		1.70		0.80		2.00								
		Remarks:												
Machine excavated trial pit to 2.00mbgl.														
Trial pit dry.														

<div><div>LKCONSULT</div></div>		<div>Trial Pit Log</div>					<div>Location Number: TP102</div>							
Project: Parkhill Avenue, Crumpsall			Client: Great Places Housing Group			Date: 29/04/2024								
Project No. : LKC 23 1405			Contractor: H & C Plant Hire			Co-ords: E384926.55 N402727.29								
Equipment: Excavator: 5 Tonne Tracked			Level 63.51m AOD		Logged By LGD		Scale 1:25		Page Number Sheet 1 of 1					
Depth (m)		Samples / Tests		Depth (m)		Legend		Stratum Description					Level (m)	
0.00 - 0.50 0.00 - 0.50 0.00 - 0.50		D ES PID=0.3ppm		0.50				MADE GROUND: Dark brown gravelly sandy SILT with frequent rootlets, occasional brick, concrete and rare glass, plastic, metal, ceramic fragments. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded comprising sandstone.			0.5		63.01	
0.50 - 1.00 0.50 - 1.00 0.50 - 1.00		D ES PID=0.1ppm		2.00				Soft consistency light brown slightly gravelly sandy clayey SILT. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded comprising mudstone.			1.0			
1.00 - 2.00		B						End of Trial Pit at 2.00m			1.5			
											2.0		61.51	
											2.5			
											3.0			
											3.5			
											4.0			
											4.5			
											5.0			
						Pit Dimensions			Pit Stability					
						Length (m)		Width (m)		Depth (m)		Stable		
						1.60		0.90		2.00				
						Remarks:								
Machine excavated trial pit to 2.00mbgl.														
Trial pit dry.														
Unable to perform hand shear vanes due to limited clay samples.														

		<h1>Trial Pit Log</h1>				Location Number: TP103								
Project: Parkhill Avenue, Crumpsall			Client: Great Places Housing Group			Date: 29/04/2024								
Project No. : LKC 23 1405			Contractor: H & C Plant Hire			Co-ords: E384954.93 N402740.14								
Equipment: Excavator: 5 Tonne Tracked			Level 59.70m AOD		Logged By LGD		Scale 1:25		Page Number Sheet 1 of 1					
Depth (m)		Samples / Tests		Depth (m)		Legend		Stratum Description					Level (m)	
0.00 - 1.00 0.00 - 1.00 0.00 - 1.00		D ES PID=0.2ppm						MADE GROUND: Dark brown gravelly sandy SILT with frequent rootlets, occasional brick and rare timber, glass, ceramic fragments. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded comprising sandstone.			0.5			
1.00 - 2.00 1.00 - 2.00 1.00 - 2.00		D ES PID=0.1ppm		1.00				Stiff consistency high strength light brown slightly gravelly sandy clayey SILT. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded comprising mudstone.			1.0		58.70	
1.50 - 2.00 1.50		B SV=99.00kPa									1.5			
				2.00				End of Trial Pit at 2.00m			2.0		57.70	
											2.5			
											3.0			
											3.5			
											4.0			
											4.5			
											5.0			
						Pit Dimensions						Pit Stability		
						Length (m)		Width (m)		Depth (m)		Stable		
						1.70		0.80		2.00				
						Remarks:								
Machine excavated trial pit to 2.00.														
Trial pit dry.														

		<h1>Window Sample Borehole Log</h1>				Location Number: <h2>WS101</h2>	
Project Name: Parkhill Avenue, Crumpsall			Client: Great Places Housing Group		Date: 02/05/2024		
Project No. : LKC 23 1405			Contractor: D & I Drilling Ltd		Co-ords: E384904.66 N402719.54		
Equipment: Window Sample Rig: Competitor Dart			Level 65.00m AOD	Logged By LGD	Scale 1:50	Page Number Sheet 1 of 1	

Depth (m)	Samples / Tests	Depth (m)	Legend	Stratum Description		Level (m)	Well	
0.00 - 0.50	D	0.60		MADE GROUND: Dark brown gravelly sandy SILT with frequent rootlets, brick and rare plastic, glass and ceramic fragments. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded comprising sandstone.	<div>64.40</div> <div>1</div> <div>2</div> <div>3</div> <div>4</div> <div>5</div> <div>6</div> <div>7</div> <div>8</div> <div>9</div> <div>10</div>			
0.00 - 0.50	ES						Very loose to medium dense light brown slightly gravelly silty SAND. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded comprising sandstone.	
0.00 - 0.50	PID=0.1ppm							
0.60 - 1.00	D							
0.60 - 1.00	ES							
0.60 - 1.00	PID=0.0ppm							
1.00 - 2.00	D							
1.20 - 1.65	N=4 (1,1/1,1,1,1)							Band of sand and gravel at 2.80mbgl to 3.00mbgl.
2.00 - 3.00	D							
2.00 - 2.45	N=8 (1,1/2,2,2,2)							
3.00 - 4.00	D							
3.00 - 3.45	N=12 (3,3/3,3,3,3)							
4.00 - 5.00	D							
4.00 - 4.45	N=16 (3,3/4,4,4,4)							
5.00 - 5.45	N=18 (3,2/3,4,5,6)							
		5.45	End of Borehole at 5.45m	59.56				

Remarks:

Hand excavated trial pit to 1.20mbgl with follow on Windowless Sampler to 5.45mbgl.

Borehole dry and stable.



Window Sample Borehole Log

Location Number:
WS102

Project Name: Parkhill Avenue, Crumpsall

Client: Great Places Housing Group

Date: 02/05/2024

Project No. : LKC 23 1405

Contractor: D & I Drilling Ltd

Co-ords: E384916.59 N402731.68

Equipment: Window Sample Rig: Competitor Dart

Level
64.42m AOD

Logged By
LGD

Scale
1:50

Page Number
Sheet 1 of 1

Depth (m)	Samples / Tests	Depth (m)	Legend	Stratum Description		Level (m)	Well
0.00 - 0.20	D	0.20		MADE GROUND: Dark brown gravelly sandy SILT with frequent rootlets, occasional brick and rare plastic, glass fragments. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded comprising sandstone	1	64.22	
0.00 - 0.20	ES						
0.00 - 0.20	PID=0.2ppm						
0.20 - 0.50	D						
0.20 - 0.50	ES						
0.20 - 0.50	PID=0.1ppm			Firm to stiff medium to high strength slightly gravelly sandy silty CLAY. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded comprising mudstone.			
1.20 - 1.65	N=8 (1,1/2,2,2,2)	1.80		Clay becomes stiff at 1.60mbgl to 1.80mbgl.	2	62.62	
1.40	PP=67.4kPa						
1.70	PP=149.1kPa						
1.80 - 2.50	D						
1.80 - 2.50	ES						
1.80 - 2.50	PID=0.1ppm			Very soft to firm consistency very low to medium strength light brown slightly gravelly sandy SILT. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded comprising sandstone.			
2.00 - 2.45	N=12 (1,3/3,3,3,3)			Silt becomes firm at 2.50mbgl to 3.50mbgl			
2.25	PP=19.6kPa						
3.00 - 3.45	N=12 (3,3/3,3,3,3)	3.50		Medium dense light brown slightly gravelly silty SAND. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded comprising sandstone.	3	60.92	
3.25	PP=55.2kPa						
3.50 - 4.00	D						
3.50 - 4.00	ES						
4.00 - 4.45	N=11 (4,3/3,3,3,2)						
5.00 - 5.45	N=13 (4,4/3,3,3,4)						
		5.45		End of Borehole at 5.45m		58.97	
					6		
					7		
					8		
					9		
					10		

Remarks:

Hand excavated trial pit to 1.20mbgl with follow on Windowless Sampler to 5.45mbgl.

Borehole dry and stable.



Window Sample Borehole Log

Location Number:
WS103

Project Name: Parkhill Avenue, Crumpsall

Client: Great Places Housing Group

Date: 02/05/2024

Project No. : LKC 23 1405

Contractor: D & I Drilling Ltd

Co-ords: E384961.75 N402745.09

Equipment: Window Sample Rig: Competitor Dart

Level
58.80m AOD

Logged By
LGD

Scale
1:50

Page Number
Sheet 1 of 1

Depth (m)	Samples / Tests	Depth (m)	Legend	Stratum Description		Level (m)	Well
0.00 - 0.30 0.00 - 0.30 0.00 - 0.30	D ES PID=0.2ppm			MADE GROUND: Dark brown very gravelly silty SAND with frequent rootlets, brick, occasional coal, glass and rare ceramic. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded comprising sandstone.			
1.00 - 1.50 1.00 - 1.50 1.00 - 1.50 1.20 - 1.65 1.50	D ES PID=0.0ppm N=4 (1,1/1,1,1,1) PP=53.0kPa	1.00		Firm to stiff consistency medium to high strength light brown slightly gravelly sandy SILT. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded comprising sandstone.	1	57.80	
2.00 - 3.00 2.00 - 2.45	D N=4 (1,2/1,1,1,1)			Band of clay at 3.80mbgl to 4.00mbgl. Silt becomes stiff at 3.00mbgl to 5.50mbgl.	2		
2.50	PP=61.3kPa						
3.00 - 3.80 3.00 - 3.45	D N=16 (4,4/4,4,4,4)				3		
3.50	PP=134.9kPa						
3.80 - 4.00 4.00 - 5.00 4.00 - 4.45	D D N=16 (3,3/3,4,4,5)				4		
4.50	PP=122.6kPa						
5.00 - 5.45	N=30 (6,6/7,7,8,8)				5		
5.50 - 6.00	D	5.50		Very stiff consistency very high strength brown slightly gravelly sandy silty CLAY. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded comprising mudstone.	6	53.30	
6.00 6.00 - 6.42	PP=173.2kPa N=50 (6,8/50 for 275mm)	6.42		End of Borehole at 6.42m		52.38	
					7		
					8		
					9		
					10		

Remarks:

Hand excavated trial pit to 1.20mbgl with follow on Windowless Sampler to.

20% recovery from sampler at 2.00mbgl to 3.00mbgl.

Borehole dry and stable.

SPT refused at 6.425mbgl

		<h1>Window Sample Borehole Log</h1>				Location Number: <h2>WS104</h2>	
Project Name: Parkhill Avenue, Crumpsall			Client: Great Places Housing Group		Date: 02/05/2024		
Project No. : LKC 23 1405			Contractor: D & I Drilling Ltd		Co-ords: E384952.83 N402733.17		
Equipment: Window Sample Rig: Competitor Dart			Level 61.81m AOD	Logged By LGD	Scale 1:50	Page Number Sheet 1 of 1	

Depth (m)	Samples / Tests	Depth (m)	Legend	Stratum Description		Level (m)	Well
0.00 - 0.20	D	0.20		MADE GROUND: Dark brown gravelly sandy SILT with frequent rootlets, occasional brick and rare plastic, glass fragments. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded comprising sandstone Soft to stiff consistency medium strength light brown slightly gravelly sandy SILT with occasional rootlets. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded comprising sandstone.	1	61.61	
0.00 - 0.20	ES						
0.00 - 0.20	PID=0.2ppm						
0.20 - 1.00	D						
0.20 - 1.00	ES						
0.20 - 1.00							
1.20 - 1.65	N=8 (1,1/1,2,2,3)						
1.50 - 2.00	D						
2.00 - 2.45	N=5 (1,0/0,1,2,2)						
2.50 - 3.00	D						
3.00 - 3.45	N=5 (1,1/1,1,1,2)						
3.50 - 4.00	D						
4.00 - 4.45	N=13 (2,3/2,3,4,4)						
5.00 - 5.45	N=14 (3,2/3,3,4,4)						
5.50 - 6.00	D	5.50		Stiff consistency high strength dark brown slightly gravelly sandy silty CLAY. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded comprising sandstone	6	56.31	
6.00 - 6.45	N=17 (3,4/4,3,5,5)						
6.50 - 7.00	D						
7.00 - 7.45	N=16 (3,4/4,3,4,5)						
		7.45			8	54.36	
					9		
					10		
				End of Borehole at 10.00m			

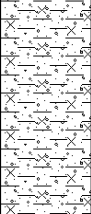
Remarks:

Hand excavated trial pit to 1.20mbgl with follow on Windowless Sampler to 7.45mbgl.

Dynamic probing from 7.45mbgl to 10.00mbgl.

Borehole dry.

Borehole collapsed at 5.00mbgl.

