Site: **Mirabel Street, Manchester**
Date: **24th March 2023**
Planning Ref: **CDN/22/0810**
Our Ref: **LKC 21 1684-B1R1-Additional GI**

Additional Ground Investigation & Revised Remediation Strategy

1 INTRODUCTION

LK Consult (LKC) has been retained by Torsion Construction Ltd to carry out additional ground investigation works at the proposed development at Mirabel Street, Manchester. Location and proposed development plans are provided in Appendix A.

The following reports have been undertaken for the site:

- Preliminary Risk Assessment (PRA) report, undertaken by LKC (Ref: CL-602- LKC 18 1208-01, dated 1st June 2018).
- Phase 2 Geo-Environmental Investigation, Risk Assessment and Remediation Strategy report, undertaken by LKC (Ref. CL-602-LKC 21 1684-01-R1, dated January 2023).

These reports should be read in conjunction with this document.

The objectives of the further investigation works were to provide further geotechnical information on the site soils across the site and to increase confidence in the existing characterisation of site made ground.

In addition, following a review of the above reports by Manchester City Council further information and clarification was requested, namely:

1) *Further comment regarding the exceedances of lead and B(a)P found in WS103A, HD101, WS101 and CP102 will be required. Will these areas be removed as part of site remediation?*

2) *Elevated concentrations of Naphthalene have been found in CP101 and it has been recommended that this area to be removed as part of the remediation strategy and sampling of the sides and base to be undertaken to confirm the contaminant has been removed which we can accept. We will need details of how this contaminated excavated ground will be stored once removed and prior to disposal.*

3) *Gas monitoring has only been completed on 4 occasions over 4 weeks to date. We will require the final 2 rounds of gas monitoring completing to meet the requirements of 6 rounds of sampling and also to include occurrences under low and falling atmospheric pressure. An updated gas risk assessment will be required to confirm the findings following the additional gas monitoring.*

4) *A United Utilities risk assessment will be required and confirmation of the water supply pipe to be installed:*

5) *Further ground investigation will be required with an updated ground investigation, risk assessment and remediation strategy report once the obstruction / building on the western area of the site has been demolished and removed.*

6) *We can accept the comments in sections 9.2 and 9.3 of the report regarding topsoil validation for the roof terrace and site verification proposals.*

LKC provided comments in response to the above and Items 1), 4) and 6) were “accepted” or “noted” by MCC. However, further information was required for Items 2), 3) and 5).

The aim of this report is to provide the requisite further information to address these remaining points in order to support the application to discharge the pre-commencement planning condition.

2 ADDITIONAL GROUND INVESTIGATION

LKC x site on 8th March 2023 and carried out the following:

- 5no. machine excavated trial pits (ref. TP201-TP205).
- 1no. machine excavated trial trench (ref TT101) with soil profile logs in the north (TT101N) centre (TT101C) and south (TT101S) of the trench.
- 1no. hand dug trial pit through the basement of Mirabel House (ref. HD201).
- 1no. hand dug trial pit on the northern site boundary to identify in ground foundations (ref. HD202).

A sampling location plan (including all previous investigation locations) is provided in Appendix A.

Soil profile logs and excavation cross sections are provided in Appendix B.

Soil samples for contamination testing were collected from HD201. Headspace testing (using a PID) was carried out and all results were at the limit of detection of 0.10ppm.

A copy of the laboratory results is provided in Appendix C.

3 SUMMARY OF GROUND CONDITIONS

The additional ground investigation encountered very similar ground conditions to the previous phases of investigation. The Made Ground appears to comprise soil, gravel and masonry with inclusions of clay, gravel and occasional ash. Remnant footings remain which will comprise a geotechnical constraint to the development.

There was no evidence of any organic and putrescible materials.

Below the floor slab of Mirabel House a nominal depth of Made Ground (0.6m) was encountered.

The additional investigation increases the confidence in the ground model for the site and that the made ground has been suitably characterised.

4 PROPOSED ENABLING WORKS

Torsion Construction Ltd has advised that given the site constraints of the city centre location and limited space on site that very little (if any) stockpiling of soils will occur and that the ground will be prepared for piling to enable development of both proposed blocks concurrently.

