

Redby Street, Manchester

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

Job Number: LKC 22 1260

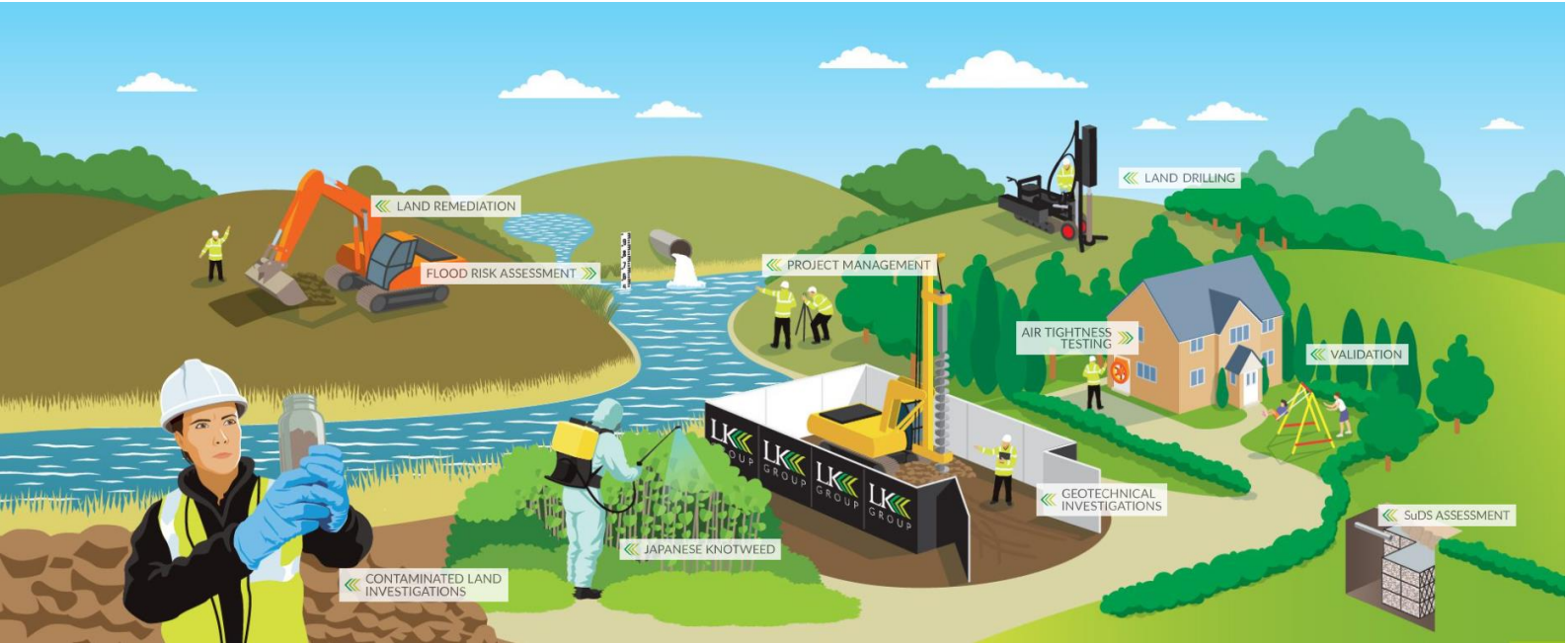
Date: March 2024

Client: Create It Studios Ltd



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DOCUMENT QUALITY ASSURANCE

Site Address	Redby street, Manchester, M11 2NP
Report Title	Phase 2 Geo-Environmental Investigation, Risk Assessment and Remediation Strategy
Job Number	LKC 22 1260
Client	Create It Studios Ltd

Revision	0	Date of Issue	14/03/24
Document Ref:	LKC22 1260 -B1-GI-Redby Street, Manchester R0		
Status	Final		
Written By	Beth Ryder-Humphries & Chris Whale		
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EXECUTIVE SUMMARY

Site Details

Location	Site located either side of Redby Street, between Ashton Old Road and Whitworth Street. Centred at approximate National Grid Reference 387820E, 397420N.
Area	2,800m ² .
Topography	61 metres Above Ordnance Datum (AOD). Site is approximately level. Slight slope present in the NW, sloping down towards Ashton Old Road. Embankments on the W and E side of Redby Street, and southern boundary of the site.
Current Site Use	Site is currently a disused parcel of land. Includes Redby Street located in the east of the site orientated NNE-SSW, and grassed areas to the E and W of the road. Disused car park located in the western area of the site.
Proposed Development	Primary school / nursery: 3-storey vocational learning centre with car park, grassed areas and play areas.

Site Setting

Main Historical Features	Onsite: field boundary, residential housing, well, railway line, / tramway, instrument works, car park. Surrounding Area: engineering works / warehouses, unspecified works, vehicle repair garage, public baths, clay pit, ponds, graveyard, brick works.
Geology / Hydrogeology	Artificial: No BGS recorded artificial. Superficial: Glacial Till. Secondary Undifferentiated Aquifer. Bedrock: Chester Formation (sandstone). Principal Aquifer.
Landfills / Infilled Ground	No recorded landfills. Potentially infilled ground identified.
Site Reconnaissance	Site is open to public. Vehicular access limited by earth bunds (blocking access from the north and south of Redby Street, and along the south-western boundary) and brambles are removed. Vegetation present across the majority of site. A cobbled road (Redby Street) is located in the east of the site with railway / tram lines present through the centre of the road. Car park present in the western area of the site (tarmac, moderate / poor condition). Fly tipping (wood, plastic bottles and food wrapping, glass bottles, ceramic, metal tins and old clothes) observed across the entire site. Embankments are present on the western and eastern sides of Redby Street, and adjacent to the southern and north-western boundaries of the site. No evidence of contamination identified.
Recommendations	Site Investigation was recommended to further assess geo-environmental risk.

Ground Investigation Work Undertaken

Date of Investigation:	13 th of February 2024.
Intrusive Investigation Work Undertaken:	4no. window sample boreholes. 1no. hand excavated trial pit. Contamination and geotechnical testing.

Ground Conditions

Made Ground	Made ground was recorded in all boreholes to depths of 0.60-2.30mbgl. The made ground comprised horizons of gravel, sand, silt, clay with anthropogenic material including ash, brick fragments, whole bricks, clinker, metal and glass.
Superficial	Superficial strata comprised horizons of firm to stiff clay, becoming very stiff with depth to >5.00mbgl
Bedrock	None encountered.
Groundwater	0.50mbgl (WS101) – noted to be perched.
Obstructions	None identified during site works.

Geotechnical Assessment

Allowable Bearing Pressure	150kN/m ² has been calculated using a Factor of Safety of 3 and an undrained shear strength of 75kN/m ² in the natural clay strata at 0.60-2.30mbgl.
Anticipated Foundation Type	Strip foundations should be constructed at least 150mm into the underlying stiff clay. As an alternative, consideration may be given to the use of mini-piled foundations to transfer loadings through the Made Ground and into the Glacial Till at depth.
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.

Contamination Risk Assessment

PL	Contaminant	Risk	Recommendations
1	ACM, heavy metals, PAH's, Herbicides (no elevations identified).	Low	No remediation recommended.
	Petroleum hydrocarbons inorganic and organic contaminants (no elevations identified).		
2	Volatile Contaminants (no elevations identified).	Low	No remediation recommended.
3	Carbon dioxide / Methane.	Moderate / Low	No remediation recommended.
4	Groundwater (mobile contaminants – no elevations identified).	Low	No remediation recommended.
5	Organic contaminants (no elevations identified).	Low	No remediation (i.e. barrier pipe) likely to be required. UURA required.

PL	Recommendation
1	No remediation required.
2	No remediation required.
3	No remediation required.
4	No remediation required.
5	No remediation (i.e. barrier pipe) likely to be required. UURA required.

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Appendix E – Generic Assessment Criteria Values

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1. Introduction

1.1. Background

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

The following work has previously been undertaken:

- Preliminary Risk Assessment (PRA) report, undertaken by LKC (Ref: LKC 22 1260, dated June 2022).

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

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

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

Location	Site located between Ashton Old Road and Whitworth Street. Centred at approximate National Grid Reference 387820E, 397420N.
Area	2,800m ² .
Topography	61 metres Above Ordnance Datum (AOD). Site is approximately level. Slight slope present in the NW, sloping down towards Ashton Old Road. Embankments on the W and E side of Redby Street, and southern boundary of the site.
Current Site Use	Site is currently a disused parcel of land. Includes Redby Street located in the east of the site orientated NNE-SSW, and grassed areas to the E and W of the road. Disused car park located in the western area of the site.
Proposed Development	Primary school / nursery: 3-storey vocational learning centre with car park, grassed areas and play areas.

Table 1-1: Summary of site details.

2. Summary of Preliminary Risk Assessment (PRA)

2.1. Phase 1 Preliminary Risk Assessment (PRA)

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

Main Historical Features	Onsite: field boundary, residential housing, well, railway line, / tramway, instrument works, car park. Surrounding Area: engineering works / warehouses, unspecified works, vehicle repair garage, public baths, clay pit, ponds, graveyard, brick works.
Geology / Hydrogeology	Artificial: No BGS recorded artificial. Superficial: Glacial Till. Secondary Undifferentiated Aquifer. Bedrock: Chester Formation (sandstone). Principal Aquifer.
Landfills / Infilled Ground	No recorded landfills. Potentially infilled ground identified.
Site Reconnaissance	Site is open to public. Vehicular access limited by earth bunds (blocking access from the north and south of Redby Street, and along the south-western boundary) and brambles are removed. Vegetation present across the majority of site. A cobbled road (Redby Street) is located in the east of the site with railway / tram lines present through the centre of the road. Car park present in the western area of the site (tarmac, moderate / poor condition). Fly tipping (wood, plastic bottles and food wrapping, glass bottles, ceramic, metal tins and old clothes) observed across the entire site. Embankments are present on the western and eastern sides of Redby Street, and adjacent to the southern and north-western boundaries of the site. No evidence of contamination identified.

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

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

Coal Mining	Site is not within a Development High Risk Area. No further assessment required.
Slope Stability	Site is relatively flat. No significant slope stability risk anticipated. No further assessment required.
Made Ground	Unknown depth and constituent of made ground across the site. Possible in-ground structures from previous developments. Potentially infilled cellars present in west of site. Unlikely to be a suitable founding strata unless engineering work is undertaken.
Superficial	Unknown strength of soils for foundation design. Clay anticipated below the site.
Bedrock	Unknown depth to bedrock.
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.
Field boundaries	Possible former hedges / trees / ditch resulting in increased likelihood of roots, organic material, shallow made ground.

Table 2-2: Summary of geotechnical constraints.