		Dynamic Probe Test Log		Location Number: WS104	
Project Name: Parkhill Avenue, Crumpsall		Client: Great Places Housing Group		Co-ords: E384952.83 N402733.17	
Project No. : LKC 23 1405		Contractor: D & I Drilling Ltd		Date: 02/05/2024	
		Level 61.81m AOD	Logged By LGD	Scale 1:50	Page Number Sheet 1 of 1
Legend	Stratum Description		<div>Number of Blows</div> <div>01020304050</div>		
	MADE GROUND: Dark brown gravelly sandy SILT with frequent rootlets, occasional brick and rare plastic, glass fragments. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded comprising sandstone	0.5			
	Soft to stiff consistency medium strength light brown slightly gravelly sandy SILT with occasional rootlets. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded comprising sandstone. Band of clay at 5.50mbgl to 5.90mbgl	1.0			
	Stiff consistency high strength dark brown slightly gravelly sandy silty CLAY. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded comprising sandstone	5.5			
	End of Borehole at 10.00m	10.0			
		10.5			
<div>4</div> <div>3</div> <div>4</div> <div>5</div> <div>5</div> <div>6</div> <div>6</div> <div>5</div> <div>5</div> <div>5</div> <div>6</div> <div>6</div> <div>8</div> <div>9</div> <div>9</div> <div>11</div> <div>11</div> <div>13</div> <div>14</div> <div>12</div> <div>12</div> <div>10</div> <div>10</div>					
Remarks					

Appendix C – Certificates of Analysis (Soil)



Kris Rodway
LK Consult Limited
Unit 29 Eton Business Park
Eton Hill Road
Manchester
M26 2ZS

Normec DETS Limited
Unit 1
Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Kent
ME17 2JN
t: 01622 850410

DETS Report No: 24-04690

Site Reference: Park Hill Avenue, Crumpsall

Project / Job Ref: LKC 24 1405

Order No: LKC231405-KR

Sample Receipt Date: 01/05/2024

Sample Scheduled Date: 01/05/2024

Report Issue Number: 1

Reporting Date: 08/05/2024

Authorised by:

Steve Knight
Customer Support Manager

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

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

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



Normec DETS Limited
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Maidstone
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Tel : 01622 850410



Soil Analysis Certificate						
DETS Report No: 24-04690	~Date Sampled	29/04/24	29/04/24	29/04/24		
LK Consult Limited	~Time Sampled	None Supplied	None Supplied	None Supplied		
~Site Reference: Park Hill Avenue, Crumpsall	~TP / BH No	TP101	TP102	TP103		
~Project / Job Ref: LKC 24 1405	~Additional Refs	None Supplied	None Supplied	None Supplied		
~Order No: LKC231405-KR	~Depth (m)	0.00 - 0.50	0.00 - 0.50	0.00 - 1.00		
Reporting Date: 08/05/2024	DETS Sample No	712600	712601	712602		

Determinand	Unit	RL	Accreditation					
Asbestos Screen ^(S)	N/a	N/a	ISO17025	Not Detected	Not Detected	Not Detected		
pH	pH Units	N/a	MCERTS	7.9	7.8	7.7		
Total Cyanide	mg/kg	< 1	NONE	1	< 1	< 1		
Free Cyanide	mg/kg	< 1	NONE	< 1	< 1	< 1		
W/S Sulphate as SO ₄ (2:1)	mg/l	< 10	MCERTS	14	< 10	< 10		
W/S Sulphate as SO ₄ (2:1)	g/l	< 0.01	MCERTS	0.01	< 0.01	< 0.01		
Organic Matter (SOM)	%	< 0.1	MCERTS	3.6	10.6	3.7		
Arsenic (As)	mg/kg	< 2	MCERTS	13	20	12		
W/S Boron	mg/kg	< 1	NONE	< 1	< 1	< 1		
Cadmium (Cd)	mg/kg	< 0.2	MCERTS	< 0.2	2.1	< 0.2		
Chromium (Cr)	mg/kg	< 2	MCERTS	15	16	20		
Chromium (hexavalent)	mg/kg	< 2	NONE	< 2	< 2	< 2		
Copper (Cu)	mg/kg	< 4	MCERTS	31	101	51		
Lead (Pb)	mg/kg	< 3	MCERTS	125	171	85		
Mercury (Hg)	mg/kg	< 1	MCERTS	< 1	< 1	< 1		
Nickel (Ni)	mg/kg	< 3	MCERTS	11	17	19		
Selenium (Se)	mg/kg	< 2	MCERTS	< 2	< 2	< 2		
Vanadium (V)	mg/kg	< 1	MCERTS	23	29	24		
Zinc (Zn)	mg/kg	< 3	MCERTS	78	623	120		
Total Phenols (monohydric)	mg/kg	< 2	NONE	< 2	< 2	< 2		

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

~ Sample details provided by the customer



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Lenham Heath
Maidstone
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Soil Analysis Certificate - Speciated PAHs						
DETS Report No: 24-04690	~Date Sampled	29/04/24	29/04/24	29/04/24		
LK Consult Limited	~Time Sampled	None Supplied	None Supplied	None Supplied		
~Site Reference: Park Hill Avenue, Crumpsall	~TP / BH No	TP101	TP102	TP103		
~Project / Job Ref: LKC 24 1405	~Additional Refs	None Supplied	None Supplied	None Supplied		
~Order No: LKC231405-KR	~Depth (m)	0.00 - 0.50	0.00 - 0.50	0.00 - 1.00		
Reporting Date: 08/05/2024	DETS Sample No	712600	712601	712602		

Determinand	Unit	RL	Accreditation				
Naphthalene	mg/kg	< 0.1	MCERTS	< 0.1	1.16	1.09	
Acenaphthylene	mg/kg	< 0.1	MCERTS	< 0.1	0.25	< 0.1	
Acenaphthene	mg/kg	< 0.1	MCERTS	0.14	0.93	1.73	
Fluorene	mg/kg	< 0.1	MCERTS	< 0.1	0.84	1.24	
Phenanthrene	mg/kg	< 0.1	MCERTS	0.97	11.70	8.98	
Anthracene	mg/kg	< 0.1	MCERTS	< 0.1	2.35	1.79	
Fluoranthene	mg/kg	< 0.1	MCERTS	0.60	30.60	6.31	
Pyrene	mg/kg	< 0.1	MCERTS	0.56	27.40	5.26	
Benzo(a)anthracene	mg/kg	< 0.1	MCERTS	0.15	13	1.71	
Chrysene	mg/kg	< 0.1	MCERTS	0.22	15.30	1.77	
Benzo(b)fluoranthene	mg/kg	< 0.1	MCERTS	0.15	17.80	1.41	
Benzo(k)fluoranthene	mg/kg	< 0.1	MCERTS	< 0.1	5.28	0.47	
Benzo(a)pyrene	mg/kg	< 0.1	MCERTS	< 0.1	11.50	1.20	
Indeno(1,2,3-cd)pyrene	mg/kg	< 0.1	MCERTS	< 0.1	5.77	0.52	
Dibenz(a,h)anthracene	mg/kg	< 0.1	MCERTS	< 0.1	1.43	< 0.1	
Benzo(ghi)perylene	mg/kg	< 0.1	MCERTS	< 0.1	5.16	0.39	
Total EPA-16 PAHs	mg/kg	< 1.6	MCERTS	2.8	150	33.9	

~ Sample details provided by the customer



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Rose Lane
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Soil Analysis Certificate - TPH CWG Banded

DETS Report No: 24-04690	~Date Sampled	29/04/24	29/04/24	29/04/24		
LK Consult Limited	~Time Sampled	None Supplied	None Supplied	None Supplied		
~Site Reference: Park Hill Avenue, Crumpsall	~TP / BH No	TP101	TP102	TP103		
~Project / Job Ref: LKC 24 1405	~Additional Refs	None Supplied	None Supplied	None Supplied		
~Order No: LKC231405-KR	~Depth (m)	0.00 - 0.50	0.00 - 0.50	0.00 - 1.00		
Reporting Date: 08/05/2024	DETS Sample No	712600	712601	712602		

Determinand	Unit	RL	Accreditation					
Aliphatic >C5 - C6 : HS 1D MS AL	mg/kg	< 0.01	NONE	< 0.01	< 0.01	< 0.01		
Aliphatic >C6 - C8 : HS 1D MS AL	mg/kg	< 0.05	NONE	< 0.05	< 0.05	< 0.05		
Aliphatic >C8 - C10 : EH CU 1D AL	mg/kg	< 2	MCERTS	< 2	< 2	< 2		
Aliphatic >C10 - C12 : EH CU 1D AL	mg/kg	< 2	MCERTS	< 2	< 2	< 2		
Aliphatic >C12 - C16 : EH CU 1D AL	mg/kg	< 3	MCERTS	< 3	< 3	< 3		
Aliphatic >C16 - C21 : EH CU 1D AL	mg/kg	< 3	MCERTS	< 3	< 3	< 3		
Aliphatic >C21 - C34 : EH CU 1D AL	mg/kg	< 10	MCERTS	< 10	< 10	< 10		
Aliphatic >C34 - C44	mg/kg	< 10	NONE	< 10	< 10	< 10		
Aliphatic (C5 - C44) : HS_1D_MS+EH_CU_1D_AL	mg/kg	< 21	NONE	< 21	< 21	< 21		
Aromatic >C5 - C7 : HS 1D MS AR	mg/kg	< 0.01	NONE	< 0.01	< 0.01	< 0.01		
Aromatic >C7 - C8 : HS 1D MS AR	mg/kg	< 0.05	NONE	< 0.05	< 0.05	< 0.05		
Aromatic >C8 - C10 : EH CU 1D AR	mg/kg	< 2	MCERTS	< 2	< 2	< 2		
Aromatic >C10 - C12 : EH CU 1D AR	mg/kg	< 2	MCERTS	< 2	< 2	< 2		
Aromatic >C12 - C16 : EH CU 1D AR	mg/kg	< 2	MCERTS	< 2	9	14		
Aromatic >C16 - C21 : EH CU 1D AR	mg/kg	< 3	MCERTS	< 3	117	40		
Aromatic >C21 - C35 : EH CU 1D AR	mg/kg	< 10	MCERTS	< 10	172	13		
Aromatic >C35 - C44	mg/kg	< 10	NONE	< 10	< 10	< 10		
Aromatic (C5 - C44) : HS_1D_MS+EH_CU_1D_AR	mg/kg	< 21	NONE	< 21	299	68		
Total >C5 - C44 : HS_1D_MS+EH_CU_1D_Tot al	mg/kg	< 42	NONE	< 42	299	68		

~ Sample details provided by the customer



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Soil Analysis Certificate - BTEX / MTBE						
DETS Report No: 24-04690	~Date Sampled	29/04/24	29/04/24	29/04/24		
LK Consult Limited	~Time Sampled	None Supplied	None Supplied	None Supplied		
~Site Reference: Park Hill Avenue, Crumpsall	~TP / BH No	TP101	TP102	TP103		
~Project / Job Ref: LKC 24 1405	~Additional Refs	None Supplied	None Supplied	None Supplied		
~Order No: LKC231405-KR	~Depth (m)	0.00 - 0.50	0.00 - 0.50	0.00 - 1.00		
Reporting Date: 08/05/2024	DETS Sample No	712600	712601	712602		

Determinand	Unit	RL	Accreditation					
Benzene : HS_1D_MS	ug/kg	< 2	MCERTS	< 2	< 2	< 2		
Toluene : HS_1D_MS	ug/kg	< 5	MCERTS	< 5	< 5	< 5		
Ethylbenzene : HS_1D_MS	ug/kg	< 2	MCERTS	< 2	< 2	< 2		
p & m-xylene : HS_1D_MS	ug/kg	< 2	MCERTS	< 2	< 2	< 2		
o-xylene : HS_1D_MS	ug/kg	< 2	MCERTS	< 2	< 2	< 2		
MTBE : HS_1D_MS	ug/kg	< 5	MCERTS	< 5	< 5	< 5		