Based upon the most recent phase of intrusive investigation the eastern area (current car park) will be excavated to a depth of 3m to remove remnant obstructions and oversize materials. Suitable materials will be re-engineered and recompacted with the remainder disposed of off-site. There is no room for a crusher or screener on site and any deleterious materials (such as timber, plastic, refuse or fines etc) will be removed along with oversize materials.

A 600mm piling mat will be installed, comprising certificated 6F2 materials.

For the western area, after demolition of Mirabel House this part of the site will be excavated and re-engineered to a depth of 2m and a 600mm piling mat installed.

The enabling works excavation depths were set following a review of the soil profile logs.

5 FURTHER RISK ASSESSMENT & PROPOSED ENABLING WORKS

Further risk assessment incorporating a discussion of proposed enabling works (including the inherent remediation works) with the aim of addressing Items 2), 3) and 5) as raised by MCC (refer to Section 1 for details) is provided below:

Item 2) Naphthalene in CP101

As per the previous Remediation Strategy the elevated naphthalene is thought to relate to tarmac inclusions in the shallow soil (0.1-0.5m). Naphthalene was not elevated in a sample from 0.1-1.1m in TP103 to the south, so this suggests a limited impact. No elevated naphthalene was identified across the remainder of the site.

As part of Torsion Construction Ltd enabling works a priority is to excavate the area around CP101 to the nominal depth of 0.5m (where tarmacadam fragments are observed in the Made Ground) and remove off site. It should be noted in TP103 that a separation membrane was present at 0.4mbgl. LKC will be in attendance during this phase of work.

Once the remediation excavation has been completed to LKC satisfaction (using visual and olfactory evidence for tarmacadam inclusions), LKC will collect a composite sample across the base of the excavation and samples from each side of the excavation at the target depth. If the results fail the generic assessment criteria, then further depth and / lateral extension of the remedial excavations will be carried out and subject to further validation testing.

The intention is to excavate and remove the remediation arisings in the same day. If, for whatever reason soil is retained overnight then it will be placed in a stockpile and sealed with Visqueen to keep it dry.

Item 3) Hazardous Gas Risk

The further intrusive works have demonstrated that the site soils are generally devoid of organic or putrescible material. The amount of intrusive works carried out adds a level of robustness to the ground model and Made Ground characterisation.

The initial conceptual model identified the site Made Ground was the only viable source of hazardous gas to the site i.e. no off-site landfills or ground gas sources such as peat, radon or coal measures were identified.

It is assumed the Made Ground adjacent to the site is of the same form and type.

The Soil Organic Matter (SOM) results ranged between 1.3% and 6.3% and is considered to be due to varying low levels of ash in the soils. The outlier is HD101 (0.5-0.8m) where an SOM of 38% was noted in a layer of black ash and coal. It should be noted this material was not encountered in any other sampling locations and will be removed off site during the reduced level excavation.

The gas monitoring was carried out in November and December 2021 on behalf of the previous vendor of the site to give interested parties' information on the site conditions and to help attract unconditional offers for the site.

LKC recognise that the monitoring does not follow the *typical/idealised periods or typical/idealised frequency* of monitoring as presented in Tables 5.5a and 5.5b of CIRIA C665[1]; however, LKC note that MCC, in common with many other local authority regulators, do not apply this guidance across all cases and development scenarios.

LKC would note that the monitoring shows repeatable results over varying atmospheric pressure trends, no flow was ever detected, and the results are typical of background soil gas levels in the UK i.e. methane below limit of detection (0.1% v/v) and carbon dioxide less than 5% v/v (maximum 3.8% v/v).

Considering the site setting and conceptual model, and the prevailing ground conditions noted in the intrusive site works only LKC would consider there was a low risk from hazardous gas to the development and that gas monitoring and gas protection measures are not required.

The gas results are reported "as is" to add a further line of evidence to support the above justification. If required by MCC these can be removed from the report and risk assessment and a qualitative assessment provided only.

Project experience indicates that Made Ground with this composition does not generate gas at any appreciable or indeed detectable flow rate (as there is negligible organic or putrescible material – as shown by a substantial amount ground investigation) and the available monitoring corroborates this.