2.2. Conceptual Model

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

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

PL	Pathway	Receptor	Contaminants of Concern (CoC)	Probability	Consequence	Risk	Recommendations
1	- Dermal contact. - Inhalation of soil, fibres and dust. - Ingestion of soils, dust. - Windblown dust.	- Future site users. - Offsite receptors.	- ACM. - Heavy metals. - PAHs.	Likely (given site history, site conditions and proposed end use)	Medium	Moderate	Intrusive investigation required. Soil analysis of CoC.
			- Petroleum hydrocarbons, inorganic and organic contaminants.	Low Likelihood (given site history, site conditions and proposed end use)	Medium	Moderate / Low (moderate assumed until ground conditions confirmed)	Intrusive investigation required. Soil analysis of CoC, subject to ground conditions encountered.
			- Herbicides	Likely (given site history, site conditions and proposed end use)	Medium	Moderate	Intrusive investigation required. Soil analysis of CoC.
2	- Inhalation of vapours. - Migration via permeable strata and preferential pathways.	- Future site users. - Offsite receptors.	- Volatile contaminants (TPHCWG, SVOC, VOCs).	Low Likelihood (given site history)	Medium	Moderate / Low (moderate assumed until ground conditions confirmed)	Intrusive investigation required, to include PID testing. Soil analysis of CoC, subject to ground conditions encountered and PID testing.
3	- Inhalation of gas. - Migration via permeable strata and preferential pathways. - Explosion in confined spaces. - Exposure to radon.	- Future site users. - Buildings. - Offsite land users.	- Hazardous gas (carbon dioxide, methane).	Low Likelihood (given potential gas source)	Severe	Moderate	Intrusive investigation to confirm ground conditions. If significant gas source and pathway identified, gas monitoring or gas protection measures required.
4	- Surface run-off. - Migration via permeable strata and preferential pathways. - Perched waters migration.	- Groundwater (Secondary & Principal Aquifers).	- Mobile contaminants such as metals, PAHs, hydrocarbons, volatile compounds.	Low Likelihood (possible mobile contamination anticipated with limited pathway)	Medium	Moderate / Low (moderate assumed until ground conditions confirmed)	Intrusive investigation required. Groundwater sampling, subject to ground conditions encountered. Analysis of CoC.
	- Ingestion of tainted water supply.	- Future site users. - Water pipes.	- Organic contaminants such as petroleum hydrocarbons, naphthalene, volatile compounds.	Low Likelihood (given site history, site conditions)	Medium	Moderate / Low (moderate risk assumed until ground conditions confirmed)	Intrusive investigation required. Soil analysis of CoC, subject to ground conditions encountered.

Table 2-3: Preliminary Contamination Conceptual Model.

3. Ground Investigation

3.1. Site Investigation Design and Methodology

The investigation was carried out on 13th of February 2024 and comprised the following:

- 4no. window sample boreholes drilled to 4.15-5.45 metres below ground level (mbgl) (ref. WS101 to WS104).
- 1no. hand pit (using spade) excavated to 0.60mbgl (ref. HD101).
- 2no. Follow on Dynamic probe tests to 9.27 & 10.00mbgl (Ref. WS101-DP & WS103-DP).

All site investigation locations are shown in Figure 3.

The locations were chosen to allow adequate assessment of ground conditions across the site. Table 3-1 details the site investigation locations.

Site Investigation Locations	Rationale
WS103. HD101	Targeting former works building / chapel.
WS101 (inc DP), WS103 (inc DP), WS104	To aid foundation design for proposed building (geotechnical).
WS104	Targeting former railway land.
WS102	General site coverage.

Table 3-1: Summary of Sampling Locations.

Access to parts of site with rig were restricted by dense vegetation, therefore the planned fifth window sample borehole was replaced with a hand excavated trial pit.

The number of site investigation points corresponds to approximately one location per 23.7m square centres. This is considered to be a conservative sampling density and is in line with BS10175³ for a 'detailed investigation'.

All profile logs are provided in Appendix B and are in line with BS14688-1⁴ and BS5930⁵.

3.2. Well Installations

3no. (WS101, WS103 & WS104) of the boreholes were installed with monitoring wells for gas and groundwater monitoring. Monitoring wells were installed in accordance with BS10175 and CIRIA C665⁶ 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 investigation⁷.

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 C665⁸ 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 3-2 shows the soil testing undertaken.

Testing	No. Samples	Justification
Metals / metalloids, pH, sulphate, speciated PAH, asbestos screen, SOM.	3	A basic suite with a broad selection of contaminants where no significant evidence of contamination was identified (except for occasional ash and coal).
Metals / metalloids, pH, sulphate, cyanide suite, TPHCWG, BTEX, MTBE, speciated PAHs, phenol, asbestos screen, SOM.	3	Although no evidence of contamination identified, detailed suite undertaken to confirm the absence of contamination and to support waste classification.
BRE Short Suite	2	To be used to aid in concrete classification.
Herbicides	1	Within the vicinity of made ground associated with former railway land.

Table 3-2: 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.

Soil samples taken during the investigation were collected in tubs, bulk bags for in house testing and DETS for geotechnical testing.

Many of the tests are UKAS accredited and further details are given in the laboratory report presented in Appendix D. Table 3-3 shows the geotechnical testing undertaken.

Testing	No. Samples
pH and water-soluble sulphate	1
Atterberg Limits (plasticity testing)	3

Table 3-3: Summary of Geotechnical Testing Undertaken.

3.3.2. Water Sampling and Leaching Testing

Groundwater sampling or leaching testing was not carried out as part of this investigation.

A moderate / low risk was identified in the preliminary contamination conceptual model for controlled waters (Pollutant Linkage 4) and further action was only recommended if significant soil contamination was identified on site. Based on the ground conditions encountered, LKC did not consider testing to be required. This is discussed further in Section 6.4.

3.4. In-situ Testing

3.4.1. Geotechnical Testing

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

- Standard Penetration Tests (SPTs) were performed in the window sample boreholes at approximately 1m intervals.
- Pocket penetrometer tests (giving undrained shear strength) were performed in the window sample boreholes within cohesive strata. Tests were not always possible due to the friable or gravel rich nature of some of the clay deposits.
- Dynamic probes were performed to provide continuous equivalent SPTs (strata not determined).

The results are provided within Appendix B.

3.5. Gas Monitoring

A moderate risk was identified in the preliminary contamination conceptual model for gas (Pollutant Linkage 3) due to the identification on a potential source. Further action was only recommended if significant organic / putrescible material was identified on site. Based on the ground conditions encountered, LKC did not consider gas monitoring to be required. This is discussed further in Section 6.3.

Contact has been made to Manchester City Council Contaminated Land Officer to confirm the above assessment is satisfactory for planning. LKC are awaiting a response for the above.

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 0.60-2.30mbgl. The made ground comprised horizons of gravel, sand, silt, clay with anthropogenic material including ash, brick fragments, whole bricks, clinker, metal and glass.

The deepest made ground (2.00-2.30mbgl) was encountered in the east of site, likely associated with former buildings (chapel, works).

4.1.2. *Natural Strata*

Superficial strata comprised horizons of firm to stiff clay, becoming very stiff with depth.

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 0.4ppm TVOC in the samples.

4.1.4. *Obstructions*

No obstructions were identified within any of the investigation locations.

4.2. Groundwater

4.2.1. *Groundwater Levels*

Perched groundwater was recorded at 0.50mbgl in WS101. No groundwater strikes were recorded in the remainder of the boreholes or hand pit. This data is provided in the profile logs (Appendix B).

4.2.2. *Contamination*

No evidence of contamination was identified in the groundwater during investigation work.

5. Geotechnical Assessment

5.1. Proposed Development

It is understood that the proposed development will comprise 3 storey vocational learning centre with car park, grassed areas and play areas. The building is approximately 'L' shaped fronting on to Ashton Old Road, with parking off Whitworth Street.

Details of the proposed loadings are not known and therefore a line loading of 100kN/m has been assumed for preliminary assessment purposes only.

The finished ground levels are anticipated to be close to 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.

5.2. Summary of Ground Conditions

Ground conditions identified at the site are detailed in Section 4.1 and summarised in Table 5-1 below:

Strata	Typical Description	Min Depth to top of Strata (mbgl)	Max Depth to top of Strata (mbgl)	Max Thickness (m)
Made Ground	Dark grey gravelly sand	0.00	2.30	2.30
Cohesive	Firm to stiff becoming stiff brown and grey gravelly sandy clay (Glacial Till)	2.30	5.45	Not proven

Table 5-1: Summary of Ground Conditions.

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 Works⁹. 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 associated with former buildings. These should be excavated from below the proposed development footprint with the resulting void backfilled.

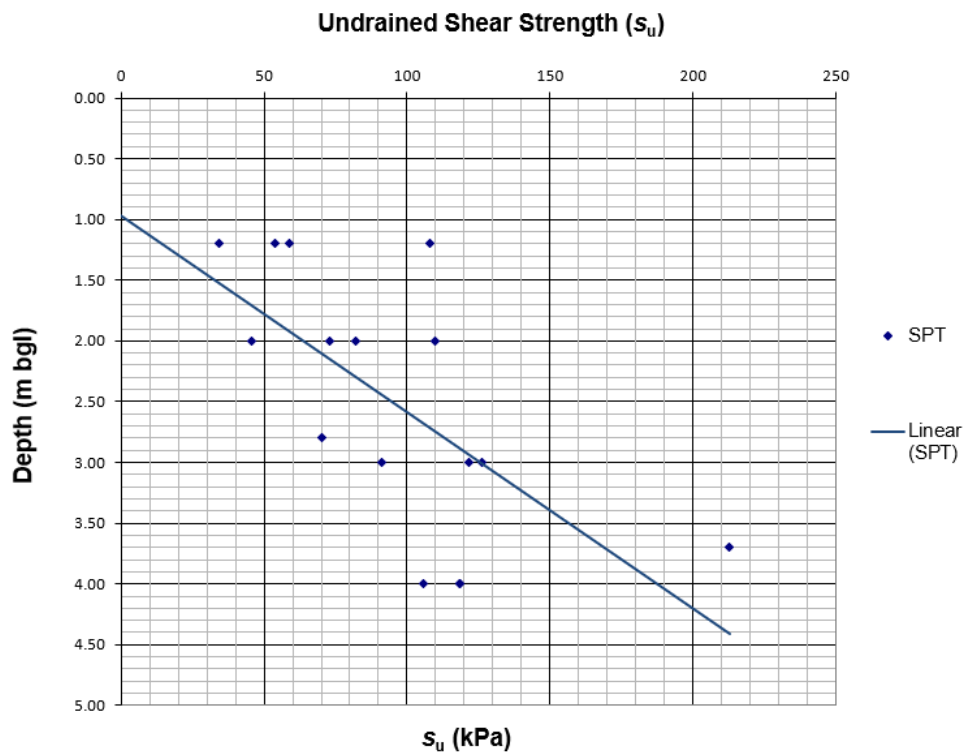
The near surface soils may potentially be disturbed by weathering and site traffic. Precautions should be taken to avoid this, as excessive disturbance may result in more onerous floor slab design, road cap thickness and increased amount of site disposal etc. Based on site observations the near surface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

or reinforcing to allow safe movement of construction plant and labour. A working platform will be required for piling plant.