~ Sample details provided by the customer



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Waste Acceptance Criteria Analytical Certificate																																							
DETS Report No: 24-04690		~Date Sampled	29/04/24		<table border="1"> <thead> <tr> <th colspan="3">Landfill Waste Acceptance Criteria Limits</th> </tr> <tr> <th>Inert Waste Landfill</th> <th>Stable Non-reactive HAZARDOUS waste in non-hazardous Landfill</th> <th>Hazardous Waste Landfill</th> </tr> </thead> <tbody> <tr> <td>3%</td> <td>5%</td> <td>6%</td> </tr> <tr> <td>--</td> <td>--</td> <td>10%</td> </tr> <tr> <td>6</td> <td>--</td> <td>--</td> </tr> <tr> <td>1</td> <td>--</td> <td>--</td> </tr> <tr> <td>500</td> <td>--</td> <td>--</td> </tr> <tr> <td>100</td> <td>--</td> <td>--</td> </tr> <tr> <td>--</td> <td>>6</td> <td>--</td> </tr> <tr> <td>--</td> <td>To be evaluated</td> <td>To be evaluated</td> </tr> </tbody> </table>					Landfill Waste Acceptance Criteria Limits			Inert Waste Landfill	Stable Non-reactive HAZARDOUS waste in non-hazardous Landfill	Hazardous Waste Landfill	3%	5%	6%	--	--	10%	6	--	--	1	--	--	500	--	--	100	--	--	--	>6	--	--	To be evaluated	To be evaluated
Landfill Waste Acceptance Criteria Limits																																							
Inert Waste Landfill	Stable Non-reactive HAZARDOUS waste in non-hazardous Landfill	Hazardous Waste Landfill																																					
3%	5%	6%																																					
--	--	10%																																					
6	--	--																																					
1	--	--																																					
500	--	--																																					
100	--	--																																					
--	>6	--																																					
--	To be evaluated	To be evaluated																																					
LK Consult Limited		~Time Sampled	None Supplied																																				
~Site Reference: Park Hill Avenue, Crumpsall		~TP / BH No	TP101																																				
~Project / Job Ref: LKC 24 1405		~Additional Refs	None Supplied																																				
~Order No: LKC231405-KR		~Depth (m)	0.00 - 0.50																																				
Reporting Date: 08/05/2024		DETS Sample No	712600																																				
Determinand	Unit	MDL																																					
TOC ^{MU}	%	< 0.1	2.1																																				
Loss on Ignition ^{MU}	%	< 0.01	7.70																																				
BTEX ^{MU}	mg/kg	< 0.05	< 0.05																																				
Sum of PCBs	mg/kg	< 0.1	< 0.1																																				
Mineral Oil ^{MU}	mg/kg	< 10	< 10																																				
Total PAH ^{MU}	mg/kg	< 1.7	2.8																																				
pH ^{MU}	pH Units	N/a	7.9																																				
Acid Neutralisation Capacity	mol/kg (+/-)	< 1	< 1																																				
Eluate Analysis			2:1 mg/l	8:1 mg/l		Cumulative 10:1 * mg/kg	Limit values for compliance leaching test using BS EN 12457-3 at L/S 10 l/kg (mg/kg)																																
Arsenic ^U		0.0013	0.0016		0.029	0.5	2	25																															
Barium ^U		0.0259	0.0196		0.359	20	100	300																															
Cadmium ^U		< 0.0002	< 0.0002		< 0.002	0.04	1	5																															
Chromium ^U		0.0104	0.0026		0.052	0.5	10	70																															
Copper ^U		0.0049	0.0141		0.249	2	50	100																															
Mercury ^U		< 0.00004	< 0.00004		< 0.0004	0.01	0.2	2																															
Molybdenum ^U		0.0357	0.0133		0.256	0.5	10	30																															
Nickel ^U		0.0004	0.0005		0.0099	0.4	10	40																															
Lead ^U		0.0003	0.0017		0.030	0.5	10	50																															
Antimony ^U		0.0098	< 0.0002		0.007	0.06	0.7	5																															
Selenium ^U		0.0006	0.0006		0.0103	0.1	0.5	7																															
Zinc ^U		0.004	0.031		0.54	4	50	200																															
Chloride ^U		1	3		56	800	15000	25000																															
Fluoride ^U		0.6	< 0.5		< 1	10	150	500																															
Sulphate ^U		6	3		55	1000	20000	50000																															
TDS		117	77		1422	4000	60000	100000																															
Phenol Index ^U		< 0.01	< 0.01		< 0.5	1	-	-																															
DOC ^U		12.4	11.5		209	500	800	1000																															
Leach Test Information																																							
Sample Mass (kg)			0.10																																				
Dry Matter (%)			85.5																																				
Moisture (%)			17																																				
Stage 1																																							
Volume Eluate L2 (litres)			0.16																																				
Filtered Eluate VE1 (litres)			0.06																																				

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30°C. The Samples Descriptions page describes if the test is performed on the dried or as-received portion
 Stated limits are for guidance only and Normec DETS Limited cannot be held responsible for any discrepancies with current legislation
 M Denotes MCERTS accredited test
 U Denotes ISO17025 accredited test
 ~ Sample details provided by the customer
 * DETS are accredited for the testing of leachate and not the leachate preparation stage which is unaccredited



Normec DETS Limited
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Soil Analysis Certificate - Sample Descriptions	
DETS Report No: 24-04690	
LK Consult Limited	
~Site Reference: Park Hill Avenue, Crumpsall	
~Project / Job Ref: LKC 24 1405	
~Order No: LKC231405-KR	
Reporting Date: 08/05/2024	

DETS Sample No	~TP / BH No	~Additional Refs	~Depth (m)	Moisture Content (%)	Sample Matrix Description
712600	TP101	None Supplied	0.00 - 0.50	14	Brown sandy clay with brick and concrete
712601	TP102	None Supplied	0.00 - 0.50	13	Black loamy sand with stones
712602	TP103	None Supplied	0.00 - 1.00	12.2	Brown sandy clay with stones and vegetation

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

Insufficient Sample ^{1/5}

Unsuitable Sample ^{1/5}

~ Sample details provided by the customer



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Soil Analysis Certificate - Methodology & Miscellaneous Information

DETS Report No: 24-04690

LK Consult Limited

~Site Reference: Park Hill Avenue, Crumpsall

~Project / Job Ref: LKC 24 1405

~Order No: LKC231405-KR

Reporting Date: 08/05/2024

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

D Dried
AR As Received

~ Sample details provided by the customer



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Water Analysis Certificate - Methodology & Miscellaneous Information

DETS Report No: 24-04690

LK Consult Limited

~Site Reference: Park Hill Avenue, Crumpsall

~Project / Job Ref: LKC 24 1405

~Order No: LKC231405-KR

Reporting Date: 08/05/2024

Matrix	Analysed On	Determinand	Brief Method Description	Method No
Water	UF	Alkalinity	Determination of alkalinity by titration against hydrochloric acid using bromocresol green as the end point	E103
Water	F	Ammoniacal Nitrogen	Determination of ammoniacal nitrogen by discrete analyser.	E126
Water	UF	BTEX	Determination of BTEX by headspace GC-MS	E101
Water	F	Cations	Determination of cations by filtration followed by ICP-MS	E102
Water	U	Chemical Oxygen Demand (COD)	Determination using a COD reactor followed by colorimetry	E112
Water	UF	Biological Oxygen Demand (BOD)	Determination using BOD sensors measuring the change of pressure	E133
Water	F	Chloride	Determination of chloride by filtration & analysed by ion chromatography	E109
Water	F	Chromium - Hexavalent	Determination of hexavalent chromium by acidification, addition of 1,5 diphenylcarbazide followed by	E116
Water	UF	Cyanide - Complex	Determination of complex cyanide by distillation followed by colorimetry	E115
Water	UF	Cyanide - Free	Determination of free cyanide by distillation followed by colorimetry	E115
Water	UF	Cyanide - Total	Determination of total cyanide by distillation followed by colorimetry	E115
Water	UF	Cyclohexane Extractable Matter (CEM)	Gravimetrically determined through liquid:liquid extraction with cyclohexane	E111
Water	F	Diesel Range Organics (C10 - C24)	Determination of liquid:liquid extraction with hexane followed by GC-FID	E104
Water	F	Dissolved Organic Content (DOC)	Determination of DOC by filtration followed by low heat with persulphate addition followed by IR detection	E110
Water	UF	Electrical Conductivity	Determination of electrical conductivity by electrometric measurement	E123
Water	F	EPH (C10 - C40)	Determination of liquid:liquid extraction with hexane followed by GC-FID	E104
Water	F	EPH TEXAS (C6-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C40)	Determination of liquid:liquid extraction with hexane followed by GC-FID for C8 to C40. C6 to C8 by headspace GC-MS	E104
Water	F	Fluoride	Determination of Fluoride by filtration & analysed by ion chromatography	E109
Water	F	Hardness	Determination of Ca and Mg by ICP-MS followed by calculation	E102
Leachate	F	Leachate Preparation - NRA	Based on National Rivers Authority leaching test 1994	E301
Leachate	F	Leachate Preparation - WAC	Based on BS EN 12457 Pt1, 2, 3	E302
Water	F	Metals	Determination of metals by filtration followed by ICP-MS	E102
Water	F	Mineral Oil (C10 - C40)	Determination of liquid:liquid extraction with hexane followed by GI-FID	E104
Water	F	Nitrate	Determination of nitrate by filtration & analysed by ion chromatography	E109
Water	UF	Monohydric Phenol	Determination of phenols by distillation followed by colorimetry	E121
Water	F	PAH - Speciated (EPA 16)	Determination of PAH compounds by concentration through SPE cartridge, collection in dichloromethane followed by GC-MS	E105
Water	F	PCB - 7 Congeners	Determination of PCB compounds by concentration through SPE cartridge, collection in dichloromethane	E108
Water	UF	Petroleum Ether Extract (PEE)	Gravimetrically determined through liquid:liquid extraction with petroleum ether	E111
Water	UF	pH	Determination of pH by electrometric measurement	E107
Water	F	Phosphate	Determination of phosphate by filtration & analysed by ion chromatography	E109
Water	UF	Redox Potential	Determination of redox potential by electrometric measurement	E113
Water	F	Sulphate (as SO4)	Determination of sulphate by filtration & analysed by ion chromatography	E109
Water	UF	Sulphide	Determination of sulphide by distillation followed by colorimetry	E118
Water	F	SVOC	Determination of semi-volatile organic compounds by concentration through SPE cartridge, collection in dichloromethane followed by GC-MS	E106
Water	UF	Toluene Extractable Matter (TEM)	Gravimetrically determined through liquid:liquid extraction with toluene	E111
Water	UF	Total Organic Carbon (TOC)	Low heat with persulphate addition followed by IR detection	E110
Water	F	TPH CWG (all: C5-C6, C6-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C34, aro: C5-C7, C7-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C35)	Determination of liquid:liquid extraction with hexane, fractionating with SPE followed by GC-FID for C8 to C35. C5 to C8 by headspace GC-MS	E104
Water	F	TPH LQM (all: C5-C6, C6-C8, C8-C10, C10-C12, C12-C16, C16-C35, C35-C44, aro: C5-C7, C7-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C35, C35-C44)	Determination of liquid:liquid extraction with hexane, fractionating with SPE followed by GC-FID for C8 to C44. C5 to C8 by headspace GC-MS	E104
Water	UF	VOCs	Determination of volatile organic compounds by headspace GC-MS	E101
Water	UF	VPH (C6-C8 & C8-C10)	Determination of hydrocarbons C6-C8 by headspace GC-MS & C8-C10 by GC-FID	E101

Key

F Filtered

UF Unfiltered

~ Sample details provided by the customer



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List of HWOL Acronyms and Operators	
DETS Report No: 24-04690	
LK Consult Limited	
~Site Reference: Park Hill Avenue, Crumpsall	
~Project / Job Ref: LKC 24 1405	
~Order No: LKC231405-KR	
Reporting Date: 08/05/2024	

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

Benzene - HS_1D_MS
Ethylbenzene - HS_1D_MS
MTBE - HS_1D_MS
Mineral Oil (C10 - C40) (BS EN 12457-3) - EH_CU_1D_AL
TPH CWG - Aliphatic >C10 - C12 - EH_CU_1D_AL
TPH CWG - Aliphatic >C12 - C16 - EH_CU_1D_AL
TPH CWG - Aliphatic >C16 - C21 - EH_CU_1D_AL
TPH CWG - Aliphatic >C21 - C34 - EH_CU_1D_AL
TPH CWG - Aliphatic >C5 - C44 - HS_1D_MS+EH_CU_1D_AL
TPH CWG - Aliphatic >C5 - C6 - HS_1D_MS_AL
TPH CWG - Aliphatic >C6 - C8 - HS_1D_MS_AL
TPH CWG - Aliphatic >C8 - C10 - EH_CU_1D_AL
TPH CWG - Aromatic >C10 - C12 - EH_CU_1D_AR
TPH CWG - Aromatic >C12 - C16 - EH_CU_1D_AR
TPH CWG - Aromatic >C16 - C21 - EH_CU_1D_AR
TPH CWG - Aromatic >C21 - C35 - EH_CU_1D_AR
TPH CWG - Aromatic >C5 - C44 - HS_1D_MS+EH_CU_1D_AR
TPH CWG - Aromatic >C5 - C7 - HS_1D_MS_AR
TPH CWG - Aromatic >C7 - C8 - HS_1D_MS_AR
TPH CWG - Aromatic >C8 - C10 - EH_CU_1D_AR
TPH CWG - Total >C5 - C44 - HS_1D_MS+EH_CU_1D_Total
Toluene - HS_1D_MS
Total BTEX (BS EN 12457-3) - HS_1D_MS_Total
m & p-xylene - HS_1D_MS
o-Xylene - HS_1D_MS

Parameter	Matrix Type	Expanded Uncertainty Measurement	Unit
TOC	Soil	12.2	%
Loss on Ignition	Soil	22.9	%
BTEX	Soil	11.2	%
Sum of PCBs	Soil	43.4	%
Mineral Oil	Soil	9.0	%
Total PAH	Soil	18.5	%
pH	Soil	0.335	Units
Acid Neutralisation Capacity	Soil	18.0	%
Clay Content	Soil	15.0	%
Silt Content	Soil	14.0	%
Sand Content	Soil	13.0	%
Loss on Ignition	Soil	22.9	%
pH	Soil	0.335	Units
Carbonate	Soil	12.0	%
Total Nitrogen	Soil	12.0	%
Phosphorus (Extractable)	Soil	24.0	%
Potassium (Extractable)	Soil	20.0	%
Magnesium (Extractable)	Soil	26.0	%
Zinc	Soil	21.6	%
Copper	Soil	18.2	%
Nickel	Soil	24.3	%
Available Sodium	Soil	23.0	%
Available Calcium	Soil	23.0	%
Electrical Conductivity	Soil	10.0	%