At the limit of detection of flow of 0.1l/hr the hazardous gas concentration (methane or carbon dioxide) would need to be 70% v/v to exceed the GSV for CS1. This gas concentration is considered highly unlikely given the characterisation and composition of the Made Ground and the lack of any viable source identified which could generate such high values.

For a flow rate of 0.5l/hr, which again is considered unlikely due to the very low generation source, then hazardous gas concentrations to exceed the GSV for CS1 would need to be 14% v/v. Again this is considered highly unlikely given the composition of the Made Ground and LKC project experience.

At the maximum hazardous gas concentration detected of 3.8% a flow rate of 1.84l/hr would be required to trigger CS2. Again this is considered highly unlikely given the composition of the Made Ground and LKC project experience.

Notwithstanding the above, Section 4 describes the enabling works strategy. The excavation and processing of the Made Ground will remove unsuitable material such as many of the fines and any timber / putrescible / deleterious materials thereby providing a further route where any viable gas source not identified by the existing extensive intrusive site works will be removed.

The re-engineering of the Made Ground will undergo a level of compaction and reduce soil pore space where aerobic and anaerobic soil processes generating gas may occur. This is analogous with the remediation methods advised in CIRIA C758[2], remediating colliery spoil. Excluding or preventing air ingress reduces the combustion risk.

[1] CIRIA (2007). "Assessing Risks Posed by Hazardous Ground Gases to Buildings." CIRIA C665.
[2] CIRIA (2019). "Abandoned Mine Workings Manual". CIRIA C758.

In summary:

- The monitoring results are provided for completeness. If required by MCC these can be removed from the risk assessment and a qualitative assessment of gas risk based on ground conditions and gas generation potential. This would remove the issue of the monitoring not complying the typical/idealised period and frequency outlined in CIRIA C665.
- The intrusive investigation has robustly characterised the Made Ground and from this LKC consider the Made Ground has a very low generation potential for hazardous gas. Rare timber and ash are present but is mainly soil, gravel, clay, masonry and concrete.
- The monitoring was carried out over varying atmospheric conditions. The soil gas results are typical of background soil levels and flow rates were all below the analytical limit of detection of 0.1l/hr. The ground conditions do not indicate that worst case conditions would vary from those already encountered. There is no significant gas source.
- In order to reach a GSV which would exceed CS1 conditions (i.e. where gas protection measures were required), at the limit of detection of flow (0.1l/hr) the soil gas concentrations would need to reach 70% v/v. This is highly unlikely.
- If a flow rate of 0.5l/hr is assumed, which is considered unlikely given the nature of the site made ground, then gas concentrations of 14% v/v would be required for a GSV to exceed CS1. Again this is considered unlikely.
- At the maximum hazardous gas concentration detected of 3.8% a flow rate of 1.84l/hr would be required to exceed CS1. Again this is considered highly unlikely given the nature of the made ground and LKC project experience.
- The enabling works will remove any deleterious / organic / putrescible material (i.e. a hazardous gas source) that may not have been encountered in the ground investigation works and the re-engineering and compaction will reduce soil pore space and the potential for aerobic or anaerobic gas generation.

Considering the above lines of evidence LKC consider the gas risk is low and neither further gas monitoring, nor gas protection measures are required.

Item 5) Further Investigation Requirement

The made ground in the sampling positions in and around Mirabel House is broadly similar to elsewhere on site with the exception of shallower Made Ground below parts of Mirabel House and a thin layer of black ash and coal in the small “courtyard” area to the north elevation of Mirabel House (HD101 0.5-0.8m). This material will be removed off site.

No visual or olfactory evidence of contamination was noted.

The analytical results from this additional phase of investigation may be compared to the generic soil assessment criteria as utilised in the previous report.

No elevated levels of contaminants were identified; therefore, no additional remediation requirements have been identified.

6 REVISED REMEDIATION STRATEGY

6.1 Remediation and Validation

Considering the above additional information a revised Remediation Strategy is provided in Table 6-1.