5.4. Foundation Conditions and Bearing Capacity

5.4.1. General

The natural cohesive material has been assessed using in-situ testing by SPT and the Super Heavy Dynamic Probing) to obtain the undrained shear strength (s_u) of the material. The results of the testing have been plotted against depth and is shown in Graph 5-1.



Graph 5-1: Summary of S_u Vs. Depth from In-Situ SPT Testing.

Graph 5-1 demonstrates that the strength of the cohesive deposits typically increases with depth and the dynamic probing shows this continues with depth down to at least 10mbgl.

A conservative s_u of 750kPa is assigned to the cohesive material from a depth of c. 2mbgl for the natural superficial deposits, returning an Allowable Bearing Capacity (ABC) of 150kN/m² for trench fill foundations.

5.4.2. Plasticity

Clay samples were subjected to Atterberg Limits (plasticity) and Moisture Content testing. Results are provided in Appendix C.

The clay is classified as medium to high plasticity.

The modified plasticity index as detailed in Chapter 4.2-D5 of the NHBC standards (modified plasticity index = plasticity index x % less than 425 μ m sieve / 100%) characterises the clay as having a low to medium volume change potential.

5.4.3. Foundations Options

The made ground is not suitable for a founding material due to the inherent variability of the material. Foundation options are therefore:

- Deep strip foundations into the underlying Glacial Till.
- Mini-pile foundations.

These options are discussed in the following Sections.

5.4.4. Strip Foundations

Strip foundations should be constructed at least 150mm into the underlying stiff clay. At this depth an Allowable Bearing Capacity of 150kN/m² has been calculated using a Factor of Safety of 3 and an undrained shear strength of 75kN/m².

An assessment of settlement has been undertaken using the following:

- Allowable Bearing Capacity of 150 kN/m².
- Foundation width of 0.75m (0.5m width is the practical minimum).
- Coefficient of Volume Compressibility (Mv) of 0.2m²/MN taken from correlations with clay strength. The Mv value is taken from the stress range representative of the design foundation loading.

Based on this settlement is estimated to be less than 25mm.

Atterberg Limit determinations, summarised in Section 5.4.2, show the clay to be of intermediate to high plasticity and as such the sides of the foundations may require protection using clay board or similar.

Foundation depths should take account of the presence of existing and proposed trees with foundations deepened locally in accordance with the requirements of NHBC Standards for a clay of high plasticity. It is recommended that at working drawing stage a foundation schedule is prepared for the development taking account of the soil plasticity and the locations of trees.

Deep foundation excavations will be required close to the road and the stability of the excavations in the made ground will need to be considered. Temporary support will be required to ensure the stability of the adjacent road and any services within it.

This issue could be minimised by constructing the foundations as pads or isolated piers, spanning between with ground beams.

5.4.5. Piled Foundations

As an alternative, consideration may be given to the use of mini-piled foundations to transfer loadings through the made ground and into the Glacial Till at depth.

Use of mini piles will reduce the amount of spoil generated from foundation trenches requiring offsite disposal, along with the amount of concrete required for the development. This would also ensure the stability of the road and the risk of collapse if deep excavations.

Up to 2.30m thickness 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 such as the NHBC or LABC, may require further information on ground conditions to a minimum of 5m below the base of the pile.

Bored piles would be recommended due to the location of the site.

It is recommended that the present hard standing and made ground is first removed down to at least 0.30mbgl and replaced with a suitably compacted material to allow safe deployment of the piling rig. Any obstructions, such as old foundations, should be grubbed out at the same time to not interfere with the bored piles. It is recommended that the emplaced fill is of a granular type and is tested and rolled in line with Specification For Highways Works Series 600¹⁰. Plate Load and CBR Tests should be used to ensure the working platform is suitable for rig loadings. It may be possible to crush and reuse hardstanding, or excavate the existing made ground, riddle, and sort it to remove any unsuitable deleterious materials such as rags and timber, as noted in the logs.

Static load tests should be undertaken on the first few piles installed to confirm the pile design. Shaft friction in fine grained soils in generally take as no more than 100kN/m², unless higher values can be proven either using pile testing, or through experience in similar ground conditions¹¹. Negative skin friction imposed on the piles by the made ground needs to be considered.

For preliminary purposes the following initial pile carrying capacities have been calculated and are presented in Table 5-2. When undertaking these preliminary calculations, the following parameters have been used:

- Modelling based on assumed strata of made ground to 2.50mbgl, natural clay to 10.00mbgl.
- No groundwater.
- The made ground mass will be assumed to be 16.00kN/m³.
- Average undrained shear strength value of 150kPa within the clay (conservative Nc value of 9¹²).
- Adhesion Factor of 0.45 for a bored pile.
- Global Factor of Safety of 3.
- Assuming no shaft friction in the made ground.
- This does not consider the potential for negative skin friction due to settlement of the made ground.
- Settlement of pile has not been considered.

Depth (mbgl)	Pile Carrying Capacity (kN)		
	300mm dia	450mm dia	600mm dia
10	150	225	400

Table 5-2: Preliminary Pile Carrying Capacity.

The above examples are not intended to constitute any form of recommendation regarding pile size or type, but merely to illustrate the use of above ground coefficients. Pile design should be undertaken by a specialist contractor to allow them to reduce the

Factor or Safety based on their extensive pile testing data and for the design of appropriate piling scheme.

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

5.4.6. *Foundation Recommendations*

Deep strip foundations below 2m depth may be difficult to construct near the road, with bored piling being an alternative solution.

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' up to 2.30mbgl of made ground across the site, it is considered that a suspended floor slab will be required for the proposed structures.

5.6. **Pavement Construction**

An assessment of the likely California Bearing Ratio (CBR) for the made ground has been assessed from the following sources:

- Description of the materials encountered in the exploratory holes.

Based on this a CBR of less than 5% may be required to account for variability of the made ground equating to a subgrade surface modulus of 27.42. It is, however, recommended that this be re-assessed using on site plate tests of the formation.

5.7. **Drainage**

The presence of substantial depths of made ground across the site and impermeable clay below, conventional soakaway drainage will not 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. **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 R97¹³ utilised.

5.10. Enabling Works

It is considered that the ground will require preparation to facilitate a developable platform for the first stage of construction works.

As referenced in Section 5.3, obstacles such as foundations, floor slabs, services, basements etc. can be anticipated on site from historical land uses and it is recommended that these are grubbed out as part of a general site turnover to remove obstacles.

The enabling works should also cover activities such as undertaking site preparation works including pre commencement surveys of the site and surrounding areas, preparation of access routes and providing suitable piling mats if required, surveying the site and producing topographical plans on completion of the earthworks, as well as installation of safety signs and security fencing.

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 (LCRM¹⁴). 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) ^{15, 16}.
- LQM Suitable 4 Use Levels (S4ULs) ^{17, 18, 19, 20}.

The proposed development is for a school with playground therefore the assessment criteria for POS_{resi} has been used.

The very small areas of proposed landscaping (approximately 5m²) are unlikely to be used extensively by the key receptor (child) and are too small to be used for homegrown produce (<20m²), according to SR3. LKC considers comparing the results from soil samples analysed with the POS_{res} criteria to be more appropriate, since this criterion is based on a child using the area sporadically through the year (170-day exposure) close to home and includes track back of soil.

All criteria have been generated using the CLEA V1.06 model²¹ based either on 1%, 2.5% and 6% Soil Organic matter (SOM). Results will be compared to the nearest appropriate SOM.

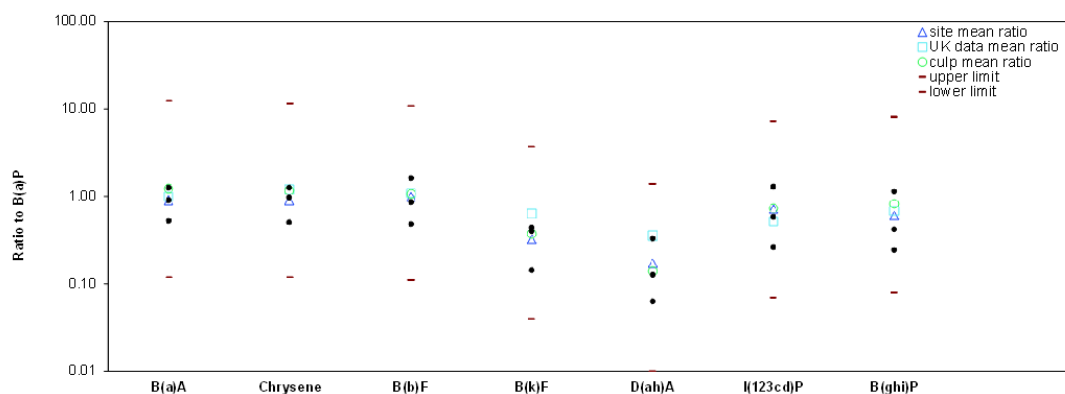
A summary of the generic assessment criteria used in this assessment is provided in Appendix E.

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^{22,23} and naphthalene the most volatile and soluble²⁴. 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 negligible²⁵. For B(a)P to be used as a surrogate marker it should follow the profile described by the HPA (2008)²⁶ 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.*²⁷, 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 3 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.

Results have been compared to the relevant assessment criteria and no elevated contaminants were identified.

No asbestos was identified in any soil samples analysed.

6.2.3. Direct Contact Risk – Pollutant Linkage 1

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

No asbestos was identified in any of the samples; therefore, the probability of asbestos affecting site users is considered to be unlikely. With a medium consequence, the risk is low. However, as a precaution, construction workers should be and vigilant for any suspected ACM during groundworks.

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 naphthalene above detection limits.

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

6.3. Gas Risk Assessment

Gas monitoring was not carried out as part of this assessment. The PRA identified a moderate risk and recommended gas monitoring if a significant depth of organic / putrescible material was identified on site.

No organic / putrescible material was encountered on site. 0.60-2.30m thickness of made ground was encountered across the site, with anthropogenic material comprising ash, clinker, brick and metal. Given the site history, the made ground is likely to be inclusive of demolition rubble (ash, clinker, brick) from backfilled cellars associated with the former residential housing and former commercial / works buildings.