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DETS Report No: 24-04917

Site Reference: Park Hill Avenue, Crumpsall

Project / Job Ref: LKC 23 1405

Order No: LKC231405-KR

Sample Receipt Date: 07/05/2024

Sample Scheduled Date: 07/05/2024

Report Issue Number: 1

Reporting Date: 13/05/2024

Authorised by:

Steve Knight
Customer Support Manager

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

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

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



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Soil Analysis Certificate					
DETS Report No: 24-04917	~Date Sampled	02/05/24	02/05/24	02/05/24	02/05/24
LK Consult Limited	~Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied
~Site Reference: Park Hill Avenue, Crumpsall	~TP / BH No	WS101	WS102	WS103	WS104
~Project / Job Ref: LKC 23 1405	~Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied
~Order No: LKC231405-KR	~Depth (m)	0.00 - 0.50	0.20 - 0.50	0.00 - 0.30	0.00 - 0.20
Reporting Date: 13/05/2024	DETS Sample No	713600	713601	713602	713603

Determinand	Unit	RL	Accreditation	(n)	(n)	(n)	(n)	(n)
Asbestos Screen ^(S)	N/a	N/a	ISO17025	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected
pH	pH Units	N/a	MCERTS	7.7	6.9	7.7	6.7	7.7
Total Cyanide	mg/kg	< 1	NONE			< 1		< 1
Free Cyanide	mg/kg	< 1	NONE			< 1		< 1
W/S Sulphate as SO ₄ (2:1)	mg/l	< 10	MCERTS	47	40	< 10	< 10	15
W/S Sulphate as SO ₄ (2:1)	g/l	< 0.01	MCERTS	0.05	0.04	< 0.01	< 0.01	0.02
Organic Matter (SOM)	%	< 0.1	MCERTS	2.7	2.3	1.1	4.4	2.2
Arsenic (As)	mg/kg	< 2	MCERTS	11	11	2	7	7
W/S Boron	mg/kg	< 1	NONE			< 1		< 1
Cadmium (Cd)	mg/kg	< 0.2	MCERTS	0.3	< 0.2	< 0.2	< 0.2	< 0.2
Chromium (Cr)	mg/kg	< 2	MCERTS	11	32	4	10	13
Chromium (hexavalent)	mg/kg	< 2	NONE	< 2	< 2	< 2	< 2	< 2
Copper (Cu)	mg/kg	< 4	MCERTS	30	37	6	21	23
Lead (Pb)	mg/kg	< 3	MCERTS	90	23	9	82	20
Mercury (Hg)	mg/kg	< 1	MCERTS	< 1	< 1	< 1	< 1	< 1
Nickel (Ni)	mg/kg	< 3	MCERTS	11	58	4	9	19
Selenium (Se)	mg/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	< 2
Vanadium (V)	mg/kg	< 1	MCERTS	22	34	7	12	17
Zinc (Zn)	mg/kg	< 3	MCERTS	91	90	15	68	58
Total Phenols (monohydric)	mg/kg	< 2	NONE			< 2		< 2

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

~ Sample details provided by the customer

(n) Please note we are only MCERTS accredited (UK soils only) for sand, loam and clay and any other matrix is outside our scope of accreditation



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Soil Analysis Certificate					
DETS Report No: 24-04917	~Date Sampled	30/04/24	01/05/24		
LK Consult Limited	~Time Sampled	None Supplied	None Supplied		
~Site Reference: Park Hill Avenue, Crumpsall	~TP / BH No	CP102	CP101		
~Project / Job Ref: LKC 23 1405	~Additional Refs	None Supplied	None Supplied		
~Order No: LKC231405-KR	~Depth (m)	0.00 - 0.30	0.50 - 1.00		
Reporting Date: 13/05/2024	DETS Sample No	713605	713606		

Determinand	Unit	RL	Accreditation					
Asbestos Screen ^(S)	N/a	N/a	ISO17025	Not Detected	Not Detected			
pH	pH Units	N/a	MCERTS	7.1	7.7			
Total Cyanide	mg/kg	< 1	NONE					
Free Cyanide	mg/kg	< 1	NONE					
W/S Sulphate as SO ₄ (2:1)	mg/l	< 10	MCERTS	< 10	92			
W/S Sulphate as SO ₄ (2:1)	g/l	< 0.01	MCERTS	< 0.01	0.09			
Organic Matter (SOM)	%	< 0.1	MCERTS	4.1	1.7			
Arsenic (As)	mg/kg	< 2	MCERTS	23	7			
W/S Boron	mg/kg	< 1	NONE					
Cadmium (Cd)	mg/kg	< 0.2	MCERTS	0.3	< 0.2			
Chromium (Cr)	mg/kg	< 2	MCERTS	17	11			
Chromium (hexavalent)	mg/kg	< 2	NONE	< 2	< 2			
Copper (Cu)	mg/kg	< 4	MCERTS	55	26			
Lead (Pb)	mg/kg	< 3	MCERTS	178	51			
Mercury (Hg)	mg/kg	< 1	MCERTS	< 1	< 1			
Nickel (Ni)	mg/kg	< 3	MCERTS	18	11			
Selenium (Se)	mg/kg	< 2	MCERTS	< 2	< 2			
Vanadium (V)	mg/kg	< 1	MCERTS	27	15			
Zinc (Zn)	mg/kg	< 3	MCERTS	95	50			
Total Phenols (monohydric)	mg/kg	< 2	NONE					

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



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Soil Analysis Certificate - Speciated PAHs						
DETS Report No: 24-04917	~Date Sampled	02/05/24	02/05/24	02/05/24	02/05/24	02/05/24
LK Consult Limited	~Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
~Site Reference: Park Hill Avenue, Crumpsall	~TP / BH No	WS101	WS102	WS103	WS104	WS104
~Project / Job Ref: LKC 23 1405	~Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
~Order No: LKC231405-KR	~Depth (m)	0.00 - 0.50	0.20 - 0.50	0.00 - 0.30	0.00 - 0.20	0.20 - 1.00
Reporting Date: 13/05/2024	DETS Sample No	713600	713601	713602	713603	713604

Determinand	Unit	RL	Accreditation	(n)	(n)	(n)	(n)	(n)
Naphthalene	mg/kg	< 0.1	MCERTS	0.16	< 0.1	0.21	0.14	< 0.1
Acenaphthylene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthene	mg/kg	< 0.1	MCERTS	0.35	< 0.1	< 0.1	< 0.1	< 0.1
Fluorene	mg/kg	< 0.1	MCERTS	0.22	< 0.1	< 0.1	< 0.1	< 0.1
Phenanthrene	mg/kg	< 0.1	MCERTS	2.14	< 0.1	0.66	0.93	0.35
Anthracene	mg/kg	< 0.1	MCERTS	0.46	< 0.1	0.14	0.16	< 0.1
Fluoranthene	mg/kg	< 0.1	MCERTS	2.38	< 0.1	1.10	1.32	0.45
Pyrene	mg/kg	< 0.1	MCERTS	2.07	< 0.1	1.07	1.23	0.40
Benzo(a)anthracene	mg/kg	< 0.1	MCERTS	0.87	< 0.1	0.50	0.46	0.16
Chrysene	mg/kg	< 0.1	MCERTS	0.98	< 0.1	0.71	0.60	0.21
Benzo(b)fluoranthene	mg/kg	< 0.1	MCERTS	0.84	< 0.1	1.01	0.58	0.21
Benzo(k)fluoranthene	mg/kg	< 0.1	MCERTS	0.32	< 0.1	0.29	0.21	< 0.1
Benzo(a)pyrene	mg/kg	< 0.1	MCERTS	0.86	< 0.1	0.86	0.44	0.19
Indeno(1,2,3-cd)pyrene	mg/kg	< 0.1	MCERTS	0.44	< 0.1	0.65	0.25	< 0.1
Dibenz(a,h)anthracene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	0.13	< 0.1	< 0.1
Benzo(ghi)perylene	mg/kg	< 0.1	MCERTS	0.38	< 0.1	0.59	0.21	< 0.1
Total EPA-16 PAHs	mg/kg	< 1.6	MCERTS	12.5	< 1.6	7.9	6.5	2

~ Sample details provided by the customer

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Soil Analysis Certificate - Speciated PAHs

DETS Report No: 24-04917	~Date Sampled	30/04/24	01/05/24			
LK Consult Limited	~Time Sampled	None Supplied	None Supplied			
~Site Reference: Park Hill Avenue, Crumpsall	~TP / BH No	CP102	CP101			
~Project / Job Ref: LKC 23 1405	~Additional Refs	None Supplied	None Supplied			
~Order No: LKC231405-KR	~Depth (m)	0.00 - 0.30	0.50 - 1.00			
Reporting Date: 13/05/2024	DETS Sample No	713605	713606			

Determinand	Unit	RL	Accreditation				
Naphthalene	mg/kg	< 0.1	MCERTS	0.13	< 0.1		
Acenaphthylene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1		
Acenaphthene	mg/kg	< 0.1	MCERTS	0.24	< 0.1		
Fluorene	mg/kg	< 0.1	MCERTS	0.14	< 0.1		
Phenanthrene	mg/kg	< 0.1	MCERTS	1.65	0.29		
Anthracene	mg/kg	< 0.1	MCERTS	0.31	< 0.1		
Fluoranthene	mg/kg	< 0.1	MCERTS	2.04	0.35		
Pyrene	mg/kg	< 0.1	MCERTS	1.77	0.32		
Benzo(a)anthracene	mg/kg	< 0.1	MCERTS	0.60	0.11		
Chrysene	mg/kg	< 0.1	MCERTS	0.84	0.15		
Benzo(b)fluoranthene	mg/kg	< 0.1	MCERTS	0.73	0.12		
Benzo(k)fluoranthene	mg/kg	< 0.1	MCERTS	0.24	< 0.1		
Benzo(a)pyrene	mg/kg	< 0.1	MCERTS	0.58	< 0.1		
Indeno(1,2,3-cd)pyrene	mg/kg	< 0.1	MCERTS	0.31	< 0.1		
Dibenz(a,h)anthracene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1		
Benzo(ghi)perylene	mg/kg	< 0.1	MCERTS	0.25	< 0.1		
Total EPA-16 PAHs	mg/kg	< 1.6	MCERTS	9.8	< 1.6		

~ Sample details provided by the customer



Normec DETS Limited
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Maidstone
Kent ME17 2JN
Tel : 01622 850410



Soil Analysis Certificate - TPH CWG Banded					
DETS Report No: 24-04917	~Date Sampled	02/05/24	02/05/24		
LK Consult Limited	~Time Sampled	None Supplied	None Supplied		
~Site Reference: Park Hill Avenue, Crumpsall	~TP / BH No	WS103	WS104		
~Project / Job Ref: LKC 23 1405	~Additional Refs	None Supplied	None Supplied		
~Order No: LKC231405-KR	~Depth (m)	0.00 - 0.30	0.20 - 1.00		
Reporting Date: 13/05/2024	DETS Sample No	713602	713604		

Determinand	Unit	RL	Accreditation					
Aliphatic >C5 - C6 : HS 1D MS AL	mg/kg	< 0.01	NONE	< 0.01	< 0.01			
Aliphatic >C6 - C8 : HS 1D MS AL	mg/kg	< 0.05	NONE	< 0.05	< 0.05			
Aliphatic >C8 - C10 : EH CU 1D AL	mg/kg	< 2	MCERTS	< 2	< 2			
Aliphatic >C10 - C12 : EH CU 1D AL	mg/kg	< 2	MCERTS	< 2	< 2			
Aliphatic >C12 - C16 : EH CU 1D AL	mg/kg	< 3	MCERTS	< 3	< 3			
Aliphatic >C16 - C21 : EH CU 1D AL	mg/kg	< 3	MCERTS	< 3	< 3			
Aliphatic >C21 - C34 : EH CU 1D AL	mg/kg	< 10	MCERTS	28	< 10			
Aliphatic >C34 - C44	mg/kg	< 10	NONE	< 10	< 10			
Aliphatic (C5 - C44) : HS_1D_MS+EH_CU_1D_AL	mg/kg	< 21	NONE	28	< 21			
Aromatic >C5 - C7 : HS 1D MS AR	mg/kg	< 0.01	NONE	< 0.01	< 0.01			
Aromatic >C7 - C8 : HS 1D MS AR	mg/kg	< 0.05	NONE	< 0.05	< 0.05			
Aromatic >C8 - C10 : EH CU 1D AR	mg/kg	< 2	MCERTS	< 2	< 2			
Aromatic >C10 - C12 : EH CU 1D AR	mg/kg	< 2	MCERTS	< 2	< 2			
Aromatic >C12 - C16 : EH CU 1D AR	mg/kg	< 2	MCERTS	5	< 2			
Aromatic >C16 - C21 : EH CU 1D AR	mg/kg	< 3	MCERTS	5	3			
Aromatic >C21 - C35 : EH CU 1D AR	mg/kg	< 10	MCERTS	80	< 10			
Aromatic >C35 - C44	mg/kg	< 10	NONE	34	< 10			
Aromatic (C5 - C44) : HS_1D_MS+EH_CU_1D_AR	mg/kg	< 21	NONE	125	< 21			
Total >C5 - C44 : HS_1D_MS+EH_CU_1D_Tot al	mg/kg	< 42	NONE	153	< 42			