Phase	Remediation Requirements	Validation Requirements
Pre-Construction / Enabling Works	Earthworks Inspections / Unexpected Contamination The relevant contractors should be briefed that during development works at the site should any unusual ground conditions and / or visual or olfactory evidence of contamination (including asbestos containing material) be encountered at the site, LKC and the Local Authority should be informed, and further assessment of the material may be required. Note that the made ground will be excavated to its full depth across the site, segregated and geotechnically suitable material re-engineered and replaced. Unsuitable material will be disposed of off-site.	Log of work undertaken including photographs. Details of any sampling undertaken and validation of any potential additional remedial work. Confirmation of removal of materials off site.
	Naphthalene Remediation (Localised around CP101). Removal of shallow made ground (0.1-0.5mbgl) with tarmacadam inclusions. Excavation to be supervised by LKC. Once satisfied validation samples to be collected of the excavation base and sides. If unsuccessful further excavation and validation to be carried out.	Photographs, waste transfer notes and validation sampling. Impacted material to be excavated and loaded for off-site disposal. No storage of waste soils on site.
	Removal of Ash and Coal Layer from HD101 Located in the northern extent of the site in the very small courtyard to Mirabel House at shallow depth (0.5-0.8mbgl). To be removed off site.	Photographs of excavation and proof of removal off site.

Table 6-1: Further work, remediation and validation

Phase	Remediation Requirements	Validation Requirements
Build-Phase Construction	Sulphate Resistant Concrete Sulphate Resistant Concrete in line with DS-2 AC-2 recommended. DS-3, AC-3 may be required in the vicinity of TP105 where the water-soluble sulphate was recorded at 1,540mg/l.	N/A – to be addressed by the structural engineer.
	Potable Water Pipes If required by United Utilities a Water Pipeline Risk Assessment (UURA) will be undertaken once the location and depth of potable water pipes are known. It is likely that barrier pipe will be required.	If barrier pipe required: Delivery notes of pipe material. Photographs of the installed pipe.
Other Requirements		
Grubbing Out of In-Ground Structures The developer has proposed to remove in-ground structures as part of the enabling / groundworks.		
Topsoil Growing Medium Soft landscaping is shown on the roof terrace proposed development plan. A topsoil cover of approximately 150mm is recommended for any soft landscaping. Testing of any imported topsoil should meet the requirements detailed in Table 9.2.		
Re-use of site won material To ensure material is compliant with appropriate waste regulations, any site won material re-used onsite should be in recourse to appropriate exemptions. A U1 and T5 exemption should be registered. This will allow the following to be used onsite or brought in for use onsite (refer to guidance for types of waste that can be used [3]): 5,000 tonnes (*c.* 2,500m^3) treatment of crushed concrete / stone. 1,000 tonnes (*c.* 500m^3) use of non-hazardous soil 5,000 tonnes (*c.* 2,500m^3) use of clays, sand, gravel, brick, concrete, stone etc. 50,000 tonnes (*c.* 25,000m^3) use of bituminous material to be used in roadways. A Materials Management Plan (MMP) with recourse to the CL:AIRE Code of Practice may be required if volumes exceed exemption limits. This must be registered **before** material movement starts onsite. If an MMP is required, this needs to be registered by a Qualified Person (QP) and there must be 'certainty of use' for any material re-used onsite or exported to site to ensure there is no 'sham recovery'. For all the above material will need to be tested at the rate and analytical suites presented in Table 9-2.		

Table 6-1 (continued): Further work, remediation and validation requirements

[3] https://www.gov.uk/guidance/waste-exemptions-using-waste

Asbestos Management Plan

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

This risk can be managed by careful procedures and site monitoring to reduce the risk of airborne fibres, and it is recommended that an appropriate 'Asbestos Management Strategy' is developed and adopted for all intrusive ground works which disturb the made ground in the area of concern. This should be carried out in line with CIRIA C733[4].

This may include asbestos awareness training for all site staff, provision of suitable personal and respiratory protective equipment and air monitoring.

With regards to cement bound asbestos, this can be handpicked, doubled bagged and disposed of appropriately to a licenced landfill. Guidance on removing asbestos cement is described in HSE (2012)[5].

If ACM is identified in soil arisings, then soil should be placed directly into covered skips and disposed of at a suitable licenced landfill, after further testing to quantify the extent of asbestos contamination of the soils. It should be considered that blue asbestos is notifiable and must be removed by a licenced contractor.

LKC have used the Joint Industry Working Group (JIWG) work categories and receptor risk ranking assessment tools for the site. The output sheets are presented in Appendix H. This has identified a medium risk during earthworks and a low risk to construction workers, the outputs are shown below.