The NHBC NF94²⁸ guidance states *“degradable materials within a soil matrix of Made Ground, are normally fairly low risk source of bulk gases, except where there is a high proportion or readily degradable material in a deep layer of fill (i.e. unregulated landfill)”*.

For the assessment, the made ground SOM across site across site has been used.

The made ground SOM was variable, therefore an average of 10.0% was used, which has an equivalent total organic carbon (TOC) of 5.9%²⁹. Ash and clinker may skew the TOC results generating a false positive for degradable material and not necessarily generating gas. The TOC can be adjusted for non-degradability by approximately 60% for ash and 13% for soil³⁰. By adjusting the average TOC by 73%, assuming 27% is non-degradable (for a mixed ash soil matrix) a revised average TOC of 4.3% (degradable fraction) can be derived for the made ground. Considering the difficulty in undertaking detailed forensic work on the sample (due to limited volume), this assumption is considered reasonable.

No offsite sources of ground gases were identified in the PRA, therefore the only possible ground gas source is the deep made ground on site from the former buildings. Given the depth of the made ground encountered on site (maximum thickness of 2.30m), this source is considered further below.

The NHBC NF94 Guidance discusses how made ground soils are not inherently a source of hazardous gas and that substantial portions of putrescible materials such as vegetation, food waste, paper, cardboard and wood would be required to be a source of gas.

The intrusive investigation did not identify made ground that was characteristic of landfill material. Ash and clinker was recorded in the made ground, but no significant proportions of putrescible materials were recorded across site. The NHBC NF94 Guidance also goes on to state that ashy made ground is not readily degradable and therefore not considered to be a significant source of gas.

In addition, BS8587³¹ Figure 6 describes *“made ground with low degradable organic content (e.g. up to 5% organic materials such as pieces of wood, pieces of paper, rags, etc. with a high proportion of ash and no food or other easily degradable waste) and natural soil strata with a low degradable organic content, e.g. alluvium, peat”* as *“very low generation potential”*. There is no evidence of >5% of such materials from the descriptions provided within the profile logs (Appendix B).

Therefore, given the above lines of evidence, LKC consider that there are no significant onsite sources of gas.

6.4. Controlled Water Assessment

A Secondary A Aquifer (superficial) and Principal Aquifer (bedrock) are recorded beneath the site. The PRA identified a moderate / low risk with respect to controlled waters as possible source of mobile contamination was anticipated, with a limited pathway as clay was expected beneath site. No abstractions have been identified within influencing distance and the site is not located in a Source Protection Zone. The surface water is not considered to be a significant receptor.

No evidence of significant mobile contamination was identified during the ground investigation. No elevated metals or PAHs were identified within the soils. Furthermore, although a Principal Aquifer is present below the site, natural clay was encountered across the site that will limit vertical migration.

This confirms an unlikely probability of onsite contamination affecting controlled waters. With a medium consequence the risk is anticipated to be low, and no remediation is required.

6.5. Potable Water Supply (Pollutant Linkage 5)

Soil results were compared to United Utilities (UU) guidelines for the selection of potable water pipes in land potentially affected by contamination. Only contaminants of concern, based on the preliminary conceptual model and ground conditions encountered, were analysed.

No elevated organic contaminants were identified in the soil samples analysed.

The probability of organic contaminants affecting potable water pipes is unlikely. Given the consequence is considered to be moderate, the risk (Pollutant Linkage 5) is anticipated to be low risk and no remediation is likely to be required.

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 6.1-6.5. 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 6-1.

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 of Concern (source)	Pathway	Receptor	Probability	Consequence	Risk	Recommendations
1	ACM, heavy metals, PAHs, herbicides, TPHs (no elevations identified).	Dermal contact. Inhalation of soil, fibres, and dust. Ingestion of soils, dust. Windblown dust.	Future site users. Offsite receptors.	Unlikely	Medium	Low	No remediation recommended.
2	Naphthalene (no elevations identified).	Inhalation of vapours. Migration via permeable strata and preferential pathways.	Future site users. Offsite receptors.	Unlikely	Medium	Low	No remediation recommended.
3	Hazardous / ground gas: methane, carbon dioxide (deep made ground)	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 recommended.
4	Mobile contaminants such as metals, PAHs, hydrocarbons (no elevations identified).	Surface run-off. Migration via permeable strata and preferential pathways. Perched waters migration.	Groundwater	Unlikely	Medium	Low	No remediation recommended.
5	Organic contaminants such as petroleum hydrocarbons, naphthalene (no elevations identified).	Ingestion of tainted water supply.	Future site users. Water pipes.	Unlikely	Medium	Low	No remediation (i.e. barrier pipe) likely to be required. UURA required.

Table 6-1: Revised Contamination Conceptual Model.

7. Summary Conclusions

7.1. Ground Conditions

Ground conditions are summarised in Table 7-1 below.

Made Ground	Made ground was recorded in all boreholes to depths of 0.60-2.30mbgl. The made ground comprised horizons of gravel, sand, silt, clay with anthropogenic material including ash, brick fragments, whole bricks, clinker, metal and glass.
Superficial	Superficial strata comprised horizons of firm to stiff clay, becoming very stiff with depth to >5.00mbgl
Bedrock	None encountered.
Groundwater	0.50mbgl (WS101) – noted to be perched.
Obstructions	None identified during site works.

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	150kN/m ² has been calculated using a Factor of Safety of 3 and an undrained shear strength of 75kN/m ² in the natural clay strata at 0.60-2.30mbgl.
Anticipated Foundation Type	Strip foundations should be constructed at least 150mm into the underlying stiff clay. As an alternative, consideration may be given to the use of mini-piled foundations to transfer loadings through the Made Ground and into the Glacial Till at depth.
Shallow Groundwater	Shallow groundwater identified on the site which will present a constraint to the development. Suitable drainage should be considered in the proposed development layout. Lowering of the water table may be required to facilitate the construction work especially site level reductions. A discharge consent to release water to existing storm water or foul water drains may be required.
Concrete Requirements	Based on BRE Digest 2005 ³² – DS-1 AC-1s recommended.
Services	Services – consideration to the presence of services running through the site. Services may need to be re-routed.
Temporary support of excavation	May be required; however, boreholes were generally recorded as stable.
Plasticity	Consideration will need to be given to the shrink / swell of the clay strata if it is to be used as founding strata, particularly where trees/hedges are present. Foundations may need to be deepened. A low to moderate volume change potential has been calculated for the site.
Ground Floor Slab	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' up to 1.0m depth of Made Ground across the site, it is considered that a suspended floor slab will be required for the proposed structures.

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	ACM, heavy metals, PAH's, Herbicides (no elevations identified).	Low	No remediation recommended.
	Petroleum hydrocarbons inorganic and organic contaminants (no elevations identified).		
2	Volatile Contaminants (no elevations identified).	Low	No remediation recommended.
3	Carbon dioxide / Methane.	Moderate / Low	No remediation recommended.
4	Groundwater (mobile contaminants – no elevations identified).	Low	No remediation recommended.
5	Organic contaminants (no elevations identified).	Low	No remediation (i.e. barrier pipe) likely to be required. UURA required.

Table 7-3: Summary Risk Table.

PL=Pollutant Linkage, see Table 6-1 for details.

7.4. Recommendations

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

A summary of remediation requirements is included in Table 7-4.

PL	Recommendation
1	No remediation required.
2	No remediation required.
3	No remediation required.
4	No remediation required.
5	No remediation (i.e. barrier pipe) likely to be required. UURA required.

Table 7-4: Remediation Summary.

Based on the findings of the site investigation and risk assessment, no remediation is recommended. A watching brief for any unexpected contamination should be maintained during groundworks, and any imported soils brought to site for use in gardens / soft landscaping should be validated to ensure they are suitable for use against the criteria detailed in Section 6.2.1. Confirmation of appropriate testing suites and verification sampling verification should be sought from the local authority.

7.4.1. Topsoil Growing Medium

Although no contamination was identified in the soils on site, the existing made ground is not expected to be a suitable growing medium given the nature of the soil and the undesirable material present (abundant glass, brick fragments, clinker and ceramics).

A topsoil cover of approximately 450mm (given depth of made ground in the east of the site) is recommended in soft landscaping areas.

Figures



Client: Create It Studio Architects				Title: Site Location & Boundary Plan			
Site: Redby Street, Manchester				Scale (see scale bar): 1:25,000 & 1:1,000 @ A4			
Job No.: LKC 22 1260	Drawn By: JW	Checked By: EK	Drawn: May 2022	Figure: 1	Revision:		



KEY

Site Boundary

LEGEND

Site Boundary

2.1m High anti-climb security fence

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.

LK

CONSULT LIMITED

Client:

Create It Studio Architects

Site:

Redby Street, Manchester

Title:

Proposed Development Plan

Job No.:

LKC 22 1260

Scale (See Scale Bar):

See Scale Bar

Figure:

2

Revision:

Drawn By:

AC

Checked By:

JW

Drawn:

May 2022

Extract from: Create It Studios (NW) Ltd
 Drawing Ref: Proposed Site Plan, No.A1417(02)AP001, Rev:P5 (22/04/2022)



KEY

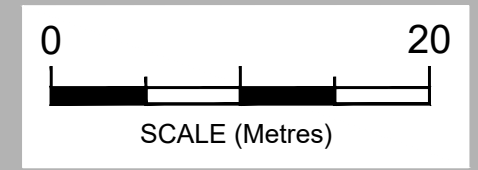
- Site Boundary
- Window Sample Borehole (WS)
- Dynamic Probe (DP)
- Hand Dug Trial Pit (HD)

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: Create It Studio Architects			
Site: Redby Street, Manchester			
Title: Site Investigation Location Plan			
Job No.: LKC 22 1260	Scale (See Scale Bar): See Scale Bar	Figure: 3	Revision:
Drawn By: AC	Checked By: FP	Date: Feb 2024	

Extract from: Create It Studios (NW) Ltd
 Drawing Ref: Proposed Site Plan, No.A1417(02)AP001, Rev:P5 (22/04/2022)



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 552³³. It involves the classification of the:

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

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

Table A. Classification of Consequence

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

Table B. Classification of Probability.

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

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

Table C. Comparison of Consequence against Probability

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

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

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

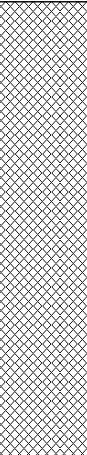
Where a very low risk is identified no specific remediation is required.