~ Sample details provided by the customer



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Soil Analysis Certificate - BTEX / MTBE						
DETS Report No: 24-04917	~Date Sampled	02/05/24	02/05/24			
LK Consult Limited	~Time Sampled	None Supplied	None Supplied			
~Site Reference: Park Hill Avenue, Crumpsall	~TP / BH No	WS103	WS104			
~Project / Job Ref: LKC 23 1405	~Additional Refs	None Supplied	None Supplied			
~Order No: LKC231405-KR	~Depth (m)	0.00 - 0.30	0.20 - 1.00			
Reporting Date: 13/05/2024	DETS Sample No	713602	713604			

Determinand	Unit	RL	Accreditation				
Benzene : HS_1D_MS	ug/kg	< 2	MCERTS	< 2	< 2		
Toluene : HS_1D_MS	ug/kg	< 5	MCERTS	< 5	< 5		
Ethylbenzene : HS_1D_MS	ug/kg	< 2	MCERTS	< 2	< 2		
p & m-xylene : HS_1D_MS	ug/kg	< 2	MCERTS	< 2	< 2		
o-xylene : HS_1D_MS	ug/kg	< 2	MCERTS	< 2	< 2		
MTBE : HS_1D_MS	ug/kg	< 5	MCERTS	< 5	< 5		

~ Sample details provided by the customer



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Lenham Heath
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Tel : 01622 850410



Waste Acceptance Criteria Analytical Certificate																																							
DETS Report No: 24-04917		~Date Sampled	02/05/24		<table border="1"> <thead> <tr> <th colspan="3">Landfill Waste Acceptance Criteria Limits</th> </tr> <tr> <th>Inert Waste Landfill</th> <th>Stable Non-reactive HAZARDOUS waste in non-hazardous Landfill</th> <th>Hazardous Waste Landfill</th> </tr> </thead> <tbody> <tr> <td>3%</td> <td>5%</td> <td>6%</td> </tr> <tr> <td>--</td> <td>--</td> <td>10%</td> </tr> <tr> <td>6</td> <td>--</td> <td>--</td> </tr> <tr> <td>1</td> <td>--</td> <td>--</td> </tr> <tr> <td>500</td> <td>--</td> <td>--</td> </tr> <tr> <td>100</td> <td>--</td> <td>--</td> </tr> <tr> <td>--</td> <td>>6</td> <td>--</td> </tr> <tr> <td>--</td> <td>To be evaluated</td> <td>To be evaluated</td> </tr> </tbody> </table>					Landfill Waste Acceptance Criteria Limits			Inert Waste Landfill	Stable Non-reactive HAZARDOUS waste in non-hazardous Landfill	Hazardous Waste Landfill	3%	5%	6%	--	--	10%	6	--	--	1	--	--	500	--	--	100	--	--	--	>6	--	--	To be evaluated	To be evaluated
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100	--	--																																					
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LK Consult Limited		~Time Sampled	None Supplied																																				
~Site Reference: Park Hill Avenue, Crumpsall		~TP / BH No	WS103																																				
~Project / Job Ref: LKC 23 1405		~Additional Refs	None Supplied																																				
~Order No: LKC231405-KR		~Depth (m)	0.00 - 0.30																																				
Reporting Date: 13/05/2024		DETS Sample No	713602																																				
Determinand	Unit	MDL																																					
TOC ^{MU}	%	< 0.1	0.7																																				
Loss on Ignition ^{MU}	%	< 0.01	1.11																																				
BTEX ^{MU}	mg/kg	< 0.05	< 0.05																																				
Sum of PCBs	mg/kg	< 0.1	< 0.1																																				
Mineral Oil ^{MU}	mg/kg	< 10	37																																				
Total PAH ^{MU}	mg/kg	< 1.7	8.1																																				
pH ^{MU}	pH Units	N/a	7.7																																				
Acid Neutralisation Capacity	mol/kg (+/-)	< 1	< 1																																				
Eluate Analysis			2:1 mg/l	8:1 mg/l		Cumulative 10:1 * mg/kg	Limit values for compliance leaching test using BS EN 12457-3 at L/S 10 l/kg (mg/kg)																																
Arsenic ^U		0.0051	0.0061		0.110	0.5	2	25																															
Barium ^U		0.0355	0.0124		0.245	20	100	300																															
Cadmium ^U		< 0.0002	< 0.0002		< 0.002	0.04	1	5																															
Chromium ^U		< 0.0002	0.0009		0.015	0.5	10	70																															
Copper ^U		0.0037	0.0009		0.019	2	50	100																															
Mercury ^U		0.00009	< 0.00004		< 0.0004	0.01	0.2	2																															
Molybdenum ^U		0.0246	0.0039		0.089	0.5	10	30																															
Nickel ^U		< 0.0002	< 0.0002		< 0.0002	0.4	10	40																															
Lead ^U		0.0008	0.0026		0.046	0.5	10	50																															
Antimony ^U		0.0064	< 0.0002		0.005	0.06	0.7	5																															
Selenium ^U		0.0008	0.0005		0.0099	0.1	0.5	7																															
Zinc ^U		0.004	0.003		0.05	4	50	200																															
Chloride ^U		18	2		46	800	15000	25000																															
Fluoride ^U		0.7	< 0.5		< 1	10	150	500																															
Sulphate ^U		100	10		260	1000	20000	50000																															
TDS		188	61		1213	4000	60000	100000																															
Phenol Index ^U		< 0.01	< 0.01		< 0.5	1	-	-																															
DOC ^U		23	11.3		215	500	800	1000																															
Leach Test Information																																							
Sample Mass (kg)			0.09																																				
Dry Matter (%)			92.8																																				
Moisture (%)			7.8																																				
Stage 1																																							
Volume Eluate L2 (litres)			0.17																																				
Filtered Eluate VE1 (litres)			0.07																																				
Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30°C. The Samples Descriptions page describes if the test is performed on the dried or as-received portion Stated limits are for guidance only and Normec DETS Limited cannot be held responsible for any discrepancies with current legislation M Denotes MCERTS accredited test U Denotes ISO17025 accredited test ~ Sample details provided by the customer * DETS are accredited for the testing of leachate and not the leachate preparation stage which is unaccredited																																							



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Waste Acceptance Criteria Analytical Certificate																																							
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Landfill Waste Acceptance Criteria Limits																																							
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100	--	--																																					
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LK Consult Limited		~Time Sampled	None Supplied																																				
~Site Reference: Park Hill Avenue, Crumpsall		~TP / BH No	WS104																																				
~Project / Job Ref: LKC 23 1405		~Additional Refs	None Supplied																																				
~Order No: LKC231405-KR		~Depth (m)	0.20 - 1.00																																				
Reporting Date: 13/05/2024		DETS Sample No	713604																																				
Determinand	Unit	MDL																																					
TOC ^{MU}	%	< 0.1	1.3																																				
Loss on Ignition ^{MU}	%	< 0.01	3																																				
BTEX ^{MU}	mg/kg	< 0.05	< 0.05																																				
Sum of PCBs	mg/kg	< 0.1	< 0.1																																				
Mineral Oil ^{MU}	mg/kg	< 10	< 10																																				
Total PAH ^{MU}	mg/kg	< 1.7	2																																				
pH ^{MU}	pH Units	N/a	7.7																																				
Acid Neutralisation Capacity	mol/kg (+/-)	< 1	< 1																																				
Eluate Analysis			2:1 mg/l	8:1 mg/l		Cumulative 10:1 * mg/kg	Limit values for compliance leaching test using BS EN 12457-3 at L/S 10 l/kg (mg/kg)																																
Arsenic ^U		0.0005	0.0005		0.009	0.5	2	25																															
Barium ^U		0.0257	0.0192		0.351	20	100	300																															
Cadmium ^U		< 0.0002	< 0.0002		< 0.002	0.04	1	5																															
Chromium ^U		< 0.0002	0.0009		0.015	0.5	10	70																															
Copper ^U		0.0006	0.0021		0.037	2	50	100																															
Mercury ^U		< 0.00004	< 0.00004		< 0.0004	0.01	0.2	2																															
Molybdenum ^U		0.0075	0.0039		0.073	0.5	10	30																															
Nickel ^U		< 0.0002	< 0.0002		< 0.0002	0.4	10	40																															
Lead ^U		< 0.0002	< 0.0002		0.003	0.5	10	50																															
Antimony ^U		< 0.0002	< 0.0002		< 0.002	0.06	0.7	5																															
Selenium ^U		0.0002	< 0.0002		0.0009	0.1	0.5	7																															
Zinc ^U		< 0.001	0.006		0.11	4	50	200																															
Chloride ^U		1	< 1		14	800	15000	25000																															
Fluoride ^U		1.4	0.8		14.7	10	150	500																															
Sulphate ^U		3	< 1		< 20	1000	20000	50000																															
TDS		85	41		771	4000	60000	100000																															
Phenol Index ^U		< 0.01	< 0.01		< 0.5	1	-	-																															
DOC ^U		7.1	8.1		146	500	800	1000																															
Leach Test Information																																							
Sample Mass (kg)			0.10																																				
Dry Matter (%)			84.5																																				
Moisture (%)			18.4																																				
Stage 1																																							
Volume Eluate L2 (litres)			0.16																																				
Filtered Eluate VE1 (litres)			0.06																																				

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

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

M Denotes MCERTS accredited test

U Denotes ISO17025 accredited test

~ Sample details provided by the customer

* DETS are accredited for the testing of leachate and not the leachate preparation stage which is unaccredited



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Soil Analysis Certificate - Sample Descriptions

DETS Report No: 24-04917

LK Consult Limited

~Site Reference: Park Hill Avenue, Crumpsall

~Project / Job Ref: LKC 23 1405

~Order No: LKC231405-KR

Reporting Date: 13/05/2024

DETS Sample No	~TP / BH No	~Additional Refs	~Depth (m)	Moisture Content (%)	Sample Matrix Description
713600	WS101	None Supplied	0.00 - 0.50	10.6	Brown sandy gravel with stones and brick
713601	WS102	None Supplied	0.20 - 0.50	17.1	Light brown clay with vegetation
713602	WS103	None Supplied	0.00 - 0.30	6.6	Brown sandy clay with stones
713603	WS104	None Supplied	0.00 - 0.20	23.6	Brown sandy clay with stones and brick
713604	WS104	None Supplied	0.20 - 1.00	15	Brown loamy sand with stones and vegetation
713605	CP102	None Supplied	0.00 - 0.30	15.6	Brown sandy clay
713606	CP101	None Supplied	0.50 - 1.00	11.4	Brown sandy clay

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

Insufficient Sample ^{1/5}

Unsuitable Sample ^{u/s}

~ Sample details provided by the customer



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Soil Analysis Certificate - Methodology & Miscellaneous Information

DETS Report No: 24-04917

LK Consult Limited

~Site Reference: Park Hill Avenue, Crumpsall

~Project / Job Ref: LKC 23 1405

~Order No: LKC231405-KR

Reporting Date: 13/05/2024

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

D Dried
AR As Received

~ Sample details provided by the customer



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Maidstone
Kent ME17 2JN
Tel : 01622 850410



Water Analysis Certificate - Methodology & Miscellaneous Information

DETS Report No: 24-04917

LK Consult Limited

~Site Reference: Park Hill Avenue, Crumpsall

~Project / Job Ref: LKC 23 1405

~Order No: LKC231405-KR

Reporting Date: 13/05/2024

Matrix	Analysed On	Determinand	Brief Method Description	Method No
Water	UF	Alkalinity	Determination of alkalinity by titration against hydrochloric acid using bromocresol green as the end point	E103
Water	F	Ammoniacal Nitrogen	Determination of ammoniacal nitrogen by discrete analyser.	E126
Water	UF	BTEX	Determination of BTEX by headspace GC-MS	E101
Water	F	Cations	Determination of cations by filtration followed by ICP-MS	E102
Water	U	Chemical Oxygen Demand (COD)	Determination using a COD reactor followed by colorimetry	E112
Water	UF	Biological Oxygen Demand (BOD)	Determination using BOD sensors measuring the change of pressure	E133
Water	F	Chloride	Determination of chloride by filtration & analysed by ion chromatography	E109
Water	F	Chromium - Hexavalent	Determination of hexavalent chromium by acidification, addition of 1,5 diphenylcarbazide followed by colorimetry	E116
Water	UF	Cyanide - Complex	Determination of complex cyanide by distillation followed by colorimetry	E115
Water	UF	Cyanide - Free	Determination of free cyanide by distillation followed by colorimetry	E115
Water	UF	Cyanide - Total	Determination of total cyanide by distillation followed by colorimetry	E115
Water	UF	Cyclohexane Extractable Matter (CEM)	Gravimetrically determined through liquid:liquid extraction with cyclohexane	E111
Water	F	Diesel Range Organics (C10 - C24)	Determination of liquid:liquid extraction with hexane followed by GC-FID	E104
Water	F	Dissolved Organic Content (DOC)	Determination of DOC by filtration followed by low heat with persulphate addition followed by IR detection	E110
Water	UF	Electrical Conductivity	Determination of electrical conductivity by electrometric measurement	E123
Water	F	EPH (C10 - C40)	Determination of liquid:liquid extraction with hexane followed by GC-FID	E104
Water	F	EPH TEXAS (C6-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C40)	Determination of liquid:liquid extraction with hexane followed by GC-FID for C8 to C40. C6 to C8 by headspace GC-MS	E104
Water	F	Fluoride	Determination of Fluoride by filtration & analysed by ion chromatography	E109
Water	F	Hardness	Determination of Ca and Mg by ICP-MS followed by calculation	E102
Leachate	F	Leachate Preparation - NRA	Based on National Rivers Authority leaching test 1994	E301
Leachate	F	Leachate Preparation - WAC	Based on BS EN 12457 Pt1, 2, 3	E302
Water	F	Metals	Determination of metals by filtration followed by ICP-MS	E102
Water	F	Mineral Oil (C10 - C40)	Determination of liquid:liquid extraction with hexane followed by GC-FID	E104
Water	F	Nitrate	Determination of nitrate by filtration & analysed by ion chromatography	E109
Water	UF	Monohydric Phenol	Determination of phenols by distillation followed by colorimetry	E121
Water	F	PAH - Speciated (EPA 16)	Determination of PAH compounds by concentration through SPE cartridge, collection in dichloromethane followed by GC-MS	E105
Water	F	PCB - 7 Congeners	Determination of PCB compounds by concentration through SPE cartridge, collection in dichloromethane followed by GC-MS	E108
Water	UF	Petroleum Ether Extract (PEE)	Gravimetrically determined through liquid:liquid extraction with petroleum ether	E111
Water	UF	pH	Determination of pH by electrometric measurement	E107
Water	F	Phosphate	Determination of phosphate by filtration & analysed by ion chromatography	E109
Water	UF	Redox Potential	Determination of redox potential by electrometric measurement	E113
Water	F	Sulphate (as SO ₄)	Determination of sulphate by filtration & analysed by ion chromatography	E109
Water	UF	Sulphide	Determination of sulphide by distillation followed by colorimetry	E118
Water	F	SVOC	Determination of semi-volatile organic compounds by concentration through SPE cartridge, collection in dichloromethane followed by GC-MS	E106
Water	UF	Toluene Extractable Matter (TEM)	Gravimetrically determined through liquid:liquid extraction with toluene	E111
Water	UF	Total Organic Carbon (TOC)	Low heat with persulphate addition followed by IR detection	E110
Water	F	TPH CWG (ali: C5-C6, C6-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C34, aro: C5-C7, C7-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C35)	Determination of liquid:liquid extraction with hexane, fractionating with SPE followed by GC-FID for C8 to C35. C5 to C8 by headspace GC-MS	E104
Water	F	TPH LQM (ali: C5-C6, C6-C8, C8-C10, C10-C12, C12-C16, C16-C35, C35-C44, aro: C5-C7, C7-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C35, C35-C44)	Determination of liquid:liquid extraction with hexane, fractionating with SPE followed by GC-FID for C8 to C44. C5 to C8 by headspace GC-MS	E104
Water	UF	VOCs	Determination of volatile organic compounds by headspace GC-MS	E101
Water	UF	VPH (C6-C8 & C8-C10)	Determination of hydrocarbons C6-C8 by headspace GC-MS & C8-C10 by GC-FID	E101

Key

F Filtered

UF Unfiltered

~ Sample details provided by the customer



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Tel : 01622 850410



List of HWOL Acronyms and Operators

DETS Report No: 24-04917

LK Consult Limited

~Site Reference: Park Hill Avenue, Crumpsall

~Project / Job Ref: LKC 23 1405

~Order No: LKC231405-KR

Reporting Date: 13/05/2024

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

Benzene - HS_1D_MS
Ethylbenzene - HS_1D_MS
MTBE - HS_1D_MS
Mineral Oil (C10 - C40) (BS EN 12457-3) - EH_CU_1D_AL
TPH CWG - Aliphatic >C10 - C12 - EH_CU_1D_AL
TPH CWG - Aliphatic >C12 - C16 - EH_CU_1D_AL
TPH CWG - Aliphatic >C16 - C21 - EH_CU_1D_AL
TPH CWG - Aliphatic >C21 - C34 - EH_CU_1D_AL
TPH CWG - Aliphatic >C5 - C44 - HS_1D_MS+EH_CU_1D_AL
TPH CWG - Aliphatic >C5 - C6 - HS_1D_MS_AL
TPH CWG - Aliphatic >C6 - C8 - HS_1D_MS_AL
TPH CWG - Aliphatic >C8 - C10 - EH_CU_1D_AL
TPH CWG - Aromatic >C10 - C12 - EH_CU_1D_AR
TPH CWG - Aromatic >C12 - C16 - EH_CU_1D_AR
TPH CWG - Aromatic >C16 - C21 - EH_CU_1D_AR
TPH CWG - Aromatic >C21 - C35 - EH_CU_1D_AR
TPH CWG - Aromatic >C5 - C44 - HS_1D_MS+EH_CU_1D_AR
TPH CWG - Aromatic >C5 - C7 - HS_1D_MS_AR
TPH CWG - Aromatic >C7 - C8 - HS_1D_MS_AR
TPH CWG - Aromatic >C8 - C10 - EH_CU_1D_AR
TPH CWG - Total >C5 - C44 - HS_1D_MS+EH_CU_1D_Total
Toluene - HS_1D_MS
Total BTEX (BS EN 12457-3) - HS_1D_MS_Total
m & p-xylene - HS_1D_MS
o-Xylene - HS_1D_MS

Parameter	Matrix Type	Expanded Uncertainty Measurement	Unit
TOC	Soil	12.2	%
Loss on Ignition	Soil	22.9	%
BTEX	Soil	11.2	%
Sum of PCBs	Soil	43.4	%
Mineral Oil	Soil	9.0	%
Total PAH	Soil	18.5	%
pH	Soil	0.335	Units
Acid Neutralisation Capacity	Soil	18.0	%
Clay Content	Soil	15.0	%
Silt Content	Soil	14.0	%
Sand Content	Soil	13.0	%
Loss on Ignition	Soil	22.9	%
pH	Soil	0.335	Units
Carbonate	Soil	12.0	%
Total Nitrogen	Soil	12.0	%
Phosphorus (Extractable)	Soil	24.0	%
Potassium (Extractable)	Soil	20.0	%
Magnesium (Extractable)	Soil	26.0	%
Zinc	Soil	21.6	%
Copper	Soil	18.2	%
Nickel	Soil	24.3	%
Available Sodium	Soil	23.0	%
Available Calcium	Soil	23.0	%
Electrical Conductivity	Soil	10.0	%

Appendix D – Certificates of Analysis (Geotechnical)

Appendix E – Certificates of Analysis (Water)



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M26 2ZS

Normec DETS Limited
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t: 01622 850410

DETS Report No: 24-05759

Site Reference: Park Hill Avenue, Crumpsall

Project / Job Ref: LKC 23 1405

Order No: LKC231405-CB

Sample Receipt Date: 24/05/2024

Sample Scheduled Date: 24/05/2024

Report Issue Number: 1

Reporting Date: 05/06/2024

Authorised by:

Steve Knight
Customer Support Manager

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

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



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Water Analysis Certificate						
DETS Report No: 24-05759	~Date Sampled	22/05/24	22/05/24	22/05/24		
LK Consult Limited	~Time Sampled	None Supplied	None Supplied	None Supplied		
~Site Reference: Park Hill Avenue, Crumpsall	~TP / BH No	CP101	WS103	WS104		
~Project / Job Ref: LKC 23 1405	~Additional Refs	None Supplied	None Supplied	None Supplied		
~Order No: LKC231405-CB	~Depth (m)	None Supplied	None Supplied	None Supplied		
Reporting Date: 05/06/2024	DETS Sample No	717307	717308	717309		

Determinand	Unit	RL	Accreditation	(hs)		(hs)		
pH	pH Units	N/a	ISO17025	7.9	8.1	8.0		
Total Cyanide	ug/l	< 5	ISO17025	6	< 5	< 5		
Free Cyanide	ug/l	< 5	NONE	< 5	< 5	< 5		
Sulphate as SO ₄	mg/l	< 1	ISO17025	50	66	38		
Dissolved Organic Carbon (DOC)	mg/l	<1.0	NONE	14.8	11.5	18.8		
Hardness - Total	mgCaCO ₃ /l	< 0.25	NONE	284	278	446		
Arsenic (dissolved)	ug/l	< 0.2	ISO17025	0.6	0.5	1.6		
Boron (dissolved)	ug/l	< 1	ISO17025	104	86	124		
Cadmium (dissolved)	ug/l	< 0.2	ISO17025	< 0.2	< 0.2	< 0.2		
Chromium (dissolved)	ug/l	< 0.2	ISO17025	1.0	0.9	1.3		
Chromium (hexavalent)	ug/l	< 20	NONE	< 20	< 20	< 20		
Copper (dissolved)	ug/l	< 0.2	ISO17025	1.6	0.9	1.2		
Lead (dissolved)	ug/l	< 0.2	ISO17025	0.3	0.2	0.5		
Mercury (dissolved)	ug/l	< 0.04	ISO17025	< 0.04	< 0.04	< 0.04		
Nickel (dissolved)	ug/l	< 0.2	ISO17025	2.0	18.4	6.1		
Selenium (dissolved)	ug/l	< 0.2	ISO17025	1.1	0.3	0.3		
Vanadium (dissolved)	ug/l	< 0.2	ISO17025	0.9	0.9	1.1		
Zinc (dissolved)	ug/l	< 1	ISO17025	44	60	88		
Calcium (dissolved)	mg/l	< 0.1	ISO17025	88.2	58	118		
Total Phenols (monohydric)	ug/l	< 10	ISO17025	< 10	< 10	< 10		

Subcontracted analysis ^(S)

Insufficient sample ^{I/S}

Unsuitable Sample ^{U/S}

~Sample details provided by customer and can affect the validity of results

(hs) Please note deviating sample due to head space in container



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Water Analysis Certificate - Speciated PAH						
DETS Report No: 24-05759	~Date Sampled	22/05/24	22/05/24	22/05/24		
LK Consult Limited	~Time Sampled	None Supplied	None Supplied	None Supplied		
~Site Reference: Park Hill Avenue, Crumpsall	~TP / BH No	CP101	WS103	WS104		
~Project / Job Ref: LKC 23 1405	~Additional Refs	None Supplied	None Supplied	None Supplied		
~Order No: LKC231405-CB	~Depth (m)	None Supplied	None Supplied	None Supplied		
Reporting Date: 05/06/2024	DETS Sample No	717307	717308	717309		

Determinand	Unit	RL	Accreditation	(hs)		(hs)	
Naphthalene	ug/l	< 0.01	NONE	< 0.01	0.01	< 0.01	
Acenaphthylene	ug/l	< 0.01	NONE	< 0.01	< 0.01	< 0.01	
Acenaphthene	ug/l	< 0.01	NONE	< 0.01	< 0.01	< 0.01	
Fluorene	ug/l	< 0.01	NONE	< 0.01	< 0.01	< 0.01	
Phenanthrene	ug/l	< 0.01	NONE	< 0.01	< 0.01	< 0.01	
Anthracene	ug/l	< 0.01	NONE	< 0.01	< 0.01	< 0.01	
Fluoranthene	ug/l	< 0.01	NONE	< 0.01	< 0.01	< 0.01	
Pyrene	ug/l	< 0.01	NONE	< 0.01	< 0.01	< 0.01	
Benzo(a)anthracene	ug/l	< 0.01	NONE	< 0.01	< 0.01	< 0.01	
Chrysene	ug/l	< 0.01	NONE	< 0.01	< 0.01	< 0.01	
Benzo(b)fluoranthene	ug/l	< 0.01	NONE	< 0.01	< 0.01	< 0.01	
Benzo(k)fluoranthene	ug/l	< 0.01	NONE	< 0.01	< 0.01	< 0.01	
Benzo(a)pyrene	ug/l	< 0.01	NONE	< 0.01	< 0.01	< 0.01	
Indeno(1,2,3-cd)pyrene	ug/l	< 0.01	NONE	< 0.01	< 0.01	< 0.01	
Dibenz(a,h)anthracene	ug/l	< 0.01	NONE	< 0.01	< 0.01	< 0.01	
Benzo(ghi)perylene	ug/l	0.008	NONE	< 0.008	< 0.008	< 0.008	
Total EPA-16 PAHs	ug/l	< 0.16	NONE	< 0.16	< 0.16	< 0.16	