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

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

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

Appendix B – Profile Logs

		Trial Pit Log				Location Number: HD101		
Project: Redby Street, Manchester			Client: Create It Studio Architects			Date: 13/02/2024		
Project No. : LKC 22 1260			Contractor: LKC					
Equipment: Hand excavated			Level	Logged By FP	Scale 1:10	Page Number Sheet 1 of 1		
Depth (m)	Samples / Tests	Depth (m)	Legend	Stratum Description				Level (m)
0.00 - 0.60 0.00 - 0.60	ES PID=0.3ppm	0.60		MADE GROUND: Dark grey gravelly very sandy CLAY with occasional ash, rootlets, whole brick, brick fragments, rare glass, polystyrene, clinker and metal. Sand is fine to coarse. Gravel is fine to coarse, subangular to subrounded comprising concrete, ash / clinker and sandstone.			0.5	
			End of Trial Pit at 0.60m			1.0		
						1.5		
						2.0		
				Pit Dimensions			Pit Stability	
				Length (m)	Width (m)	Depth (m)	Stable	
				0.30	0.30	0.60		
				Remarks: Hand tool refusal against whole bricks. Trial pit is dry.				

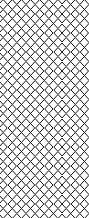
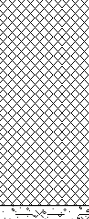
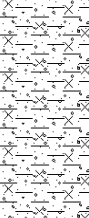
Date: 13/02/2024

Contractor: D & I Drilling

Page Number
Sheet 1 of 1[illegible]

		Window Sample Borehole Log			Location Number: WS102	
Project Name: Redby Street, Manchester			Client: Create It Studio Architects		Date: 13/02/2024	
Project No. : LKC 22 1260			Contractor: D & I Drilling			
			Level	Logged By FP	Scale 1:40	Page Number Sheet 1 of 1
Depth (m)	Samples / Tests	Depth (m)	Legend	Stratum Description		Level (m)
0.30 - 1.00 0.30 - 1.00	ES PID=0.2ppm	0.05 0.20 0.30	   	MADE GROUND: TARMACADAM MADE GROUND: Light brown gravelly SAND. Sand is fine to coarse. Gravel is fine to coarse, subangular to subrounded comprising sandstone. MADE GROUND: Concrete MADE GROUND: Black gravelly SAND of ash and clinker with rare brick fragments.		
1.00 - 2.00 1.00 - 2.00 1.20 - 1.65 1.20 - 1.65	ES PID=0.2ppm D N=7 (1,2/2,1,2,2)	1.20		MADE GROUND: Soft to firm consistency dark grey gravelly sandy CLAY with occasional ash, clinker and brick fragments. Sand is fine to coarse. Gravel is fine to coarse, subangular to subrounded comprising sandstone and mudstone.	1	
1.75	PP=36.8kPa					
2.00 - 3.00 2.00 - 2.45	ES N=16 (1,3/3,4,4,5)	2.00		Firm consistency high to very high strength brown and grey mottled gravelly sandy silty CLAY. Sand is fine to coarse. Gravel is fine to coarse, subangular to subrounded comprising sandstone, coal and mudstone.	2	
2.75	PP=220.7kPa			Clay is firm consistency high strength from 4.75mbgl.		
3.00 - 3.45 3.00 - 3.45	D N=21 (3,4/4,5,5,7)				3	
3.50 - 4.00 3.50 - 4.00 3.75	D PID=0.1ppm PP=159.4kPa					
4.00 - 4.45 4.00 - 4.45	D N=28 (4,4/5,7,7,9)				4	
4.75	PP=98.1kPa					
5.00 - 5.45 5.00 - 5.45	D N=21 (3,4/4,5,5,7)	5.45			5	
				End of Borehole at 5.45m		
					6	
					7	
					8	
Remarks: Borehole dry and stable.						

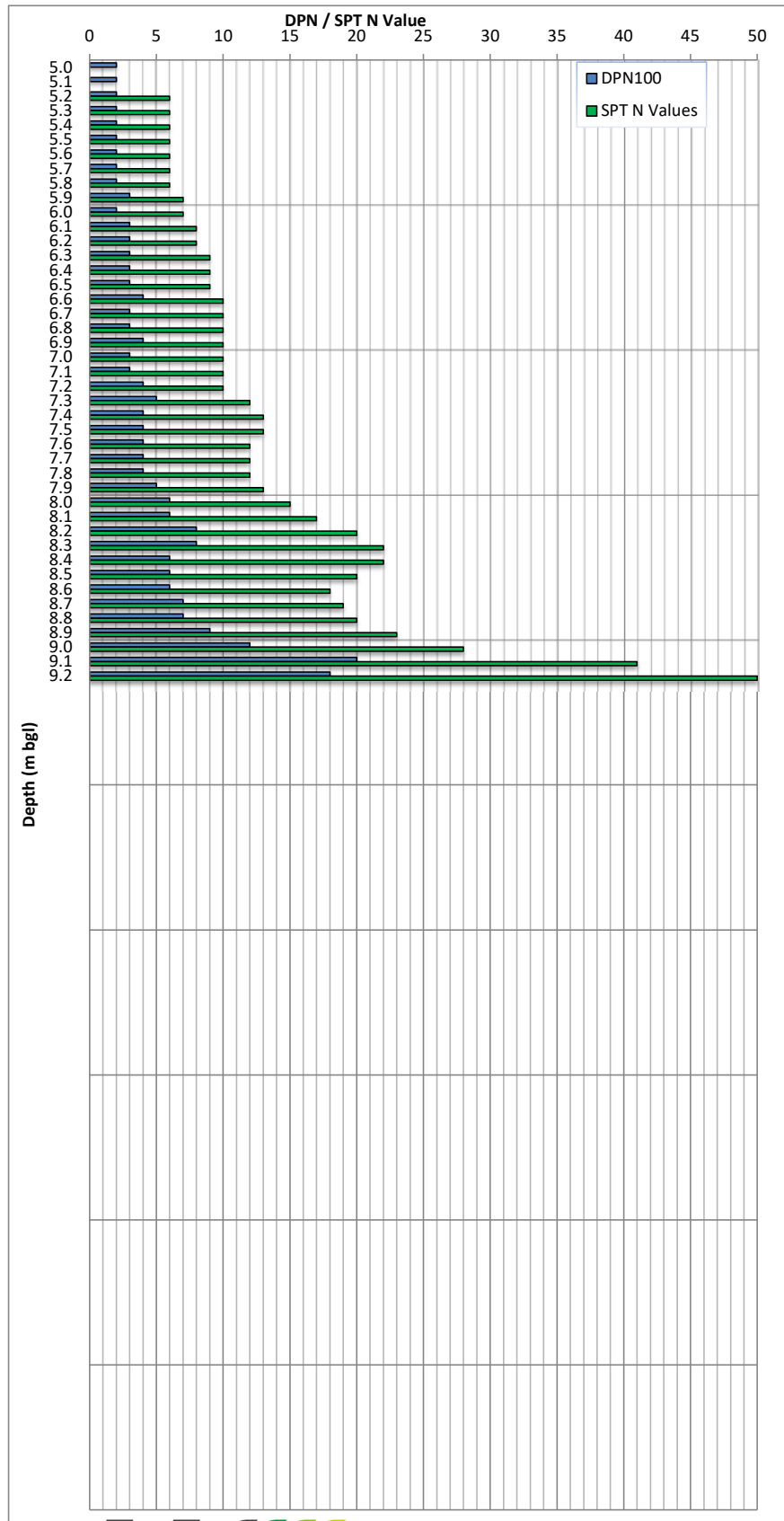
		Window Sample Borehole Log				Location Number: WS103		
Project Name: Redby Street, Manchester			Client: Create It Studio Architects			Date: 13/02/2024		
Project No. : LKC 22 1260			Contractor: D & I Drilling					
			Level	Logged By FP	Scale 1:40	Page Number Sheet 1 of 1		
Depth (m)	Samples / Tests	Depth (m)	Legend	Stratum Description			Level (m)	Well
0.00 - 0.30 0.00 - 0.30 0.30 - 1.20 0.30 - 1.20	ES PID=0.2ppm ES PID=0.3ppm	0.30		MADE GROUND: Dark brown gravelly silty SAND with rare brick fragments. Sand is fine to coarse. Gravel is fine to medium, subangular to subrounded comprising sandstone and mudstone.				
				MADE GROUND: Dark brown gravelly clayey SAND with frequent brick fragments, occasional whole brick, rare ash and metal. Sand is fine to coarse. Gravel is fine to medium, subangular to subrounded comprising sandstone and mudstone.				
1.20 - 1.80 1.20 - 1.80 1.20 - 1.65	D PID=0.3ppm N=12 (3,6/3,3,3,3)	1.20		MADE GROUND: Red sandy GRAVEL of brick fragments.		1		
1.80 - 2.00 1.80 - 2.00 2.00 - 2.45 2.00 - 2.45 2.20 - 3.00 2.20 - 3.00	D PID=0.2ppm D N=10 (13,3/3,2,2,3) ES PID=0.2ppm	1.80 2.20		MADE GROUND: Dark grey gravelly silty SAND with frequent ash. Sand is fine to coarse. Gravel is fine to coarse, subangular to subrounded comprising concrete, ash and sandstone.		2		
3.00 - 3.45 3.00 - 3.45	D N=28 (3,4/6,6,7,9)			Firm consistency very high strength brown and grey mottled gravelly sandy silty CLAY. Sand is fine to coarse. Gravel is fine to coarse, subangular to subrounded comprising sandstone, coal and mudstone.				
3.50 - 4.00 3.75	D PP=220.7kPa					3		
4.00 - 4.45 4.00 - 4.45	D N=28 (4,4/4,7,8,9)					4		
4.75	PP=196.2kPa	5.00						
				End of Borehole at 5.00m		5		
						6		
						7		
						8		
Remarks: Borehole dry and stable. Dynamic probe carried out within borehole on completion, Ref. WS103-DP.								

		Window Sample Borehole Log				Location Number: WS104		
Project Name: Redby Street, Manchester			Client: Create It Studio Architects			Date: 13/02/2024		
Project No. : LKC 22 1260			Contractor: D & I Drilling					
			Level	Logged By FP	Scale 1:40	Page Number Sheet 1 of 1		
Depth (m)	Samples / Tests	Depth (m)	Legend	Stratum Description			Level (m)	Well
0.00 - 1.00 0.00 - 1.00	ES PID=0.2ppm			MADE GROUND: Dark grey gravelly sandy CLAY with occasional ash, rootlets, brick fragments and rare glass. Sand is fine to coarse. Gravel is fine to coarse, subangular to subrounded comprising concrete, ash and sandstone.				
0.80	PP=49.0kPa							
1.20 - 1.65 1.20 - 2.30 1.20 - 2.30 1.20 - 1.65	D ES PID=0.4ppm N=8 (2,2/2,2,2,2)	1.20		MADE GROUND: Dark grey gravelly silty SAND with frequent ash and brick fragments. Sand is fine to coarse. Gravel is fine to coarse, subangular to subrounded comprising brick fragments, ash and sandstone.				
2.00 - 2.45 2.00 - 2.45	D N=15 (10,8/3,3,4,5)							
2.30 - 3.00 2.30 - 3.00	ES PID=0.2ppm	2.30		Firm consistency very high strength brown and grey mottled gravelly sandy silty CLAY. Sand is fine to coarse. Gravel is fine to coarse, subangular to subrounded comprising sandstone, coal and mudstone.				
2.75 2.80 - 3.25 2.80 - 3.25	PP=220.7kPa D N=30 (4,5/6,7,8,9)							
3.50 - 3.70 3.70 - 4.15 3.70 - 4.15 3.75	D D N=50 (8,9/10,12,13,15) PP=208.5kPa	4.15		End of Borehole at 4.15m				
							1	
							2	
							3	
							4	
							5	
							6	
							7	
							8	
Remarks: Sampler refusal from 2.80 to 3.70mbgl, and SPT refusal at 4.15mbgl in very stiff very high strength clay. Borehole dry and stable.								