~Sample details provided by customer and can affect the validity of results



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Water Analysis Certificate - TPH CWG Banded						
DETS Report No: 24-05759	~Date Sampled	22/05/24	22/05/24	22/05/24		
LK Consult Limited	~Time Sampled	None Supplied	None Supplied	None Supplied		
~Site Reference: Park Hill Avenue, Crumpsall	~TP / BH No	CP101	WS103	WS104		
~Project / Job Ref: LKC 23 1405	~Additional Refs	None Supplied	None Supplied	None Supplied		
~Order No: LKC231405-CB	~Depth (m)	None Supplied	None Supplied	None Supplied		
Reporting Date: 05/06/2024	DETS Sample No	717307	717308	717309		

Determinand	Unit	RL	Accreditation	(hs)		(hs)	
Aliphatic >C5 - C6 : HS 1D MS AL	ug/l	< 10	NONE	< 10	< 10	< 10	
Aliphatic >C6 - C8 : HS 1D MS AL	ug/l	< 10	NONE	< 10	< 10	< 10	
Aliphatic >C8 - C10 : EH CU 1D AL	ug/l	< 10	NONE	< 10	< 10	< 10	
Aliphatic >C10 - C12 : EH CU 1D AL	ug/l	< 10	NONE	< 10	< 10	< 10	
Aliphatic >C12 - C16 : EH CU 1D AL	ug/l	< 10	NONE	< 10	< 10	< 10	
Aliphatic >C16 - C21 : EH CU 1D AL	ug/l	< 10	NONE	< 10	< 10	< 10	
Aliphatic >C21 - C34 : EH CU 1D AL	ug/l	< 10	NONE	< 10	< 10	< 10	
Aliphatic >C34 - C44 : EH CU 1D AL	ug/l	< 10	NONE	< 10	< 10	< 10	
Aliphatic (C5 - C44) : HS 1D MS+EH CU 1D AL	ug/l	< 70	NONE	< 70	< 70	< 70	
Aromatic >C5 - C7 : HS 1D MS AR	ug/l	< 10	NONE	< 10	< 10	< 10	
Aromatic >C7 - C8 : HS 1D MS AR	ug/l	< 10	NONE	< 10	< 10	< 10	
Aromatic >C8 - C10 : EH CU 1D AR	ug/l	< 10	NONE	< 10	< 10	< 10	
Aromatic >C10 - C12 : EH CU 1D AR	ug/l	< 10	NONE	< 10	< 10	< 10	
Aromatic >C12 - C16 : EH CU 1D AR	ug/l	< 10	NONE	< 10	< 10	< 10	
Aromatic >C16 - C21 : EH CU 1D AR	ug/l	< 10	NONE	< 10	< 10	< 10	
Aromatic >C21 - C35 : EH CU 1D AR	ug/l	< 10	NONE	< 10	< 10	< 10	
Aromatic >C35 - C44 : EH CU 1D AR	ug/l	< 10	NONE	< 10	< 10	< 10	
Aromatic (C5 - C44) : HS 1D MS+EH CU 1D AR	ug/l	< 70	NONE	< 70	< 70	< 70	
Total >C5 - C44 : HS 1D MS+EH CU 1D Total	ug/l	< 140	NONE	< 140	< 140	< 140	

~Sample details provided by customer and can affect the validity of results
(hs) Please note deviating sample due to head space in container



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Water Analysis Certificate - BTEX / MTBE						
DETS Report No: 24-05759	~Date Sampled	22/05/24	22/05/24	22/05/24		
LK Consult Limited	~Time Sampled	None Supplied	None Supplied	None Supplied		
~Site Reference: Park Hill Avenue, Crumpsall	~TP / BH No	CP101	WS103	WS104		
~Project / Job Ref: LKC 23 1405	~Additional Refs	None Supplied	None Supplied	None Supplied		
~Order No: LKC231405-CB	~Depth (m)	None Supplied	None Supplied	None Supplied		
Reporting Date: 05/06/2024	DETS Sample No	717307	717308	717309		

Determinand	Unit	RL	Accreditation	(hs)		(hs)	
Benzene : HS 1D MS	ug/l	< 1	ISO17025	< 1	< 1	< 1	
Toluene : HS 1D MS	ug/l	< 5	ISO17025	< 5	< 5	< 5	
Ethylbenzene : HS 1D MS	ug/l	< 5	ISO17025	< 5	< 5	< 5	
p & m-xylene : HS 1D MS	ug/l	< 10	ISO17025	< 10	< 10	< 10	
o-xylene : HS 1D MS	ug/l	< 5	ISO17025	< 5	< 5	< 5	
MTBE : HS 1D MS	ug/l	< 10	ISO17025	< 10	< 10	< 10	

~Sample details provided by customer and can affect the validity of results

(hs) Please note deviating sample due to head space in container



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Water Analysis Certificate - Methodology & Miscellaneous Information

DETS Report No: 24-05759

LK Consult Limited

~Site Reference: Park Hill Avenue, Crumpsall

~Project / Job Ref: LKC 23 1405

~Order No: LKC231405-CB

Reporting Date: 05/06/2024

Matrix	Analysed On	Determinand	Brief Method Description	Method No
Water	UF	Alkalinity	Determination of alkalinity by titration against hydrochloric acid using bromocresol green as the end point	E103
Water	F	Ammoniacal Nitrogen	Determination of ammoniacal nitrogen by discrete analyser.	E126
Water	UF	BTEX	Determination of BTEX by headspace GC-MS	E101
Water	F	Cations	Determination of cations by filtration followed by ICP-MS	E102
Water	U	Chemical Oxygen Demand (COD)	Determination using a COD reactor followed by colorimetry	E112
Water	UF	Biological Oxygen Demand (COD)	Determination using BOD sensors measuring the change of pressure	E133
Water	F	Chloride	Determination of chloride by filtration & analysed by ion chromatography	E109
Water	F	Chromium - Hexavalent	Determination of hexavalent chromium by acidification, addition of 1,5 diphenylcarbazide followed by	E116
Water	UF	Cyanide - Complex	Determination of complex cyanide by distillation followed by colorimetry	E115
Water	UF	Cyanide - Free	Determination of free cyanide by distillation followed by colorimetry	E115
Water	UF	Cyanide - Total	Determination of total cyanide by distillation followed by colorimetry	E115
Water	UF	Cyclohexane Extractable Matter (CEM)	Gravimetrically determined through liquid:liquid extraction with cyclohexane	E111
Water	F	Diesel Range Organics (C10 - C24)	Determination of liquid:liquid extraction with hexane followed by GC-FID	E104
Water	F	Dissolved Organic Content (DOC)	Determination of DOC by filtration followed by low heat with persulphate addition followed by IR dete	E110
Water	UF	Electrical Conductivity	Determination of electrical conductivity by electrometric measurement	E123
Water	F	EPH (C10 - C40)	Determination of liquid:liquid extraction with hexane followed by GC-FID	E104
Water	F	EPH TEXAS (C6-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C40)	Determination of liquid:liquid extraction with hexane followed by GC-FID for C8 to C40. C6 to C8 by headspace GC-MS	E104
Water	F	Fluoride	Determination of Fluoride by filtration & analysed by ion chromatography	E109
Water	F	Hardness	Determination of Ca and Mg by ICP-MS followed by calculation	E102
Leachate	F	Leachate Preparation - NRA	Based on National Rivers Authority leaching test 1994	E301
Leachate	F	Leachate Preparation - WAC	Based on BS EN 12457 Pt1, 2, 3	E302
Water	F	Metals	Determination of metals by filtration followed by ICP-MS	E102
Water	F	Mineral Oil (C10 - C40)	Determination of liquid:liquid extraction with hexane followed by GI-FID	E104
Water	F	Nitrate	Determination of nitrate by filtration & analysed by ion chromatography	E109
Water	UF	Monohydric Phenol	Determination of phenols by distillation followed by colorimetry	E121
Water	F	PAH - Speciated (EPA 16)	Determination of PAH compounds by concentration through SPE cartridge, collection in dichloromethane followed by GC-MS	E105
Water	F	PCB - 7 Congeners	Determination of PCB compounds by concentration through SPE cartridge, collection in dichloromethane followed by GC-MS	E108
Water	UF	Petroleum Ether Extract (PEE)	Gravimetrically determined through liquid:liquid extraction with petroleum ether	E111
Water	UF	pH	Determination of pH by electrometric measurement	E107
Water	F	Phosphate	Determination of phosphate by filtration & analysed by ion chromatography	E109
Water	UF	Redox Potential	Determination of redox potential by electrometric measurement	E113
Water	F	Sulphate (as SO4)	Determination of sulphate by filtration & analysed by ion chromatography	E109
Water	UF	Sulphide	Determination of sulphide by distillation followed by colorimetry	E118
Water	F	SVOC	Determination of semi-volatile organic compounds by concentration through SPE cartridge, collection in dichloromethane followed by GC-MS	E106
Water	UF	Toluene Extractable Matter (TEM)	Gravimetrically determined through liquid:liquid extraction with toluene	E111
Water	UF	Total Organic Carbon (TOC)	Low heat with persulphate addition followed by IR detection	E110
Water	F	TPH CWG (ali: C5-C6, C6-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C34, aro: C5-C7, C7-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C35)	Determination of liquid:liquid extraction with hexane, fractionating with SPE followed by GC-FID for C8 to C35. C5 to C8 by headspace GC-MS	E104
Water	F	TPH LQM (ali: C5-C6, C6-C8, C8-C10, C10-C12, C12-C16, C16-C35, C35-C44, aro: C5-C7, C7-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C35, C35-C44)	Determination of liquid:liquid extraction with hexane, fractionating with SPE followed by GC-FID for C8 to C44. C5 to C8 by headspace GC-MS	E104
Water	UF	VOCs	Determination of volatile organic compounds by headspace GC-MS	E101
Water	UF	VPH (C6-C8 & C8-C10)	Determination of hydrocarbons C6-C8 by headspace GC-MS & C8-C10 by GC-FID	E101

Key

F Filtered
UF Unfiltered

~Sample details provided by customer and can affect the validity of results



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List of HWOL Acronyms and Operators

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

Benzene - HS_1D_MS
Ethylbenzene - HS_1D_MS
MTBE - HS_1D_MS
TPH - Aliphatic >C34 - C44 - raw data - EH_CU_1D_AL
TPH CWG - Aliphatic >C10 - C12 - EH_CU_1D_AL
TPH CWG - Aliphatic >C12 - C16 - EH_CU_1D_AL
TPH CWG - Aliphatic >C16 - C21 - EH_CU_1D_AL
TPH CWG - Aliphatic >C21 - C34 - EH_CU_1D_AL
TPH CWG - Aliphatic >C34 - C44 - EH_CU_1D_AL
TPH CWG - Aliphatic >C5 - C44 - HS_1D_MS+EH_CU_1D_AL
TPH CWG - Aliphatic >C5 - C6 - HS_1D_MS_AL
TPH CWG - Aliphatic >C6 - C8 - HS_1D_MS_AL
TPH CWG - Aliphatic >C8 - C10 - EH_CU_1D_AL
TPH CWG - Aromatic >C10 - C12 - EH_CU_1D_AR
TPH CWG - Aromatic >C12 - C16 - EH_CU_1D_AR
TPH CWG - Aromatic >C16 - C21 - EH_CU_1D_AR
TPH CWG - Aromatic >C21 - C35 - EH_CU_1D_AR
TPH CWG - Aromatic >C35 - C44 - EH_CU_1D_AR
TPH CWG - Aromatic >C5 - C44 - HS_1D_MS+EH_CU_1D_AR
TPH CWG - Aromatic >C5 - C7 - HS_1D_MS_AR
TPH CWG - Aromatic >C7 - C8 - HS_1D_MS_AR
TPH CWG - Aromatic >C8 - C10 - EH_CU_1D_AR
TPH CWG - Total >C5 - C44 - HS_1D_MS+EH_CU_1D_Total
Toluene - HS_1D_MS
m & p-xylene - HS_1D_MS
o-Xylene - HS_1D_MS

Appendix F – Gas Monitoring Results

	LK CONSULT LTD	Site Details		Monitoring Visit Conditions		Visit No.
	GAS MONITORING RECORD	Site Name	Parkhill Avenue, Crumpsall	Recent Weather	Sunny	1
		Job Number	LKC 23 1405	Ground Conditions	Dry	of
		Engineer	LGD	Approx. Air temperature (°C)	20	6
		Date	10/05/2024	Atmospheric Pressure (Prev. 24 hrs)	Steady	

Site Monitoring Visit Details	BH Ref.	CP101	WS101	WS102	WS103	WS104											
	Time	13:14:35	13:03:19	13:54:15	14:04:35	14:18:17											
	Barometric Pressure (mb)	1015	1015	1016	1016	1017											
	Relative Pressure (mb)	-5.71	-5.07	-6.7	-10.58	-3.99											
Gas and Groundwater Monitoring Data	Internal Flow ³ (l/hr)	0	0	0	0	0											
	Peak Flow (l/hr)	0	0	0	0	0											
	Steady CH ₄ (%v/v)	0	0	0	0	0											
	Peak CH ₄ (%v/v)	0	0	0	0	0											
	% LEL ²	0	0	0	0	0											
	Steady CO ₂ (%v/v)	1.9	1.6	2.8	6.6	2.5											
	Peak CO ₂ (%v/v)	1.9	1.6	2.8	6.6	3.4											
	Steady O ₂ (%v/v)	17.5	18.3	17.3	11.2	15.4											
	Min O ₂ (%v/v)	17.5	18.3	17.3	11.2	13.3											
	Balance (%)	80.6	80.1	79.9	82.2	82.1											
	Steady CO (ppm)	2	2	3	5	4											
	Peak CO (ppm)	3	2	1	6	5											
	Steady H ₂ S (ppm)	0	1	0	1	0											
	Peak H ₂ S (ppm)	0	1	0	1	0											
	Steady PID (ppm)	0	0.1	0	0	0											
	Max PID (ppm)	0.1	0.3	0.1	0	0.1											
	Standing Water Level (mbgl)	7.2	Dry	Dry	3.18	3.1											
	Installation Base Depth (mbgl)	14.9	4.9	1.96	5.2	4.5											
	Response Zone/Strata	16	9.6	17	17	15											
	Comments	0	0	0	0	0											
Equipment							ABBREVIATIONS							NOTES			
Gas Machine	Gas Analyser GA5000						ND	Not detected		ppm	Parts per million		All monitoring is carried out in line with LK Consult Ltd procedures, with reference to CIRIA C665. ¹Equipment is serviced and checked as recommended by the manufacturer. Refer to calibration records and service certificates. ²CH4 is explosive between the range of 5-15%v/v. 100% lower explosive limit is equal to 5%v/v CH4. ³Flow readings are based on steady 1 minute value where flow is detected (equipment range of +/- 12 ltr/hr).				
	G502417						NR	Not recorded		mb	Millibars						
Dipmeter	HydroTechnik						UR	Unable to record		l/hr	Litres per hour						
	HT-03						OS	Off recordable scale		mbgl	Metres below ground level						
PID	0						N/A	Not applicable		LEL	Lower explosive limit in air						
	0																

	LK CONSULT LTD	Site Details		Monitoring Visit Conditions		Visit No. 2 of 6
	GAS MONITORING RECORD	Site Name	Parkhill Avenue, Crumpsall	Recent Weather	Heavy rain, light wind, cool.	
		Job Number	LKC 23 1405	Ground Conditions	Wet	
		Engineer	JW	Approx. Air temperature (°C)	12	
		Date	00/01/1900	Atmospheric Pressure (Prev. 24 hrs)	Falling	

Site Monitoring Visit Details	BH Ref.	CP101	WS101	WS102	WS103	WS104											
	Time	12:54:11	13:27:56	13:39:30	14:13:30	13:50:10											
	Barometric Pressure (mb)	996	996	996	996	996											
	Relative Pressure (mb)	-3.6	-6.52	-5.57	-4.68	-4.58											
Gas and Groundwater Monitoring Data	Internal Flow³ (l/hr)	0	0	0	0	0											
	Peak Flow (l/hr)	0	0	0	0	0											
	Steady CH₄ (%v/v)	0	0	0	0	0											
	Peak CH₄ (%v/v)	0.1	0.1	0	0.1	0.1											
	% LEL²	0	0	0	0	0											
	Steady CO₂ (%v/v)	5.6	2.7	6.5	6.3	11											
	Peak CO₂ (%v/v)	5.6	2.7	6.6	6.4	11											
	Steady O₂ (%v/v)	16.1	18.7	15.2	11	4.8											
	Min O₂ (%v/v)	16.1	18.7	15.2	11	4.8											
	Balance (%)	78.3	78.6	78.3	82.7	84.2											
	Steady CO (ppm)	2	1	1	1	1											
	Peak CO (ppm)	4	1	1	3	6											
	Steady H₂S (ppm)	0	0	0	0	0											
	Peak H₂S (ppm)	0	0	0	0	0											
	Steady PID (ppm)	NR	NR	NR	NR	NR											
	Max PID (ppm)	NR	NR	NR	NR	NR											
	Standing Water Level (mbgl)	7.24	Dry	Dry	3.28	3.39											
	Installation Base Depth (mbgl)	14.23	4.87	4.92	4.47	5.16											
	Response Zone/Strata	0	0	0	0	0											
	Comments	0	0	0	0	0											
Equipment							ABBREVIATIONS						NOTES				
Gas Machine	Gas Analyser GA5000						ND	Not detected		ppm	Parts per million		All monitoring is carried out in line with LK Consult Ltd procedures, with reference to CIRIA C665. ¹Equipment is serviced and checked as recommended by the manufacturer. Refer to calibration records and service certificates. ²CH4 is explosive between the range of 5-15%v/v. 100% lower explosive limit is equal to 5%v/v CH4. ³Flow readings are based on steady 1 minute value where flow is detected (equipment range of +/- 12 ltr/hr).				
	G502417						NR	Not recorded		mb	Millibars						
Dipmeter	Geotech Oil-in-Water Interface Meter						UR	Unable to record		l/hr	Litres per hour						
	HT-01						OS	Off recordable scale		mbgl	Metres below ground level						
PID	-						N/A	Not applicable		LEL	Lower explosive limit in air						
	-																

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	N/A	180	180	230	980	230	3,400	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(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 _{resi}	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)	LQM S4UL
		6%	660	3,900	120	180,000 (4,360) ^{vap}	56,000	100,000 (4,360)	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)	LQM S4UL
		6%	260	440	91	27,000 (2,840) ^{vap}	25,000	27,000 (2,840)	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)	LQM S4UL
		6%	320	450	170	31,000 (3,460) ^{vap}	43,000	32,000 (3,460)	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 Hydrocarbons	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	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	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	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 _{resi}	POS _{park}	Source
Chloalkanes 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)	LQM S4UL
	Trichloroethane (TCA)	2.5%	18	18	110	1,300	140,000	76,000 (2,915)	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
	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
	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
	Endosulfanns (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 ^g	94	0.13 ^g	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%	280	750	66	760 ^{dir} (31,000)	760 ^{dir} (11,000)	760 ^{dir} (8,600)	LQM S4UL
		2.5%	550	1,300	140	1,500 ^{dir} (35,000)	1,500 ^{dir}	1,500 ^{dir} (9,700)	LQM S4UL
		6%	1,100	2,300	280	3,200 ^{dir} (37,000)	3,200 ^{dir}	3,200 ^{dir} (11,000)	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									

Appendix H – References

- ¹ CIRIA, January 2001, "Contaminated land risk assessment. A guide to good practice", C552.
- ⁵ The British Standards Institution (BSI Standards), March 2018, "Geotechnical investigation and testing. Identification and classification of soil - Part 1: Identification and description", BS EN ISO 14688-1:2018.
- ⁶ The British Standards Institution (BSI Standards), May 2020, "Code of practice for ground investigations", BS 5930:2015+A1:2020.
- ⁷ CIRIA, December 2007, "Assessing risks posed by hazardous ground gases to buildings", C665.
- ⁸ Environment Agency, 2000, "Technical Aspects of Site Investigation", Technical Report P5-065/TR, Volumes I and II, Text Supplements.
- ⁹ CIRIA, December 2007, "Assessing risks posed by hazardous ground gases to buildings", C665.
- ¹⁰ The British Standards Institution (BSI Standards), May 2020, "Code of practice for ground investigations", BS 5930:2015+A1:2020.
- ¹¹ The British Standards Institution (BSI Standards), May 2009, "Water quality. Sampling - Guidance on sampling of groundwaters", BS ISO 5667-11:2009.
- ¹² The British Standards Institution (BSI Standards), December 2017, "Investigation of potentially contaminated sites - Code of practice", BS 10175:2011+A2:2017.
- ¹⁴ CIRIA, December 2007, "Assessing risks posed by hazardous ground gases to buildings", C665.
- ²⁰ European Commission, 2004 & 2007, "Eurocode 7: Geotechnical Design – Part 1 – General rules" & "Part 2: Ground investigation and testing", EN 1997-1:2004 & EN 1997-2:2007.
- ²¹ Highways England, 1998, "Specification for Highway Works. Site clearance", Volume 1, Series 200.
- ²² CIRIA, 2001, "Trenching practice", REP R 97, 2nd Edition.
- ²³ CIRIA, 2001, "Trenching practice", REP R 97, 2nd Edition.
- ²⁴ Environment Agency, October 2020, "Land contamination risk management (LCRM). How to assess and manage the risks from land contamination".
- ²⁵ DEFRA, December 2014, "Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination", SP1010, Policy Companion Document.
- ²⁶ CL:AIRE, September 2014, "Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination", SP1010, Final Project Report (Revision 2).
- ²⁷ Environment Agency, January 2009, "Updated technical background to the CLEA model", Science Report SC050021/SR3.
- ²⁸ Environment Agency, January 2009, "Human health toxicological assessment of contaminants in soil", Science Report - Final SC050021/SR2.
- ²⁹ Environment Agency, January 2009, "A review of body weight and height data used within the Contaminated Land Exposure Assessment model (CLEA)", Project SC050021/Final Technical Review 1.
- ³⁰ Environment Agency, November 2008, "Compilation of data for priority organic pollutants for derivation of Soil Guideline Values", Science Report SC050021/SR7.
- ³¹ Environment Agency, September 2009, "CLEA Software (Version 1.05) Handbook", Science Report SC050021/SR4.
- ³² Environment Agency, April 2002, "Contaminants in soils: collation of toxicological data and intake values for humans. Benzo(a)pyrene", TOX2.
- ³³ U.S. Environmental Protection Agency, September 1984, "Health Effects Assessment for Polycyclic Aromatic Hydrocarbons (PAHs)", EPA/540/1-86/013.
- ³⁴ Environment Agency, September 2003, "Review of the Fate and Transport of Selected Contaminants in the Soil Environment", Draft Technical Report P5-079/TR1.
- ³⁵ CL:AIRE, September 2014, "Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination", SP1010, Final Project Report (Revision 2).
- ³⁶ Public Health England, September 2017, "Contaminated land information sheet: risk assessment approaches for polycyclic aromatic hydrocarbons (PAHs)".
- ³⁷ Culp S.J., Gaylor D.W., Sheldon W.G., Goldstein L.S., Beland F.A., January 1998, "A comparison of the tumors induced by coal tar and benzo(a)pyrene in a 2-year bioassay", Carcinogenesis, Volume 19, P117-124.
- ⁴² CIRIA, December 2007, "Assessing risks posed by hazardous ground gases to buildings", C665.
- ⁴³ The British Standards Institution (BSI Standards), January 2019, "Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings", BS 8485:2015+A1:2019.
- ⁴⁴ CIRIA, December 2007, "Assessing risks posed by hazardous ground gases to buildings", C665.
- ⁴⁵ CIRIA, December 2007, "Assessing risks posed by hazardous ground gases to buildings", C665.
- ⁴⁶ DEFRA, 2010, "The River Basin Districts Typology, Standards and Groundwater threshold values (Water Framework Directive) (England and Wales) Directions 2010".
- ⁴⁷ DEFRA, 2015, "The Water Framework Directive (Standards and Classification) Directions (England and Wales) 2015".
- ⁴⁸ Statutory Instruments, 2016, "Private Water Supplies (England) Regulations 2016", No. 618.
- ⁴⁹ Environment Agency, May 2002, "Environment Agency technical advice to third parties on Pollution of Controlled Waters for Part IIA of the Environmental Protection Act 1990", Version 2.
- ⁵⁰ Scottish Environmental Protection Agency (SEPA), August 2014, "Assigning Groundwater Assessment Criteria for Pollutant Inputs", Position Statement (WAT-PS-10-01), Version v3.0.

⁵¹ CL:AIRE, March 2017, "Petroleum Hydrocarbons in Groundwater: Guidance on assessing petroleum hydrocarbons using existing hydrogeological risk assessment methodologies", Version 1.1.

⁵² Building Research Establishment (BRE), June 2005, "Concrete in Aggressive Ground", SD1.

⁵³ Environment Agency, April 2021, "Land contamination risk management (LCRM). Stage 3 remediation and verification".

⁵⁴ CIRIA, January 2001, "Contaminated land risk assessment. A guide to good practice", C552.

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