Dynamic Probe Test Results

Site Name: Redby Street, Manchester
Job Number: LKC 22 1260
Client: Create It Studios Architects
Hole Location: WS101 - DP
Start Depth: 5.00 m bgl
Final Depth: 9.27 m bgl

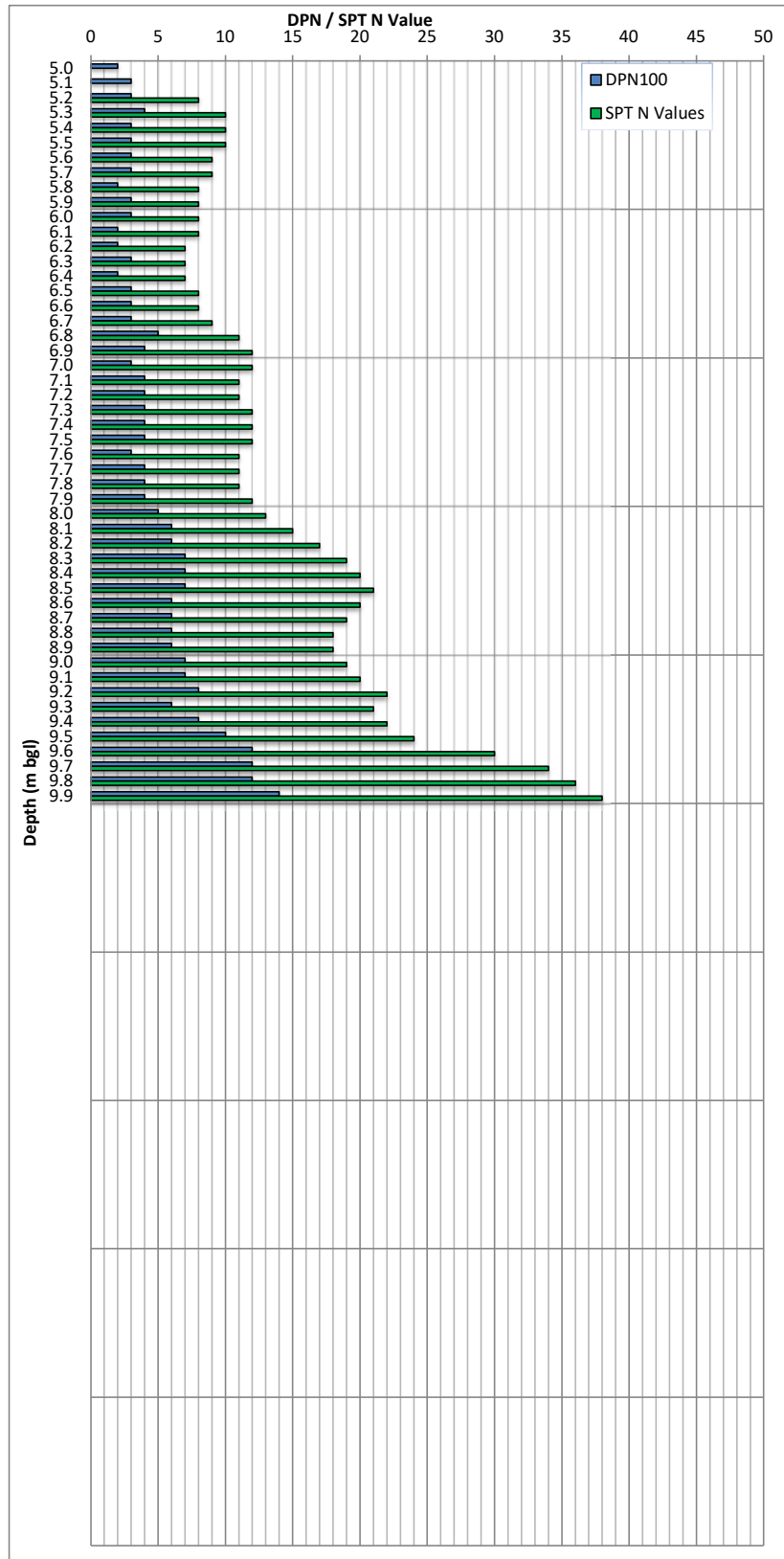
Date:	13-Feb-24
Test Type:	Super Heavy
Rig Type	Window Sample Rig

[illegible]

Dynamic Probe Test Results

Site Name: Redby Street, Manchester
Job Number: LKC 22 1260
Client: Create It Studios Architects
Hole Location: WS103 - DP
Start Depth: 5.00 m bgl
Final Depth: 10.00 m bgl

Date:	13-Feb-24
Test Type:	Super Heavy
Rig Type	Window Sample Rig

[illegible]

Appendix C – Certificates of Analysis (Soil)



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

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

DETS Report No: 24-01745

Site Reference: Redby Street, Manchester

Project / Job Ref: LKC 22 1260

Order No: LKC221260-EK

Sample Receipt Date: 20/02/2024

Sample Scheduled Date: 20/02/2024

Report Issue Number: 1

Reporting Date: 06/03/2024

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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Soil Analysis Certificate						
DETS Report No: 24-01745	Date Sampled	13/02/24	13/02/24	13/02/24	13/02/24	13/02/24
LK Consult Limited	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: Redby Street, Manchester	TP / BH No	HD101	WS101	WS101	WS102	WS103
Project / Job Ref: LKC 22 1260	Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Order No: LKC221260-EK	Depth (m)	0.00 - 0.60	0.40 - 0.60	0.60 - 1.00	0.3 - 1.00	2.20 - 3.00
Reporting Date: 06/03/2024	DETS Sample No	700140	700141	700142	700143	700144

Determinand	Unit	RL	Accreditation	(n)				
Asbestos Screen ^(S)	N/a	N/a	ISO17025	Not Detected	Not Detected	Not Detected	Not Detected	
pH	pH Units	N/a	MCERTS	8.1	7.6	8.2	8.7	8.2
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	227	69	52	71	184
W/S Sulphate as SO ₄ (2:1)	g/l	< 0.01	MCERTS	0.23	0.07	0.05	0.07	0.18
Organic Matter (SOM)	%	< 0.1	MCERTS	5.7	3.1	3.5	33.1	
W/S Chloride (2:1)	mg/kg	< 1	MCERTS					
W/S Chloride (2:1)	mg/l	< 0.5	MCERTS					
Water Soluble Nitrate (2:1) as NO ₃	mg/kg	< 3	MCERTS					
Water Soluble Nitrate (2:1) as NO ₃	mg/l	< 1.5	MCERTS					
Arsenic (As)	mg/kg	< 2	MCERTS	15	11	4	30	
W/S Boron	mg/kg	< 1	NONE	< 1	< 1		< 1	
Cadmium (Cd)	mg/kg	< 0.2	MCERTS	0.6	< 0.2	< 0.2	4.4	
Chromium (Cr)	mg/kg	< 2	MCERTS	17	26	21	11	
Chromium (hexavalent)	mg/kg	< 2	NONE	< 2	< 2	< 2	< 2	
Copper (Cu)	mg/kg	< 4	MCERTS	90	29	18	94	
Lead (Pb)	mg/kg	< 3	MCERTS	123	59	18	215	
W/S Magnesium	mg/l	< 0.1	NONE					
Mercury (Hg)	mg/kg	< 1	MCERTS	< 1	< 1	< 1	< 1	
Nickel (Ni)	mg/kg	< 3	MCERTS	13	27	8	25	
Selenium (Se)	mg/kg	< 2	MCERTS	< 2	< 2	< 2	< 2	
Vanadium (V)	mg/kg	< 1	MCERTS	21	35	13	37	
Zinc (Zn)	mg/kg	< 3	MCERTS	246	52	13	396	
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)

(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: 24-01745	Date Sampled	13/02/24	13/02/24			
LK Consult Limited	Time Sampled	None Supplied	None Supplied			
Site Reference: Redby Street, Manchester	TP / BH No	WS104	WS104			
Project / Job Ref: LKC 22 1260	Additional Refs	None Supplied	None Supplied			
Order No: LKC221260-EK	Depth (m)	0.00 - 1.00	1.20 - 2.30			
Reporting Date: 06/03/2024	DETS Sample No	700145	700146			

Determinand	Unit	RL	Accreditation	(n)		
Asbestos Screen ^(S)	N/a	N/a	ISO17025	Not Detected		
pH	pH Units	N/a	MCERTS	7.9	8.6	
Total Cyanide	mg/kg	< 1	NONE			
Free Cyanide	mg/kg	< 1	NONE			
W/S Sulphate as SO ₄ (2:1)	mg/l	< 10	MCERTS	24	23	
W/S Sulphate as SO ₄ (2:1)	g/l	< 0.01	MCERTS	0.02	0.02	
Organic Matter (SOM)	%	< 0.1	MCERTS	5.1		
W/S Chloride (2:1)	mg/kg	< 1	MCERTS		6	
W/S Chloride (2:1)	mg/l	< 0.5	MCERTS		3.2	
Water Soluble Nitrate (2:1) as NO ₃	mg/kg	< 3	MCERTS		< 3	
Water Soluble Nitrate (2:1) as NO ₃	mg/l	< 1.5	MCERTS		< 1.5	
Arsenic (As)	mg/kg	< 2	MCERTS	17		
W/S Boron	mg/kg	< 1	NONE			
Cadmium (Cd)	mg/kg	< 0.2	MCERTS	0.4		
Chromium (Cr)	mg/kg	< 2	MCERTS	25		
Chromium (hexavalent)	mg/kg	< 2	NONE	< 2		
Copper (Cu)	mg/kg	< 4	MCERTS	78		
Lead (Pb)	mg/kg	< 3	MCERTS	248		
W/S Magnesium	mg/l	< 0.1	NONE		1.7	
Mercury (Hg)	mg/kg	< 1	MCERTS	< 1		
Nickel (Ni)	mg/kg	< 3	MCERTS	26		
Selenium (Se)	mg/kg	< 2	MCERTS	< 2		
Vanadium (V)	mg/kg	< 1	MCERTS	36		
Zinc (Zn)	mg/kg	< 3	MCERTS	155		
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)



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Soil Analysis Certificate - Speciated PAHs						
DETS Report No: 24-01745	Date Sampled	13/02/24	13/02/24	13/02/24	13/02/24	13/02/24
LK Consult Limited	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: Redby Street, Manchester	TP / BH No	HD101	WS101	WS101	WS102	WS104
Project / Job Ref: LKC 22 1260	Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Order No: LKC221260-EK	Depth (m)	0.00 - 0.60	0.40 - 0.60	0.60 - 1.00	0.3 - 1.00	0.00 - 1.00
Reporting Date: 06/03/2024	DETS Sample No	700140	700141	700142	700143	700145

Determinand	Unit	RL	Accreditation	(n)				
Naphthalene	mg/kg	< 0.1	MCERTS	0.44	< 0.1	< 0.1	0.30	< 0.1
Acenaphthylene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthene	mg/kg	< 0.1	MCERTS	0.64	< 0.1	< 0.1	0.30	0.18
Fluorene	mg/kg	< 0.1	MCERTS	0.46	< 0.1	< 0.1	0.20	< 0.1
Phenanthrene	mg/kg	< 0.1	MCERTS	5.58	< 0.1	< 0.1	2.77	1.25
Anthracene	mg/kg	< 0.1	MCERTS	1.22	< 0.1	< 0.1	0.70	0.32
Fluoranthene	mg/kg	< 0.1	MCERTS	7.65	< 0.1	< 0.1	3.93	2.51
Pyrene	mg/kg	< 0.1	MCERTS	6.54	< 0.1	< 0.1	4.73	2.13
Benzo(a)anthracene	mg/kg	< 0.1	MCERTS	2.99	< 0.1	< 0.1	3.50	1.13
Chrysene	mg/kg	< 0.1	MCERTS	2.82	< 0.1	< 0.1	3.50	1.21
Benzo(b)fluoranthene	mg/kg	< 0.1	MCERTS	2.72	< 0.1	< 0.1	4.51	1.08
Benzo(k)fluoranthene	mg/kg	< 0.1	MCERTS	0.79	< 0.1	< 0.1	1.22	0.50
Benzo(a)pyrene	mg/kg	< 0.1	MCERTS	2.44	< 0.1	< 0.1	4.65	1
Indeno(1,2,3-cd)pyrene	mg/kg	< 0.1	MCERTS	1.45	< 0.1	< 0.1	3.60	0.72
Dibenz(a,h)anthracene	mg/kg	< 0.1	MCERTS	0.35	< 0.1	< 0.1	0.92	0.16
Benzo(ghi)perylene	mg/kg	< 0.1	MCERTS	1.37	< 0.1	< 0.1	3.19	0.52
Total EPA-16 PAHs	mg/kg	< 1.6	MCERTS	37.5	< 1.6	< 1.6	38	12.7

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Soil Analysis Certificate - TPH CWG Banded

DETS Report No: 24-01745	Date Sampled	13/02/24	13/02/24	13/02/24	13/02/24
LK Consult Limited	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: Redby Street, Manchester	TP / BH No	HD101	WS101	WS102	WS104
Project / Job Ref: LKC 22 1260	Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied
Order No: LKC221260-EK	Depth (m)	0.00 - 0.60	0.40 - 0.60	0.3 - 1.00	1.20 - 2.30
Reporting Date: 06/03/2024	DETS Sample No	700140	700141	700143	700146

Determinand	Unit	RL	Accreditation	(n)	(n)	(n)	(n)
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 : HS_1D_MS+EH_CU_1D_AL	mg/kg	< 10	NONE	< 10	< 10	< 10	
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	6	< 2	3	
Aromatic >C16 - C21 : EH_CU_1D_AR	mg/kg	< 3	MCERTS	35	< 3	19	
Aromatic >C21 - C35 : EH_CU_1D_AR	mg/kg	< 10	MCERTS	39	< 10	46	
Aromatic >C35 - C44 : HS_1D_MS+EH_CU_1D_AR	mg/kg	< 10	NONE	19	< 10	< 10	
Total >C5 - C44 : HS_1D_MS+EH_CU_1D_Tot	mg/kg	< 21	NONE	99	< 21	69	
Total >C5 - C44 : HS_1D_MS+EH_CU_1D_Tot	mg/kg	< 42	NONE	99	< 42	69	

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Soil Analysis Certificate - BTEX / MTBE						
DETS Report No: 24-01745	Date Sampled	13/02/24	13/02/24	13/02/24		
LK Consult Limited	Time Sampled	None Supplied	None Supplied	None Supplied		
Site Reference: Redby Street, Manchester	TP / BH No	HD101	WS101	WS102		
Project / Job Ref: LKC 22 1260	Additional Refs	None Supplied	None Supplied	None Supplied		
Order No: LKC221260-EK	Depth (m)	0.00 - 0.60	0.40 - 0.60	0.3 - 1.00		
Reporting Date: 06/03/2024	DETS Sample No	700140	700141	700143		

Determinand	Unit	RL	Accreditation	(n)			
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	

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Soil Analysis Certificate - Phenoxy Acidic Herbicides						
DETS Report No: 24-01745		Date Sampled	13/02/24			
LK Consult Limited		Time Sampled	None Supplied			
Site Reference: Redby Street, Manchester		TP / BH No	WS104			
Project / Job Ref: LKC 22 1260		Additional Refs	None Supplied			
Order No: LKC221260-EK		Depth (m)	1.20 - 2.30			
Reporting Date: 06/03/2024		DETS Sample No	700146			

Determinand	Unit	RL	Accreditation	(n)				
2,3,6-TBA ^(S)	mg/kg	< 0.1	NONE	< 0.1				
2,4,5-T ^(S)	mg/kg	< 0.1	NONE	< 0.1				
2,4,5-TP (fenoprop) ^(S)	mg/kg	< 0.1	NONE	< 0.1				
2,4-D ^(S)	mg/kg	< 0.1	NONE	< 0.1				
2,4-DB ^(S)	mg/kg	< 0.1	NONE	< 0.1				
4-CPA ^(S)	mg/kg	< 0.1	NONE	< 0.1				
Benazolin ^(S)	mg/kg	< 0.1	NONE	< 0.1				
Bentazone ^(S)	mg/kg	< 0.1	NONE	< 0.1				
Bromoxynil ^(S)	mg/kg	< 0.1	NONE	< 0.1				
Clodralid ^(S)	mg/kg	< 0.1	NONE	< 0.1				
Dicamba ^(S)	mg/kg	< 0.1	NONE	< 0.1				
Dichlorprop (2,4-DP) ^(S)	mg/kg	< 0.1	NONE	< 0.1				
Diclofon ^(S)	mg/kg	< 0.1	NONE	< 0.1				
Flamprop ^(S)	mg/kg	< 0.1	NONE	< 0.1				
Flamprop-isopropyl ^(S)	mg/kg	< 0.1	NONE	< 0.1				
Ioxynil ^(S)	mg/kg	< 0.1	NONE	< 0.1				
MCPA ^(S)	mg/kg	< 0.1	NONE	< 0.1				
MCPB ^(S)	mg/kg	< 0.1	NONE	< 0.1				
MCPD ^(S)	mg/kg	< 0.1	NONE	< 0.1				
Pentachlorophenol ^(S)	mg/kg	< 0.1	NONE	< 0.1				
Picloram ^(S)	mg/kg	< 0.1	NONE	< 0.1				
Triclopyr ^(S)	mg/kg	< 0.1	NONE	< 0.1				

Subcontracted analysis^(S)

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Soil Analysis Certificate - Sample Descriptions

DETS Report No: 24-01745	
LK Consult Limited	
Site Reference: Redby Street, Manchester	
Project / Job Ref: LKC 22 1260	
Order No: LKC221260-EK	
Reporting Date: 06/03/2024	

DETS Sample No	TP / BH No	Additional Refs	Depth (m)	Moisture Content (%)	Sample Matrix Description
700140	HD101	None Supplied	0.00 - 0.60	13.9	Brown loamy sand with stones and brick
700141	WS101	None Supplied	0.40 - 0.60	17.4	Brown sandy clay with stones
700142	WS101	None Supplied	0.60 - 1.00	19.1	Grey clay
700143	WS102	None Supplied	0.3 - 1.00	15.5	Black sandy gravel with brick and concrete
700144	WS103	None Supplied	2.20 - 3.00	10.8	Brown sandy clay with stones
700145	WS104	None Supplied	0.00 - 1.00	16.8	Brown sandy clay with brick
700146	WS104	None Supplied	1.20 - 2.30	14.1	Brown sandy gravel with stones and concrete

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

Insufficient Sample ^{U/S}

Unsuitable Sample ^{U/S}



DETS Ltd
Unit 1, Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Maidstone
Kent ME17 2JN
Tel : 01622 850410



Soil Analysis Certificate - Methodology & Miscellaneous Information

DETS Report No: 24-01745

LK Consult Limited

Site Reference: Redby Street, Manchester

Project / Job Ref: LKC 22 1260

Order No: LKC221260-EK

Reporting Date: 06/03/2024

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 diphénylcarbazide 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 @ 450°C	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 (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 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 (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 hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge for C8 to C44. C5 to C8 by headspace GC-MS	E004
Soil	AR	VOCs	Determination of volatile organic compounds by headspace GC-MS	E001
Soil	AR	VPH (C6-C8 & C8-C10)	Determination of hydrocarbons C6-C8 by headspace GC-MS & C8-C10 by GC-FID	E001

D Dried
AR As Received



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List of HWOL Acronyms and Operators	
DETS Report No: 24-01745	
LK Consult Limited	
Site Reference: Redby Street, Manchester	
Project / Job Ref: LKC 22 1260	
Order No: LKC221260-EK	
Reporting Date: 06/03/2024	

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

Det - Acronym
Benzene - HS_1D_MS
Ethylbenzene - HS_1D_MS
MTBE - HS_1D_MS
TPH CWG - Aliphatic >C10 - C12 - EH_CU_1D_AL
TPH CWG - Aliphatic >C12 - C16 - EH_CU_1D_AL
TPH CWG - Aliphatic >C16 - C21 - EH_CU_1D_AL
TPH CWG - Aliphatic >C21 - C34 - EH_CU_1D_AL
TPH CWG - Aliphatic >C5 - 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
m & p-xylene - HS_1D_MS
o-Xylene - HS_1D_MS

Appendix D – Certificates of Analysis (Geotechnical)

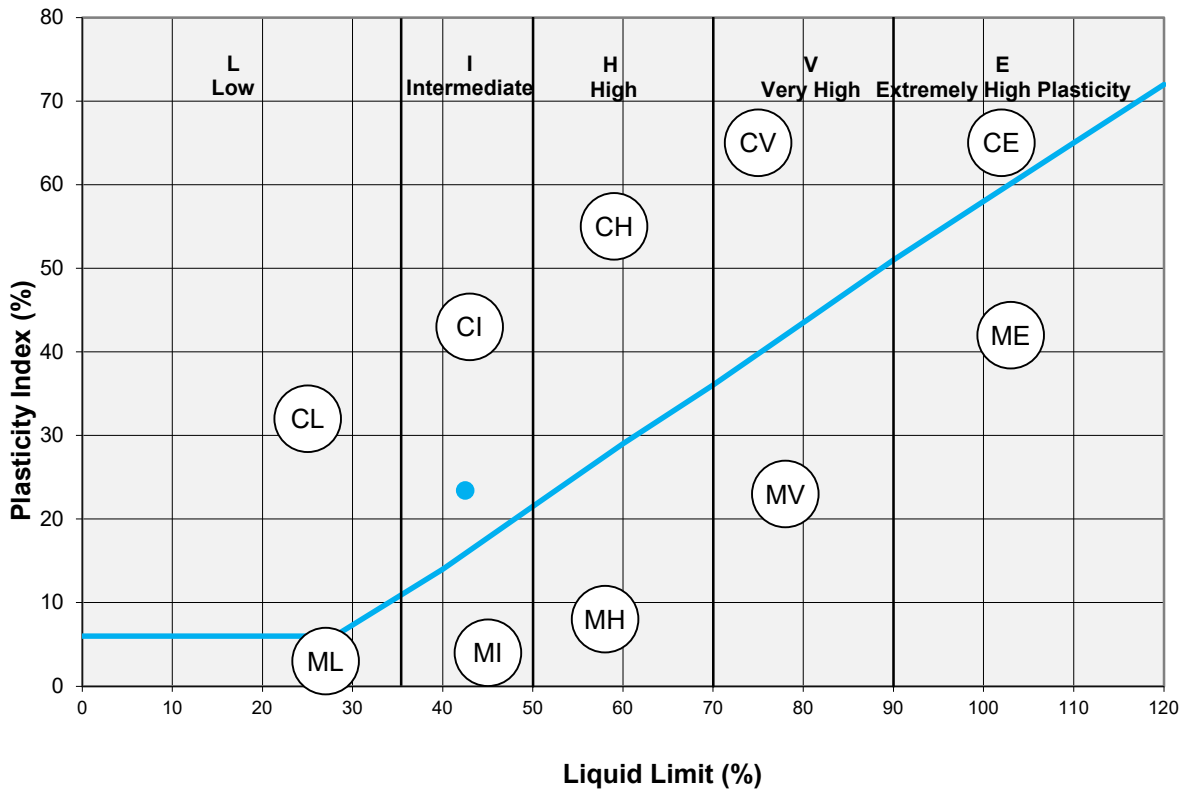
Location: Redby Street, Manchester

Sample : WS104 2.30-3.00m

Contract No. LKC 22 1260

Sample Description	Dark brown very gravelly, very sandy CLAY.
--------------------	---

Moisture Content (Natural) (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Class	Passing 425 micron (%)
16.3	43	19	23	CI	97



Tested By: EH

Checked By: CW

Date: 07/03/2024

Date: 11/03/2024

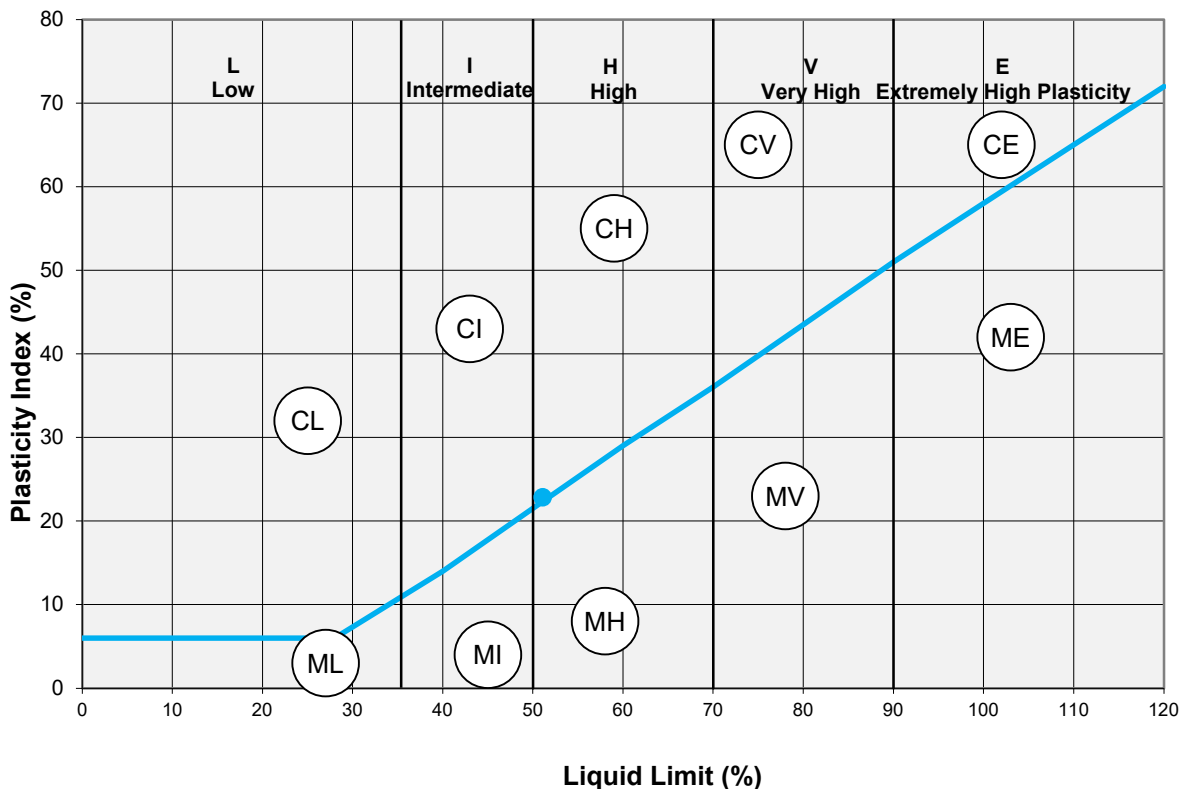
Location: Redby Street, Manchester

Sample : WS101 0.60-1.00m

Contract No. LKC 22 1260

Sample Description	Brown gravelly CLAY.
--------------------	-----------------------------

Moisture Content (Natural) (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Class	Passing 425 micron (%)
25.3	51	28	23	CI	99



Tested By: EH

Checked By: CW

Date: 05/03/2024

Date: 11/03/2024

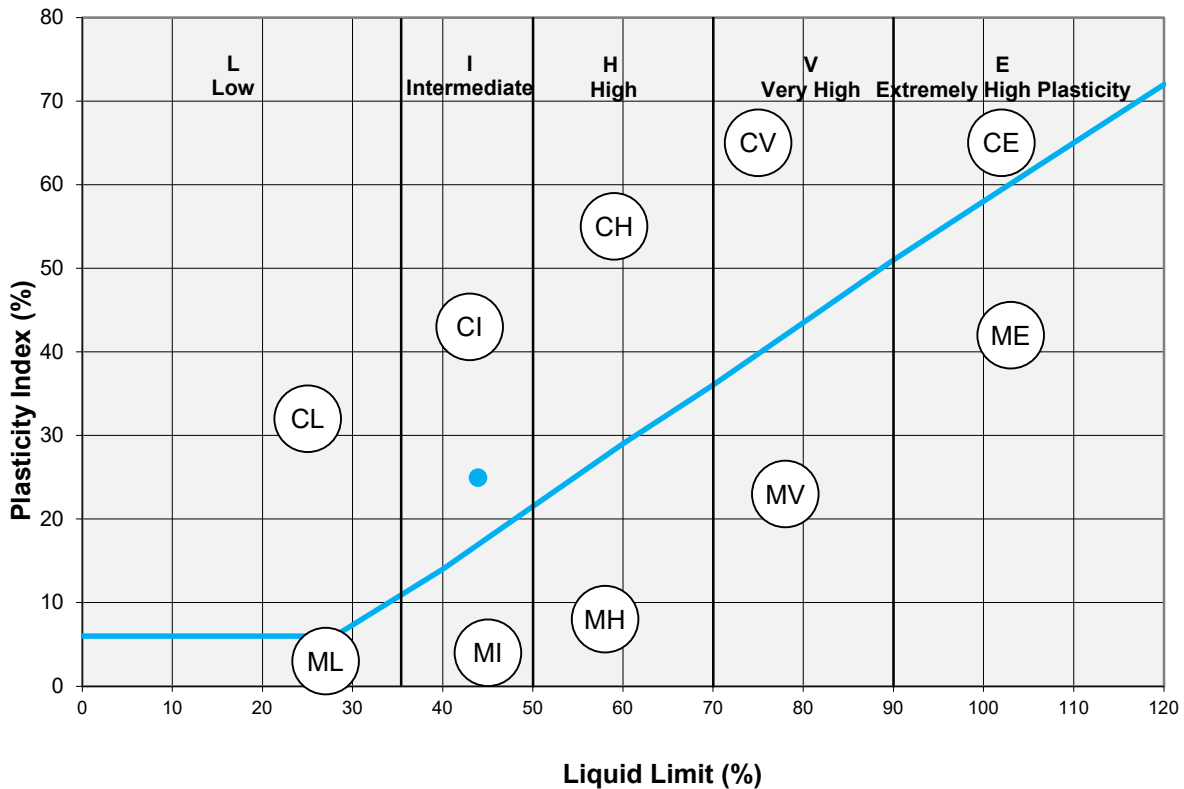
Location: Redby Street, Manchester

Sample : WS102 3.00m SPT

Contract No. LKC 22 1260

Sample Description	Dark brown slightly gravelly, slightly sandy CLAY.
--------------------	---

Moisture Content (Natural) (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Class	Passing 425 micron (%)
19.8	44	19	25	CI	97



Tested By: EH

Checked By: CW

Date: 12/03/2024

Date: 13/03/2024

Appendix E – 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	1%	1,600 ^f	1,900 ^f	1,200 ^f	28,000 ^f	3,800 ^f	7,800 ^f	LQM S4UL
	>EC44	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
		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

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