Stage 3

Risk Assessment Outputs

Probable Licensing Status	Non-Licensed Work
RPE*	EN149 type FFP3 disposable
Dust Suppression**	Manual/localised dust suppression
Hygiene/Decontamination***	Localised and basic personal decontamination facilities

*Where RPE has to be worn continuously for long periods (e.g. more than 1-hour), then powered RPE may be necessary.
**Reduction in control measures possible if natural mitigation factors are present (e.g. raining, wet ground)
***Guide only; suitability of selected personal hygiene measures may be reviewed on a site/contamination-specific basis

The asbestos management plan shall be implemented by the enabling works contractor.

Health and Safety Considerations

In working with, removing or treating any contaminating material it is important that any potential risks associated with the actual site works are mitigated by good environmental management of the site during the remedial phases. Standard health and safety precautions (as per HSE guidance[6]) should be adopted by all workers involved with site enabling and construction works.

Piling in Contaminated Land

It is understood that the buildings may be piled into the bedrock. This may provide a preferential pathway for contaminants to the Principal Aquifer. Once the method of piling has been determined, good practice for the drilling of piles on contaminated sites should be adhered to, such as guidance provided by the Environment Agency[7].

Asbestos Survey

A Pre-Demolition and Major Refurbishment Asbestos Survey should be undertaken, and any ACMs removed and properly disposed of, prior to the demolition of the existing buildings, by a suitably qualified professional.

Table 6-1 (continued): Further work, remediation and validation requirements

[4] CIRIA (2014). "Asbestos in Soil and Made Ground: A Guide to Understanding and Managing Risks". C733.
[5] HSE (2012). "Removing Asbestos Cement (AC) Debris)." A11 Asbestos Essential – Non-licenced Tasks.
[6] HSE (1991). "Protection of Workers and the General Public During Development of Contaminated Land" London HMSO.
[7] Environment Agency (2001) Piling and Penetrative Ground Improvement Methods on Land Affected by Contamination: Guidance on Pollution Prevention.

6.2 Validation of Topsoil

Chemical validation of all imported soils to be used on site in the proposed roof terrace should be undertaken. Imported soils should be accompanied by a certificate of analysis and source details.

A summary of the required imported material sampling requirements is presented in Table 9-2. Ideally, the material should be sampled at source to prevent double handling if soil fails. However, where this is not possible then material imported should be segregated based on source and soil type. Validation samples should be taken prior to placement in gardens to ensure suitability for use.

Material Type	Source	Suite of Analysis	Sampling Rate*
Topsoil	Greenfield	Suite A	1 sample per 50m^3
	Brownfield / Unknown	Suite B	

Table 9-2: Sampling requirements for imported soils.

Notes:

Suite A - Heavy metals, pH, water soluble sulphate, speciated PAH, soil organic matter and asbestos screen.
Suite B - Heavy metals, pH, water soluble sulphate, speciated PAH, phenol, total and free cyanide, soil organic matter, asbestos screen, banded petroleum hydrocarbons (TPH CWG), BTEX, MTBE.
*Minimum sampling rate of 3 samples per source.

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

In addition, it should be ensured that the matrix of the topsoil is suitable as a growing medium and no undesirable material is present (in line with BS3882[8]). LKC advise this information is provided by the supplier before material is imported onto site. Imported material to be used in gardens will be compared against residential without plant uptake criteria.

6F2 material to be imported for use in the piling mat shall be supported by suitable certification.

6.3 Site Completion Report

It is recommended that any remediation carried out on the site is validated by a third party and suitable documentary evidence provided in a Site Completion Report, such as photographs, consignment documents and analytical results. This should include as a minimum:

- Provision of waste transfer documents.
- Details of the removal of shallow naphthalene contamination around CP101 and validation sampling of the excavation.
- Details of removal of the ash and coal layer in HD101.
- Verification testing of all imported soil for soft landscaping areas.
- Piling mat certification.
- UURA and photographs of the installation of barrier pipe - if required by United Utilities.
- Details of any unexpected contamination identified onsite, suitably risk assessed and / or validated.

Report Prepared By:

Colin Crompton
Director

[8] BS (2015). "Specifications for Topsoil and Requirements for use." BS3882:2015.

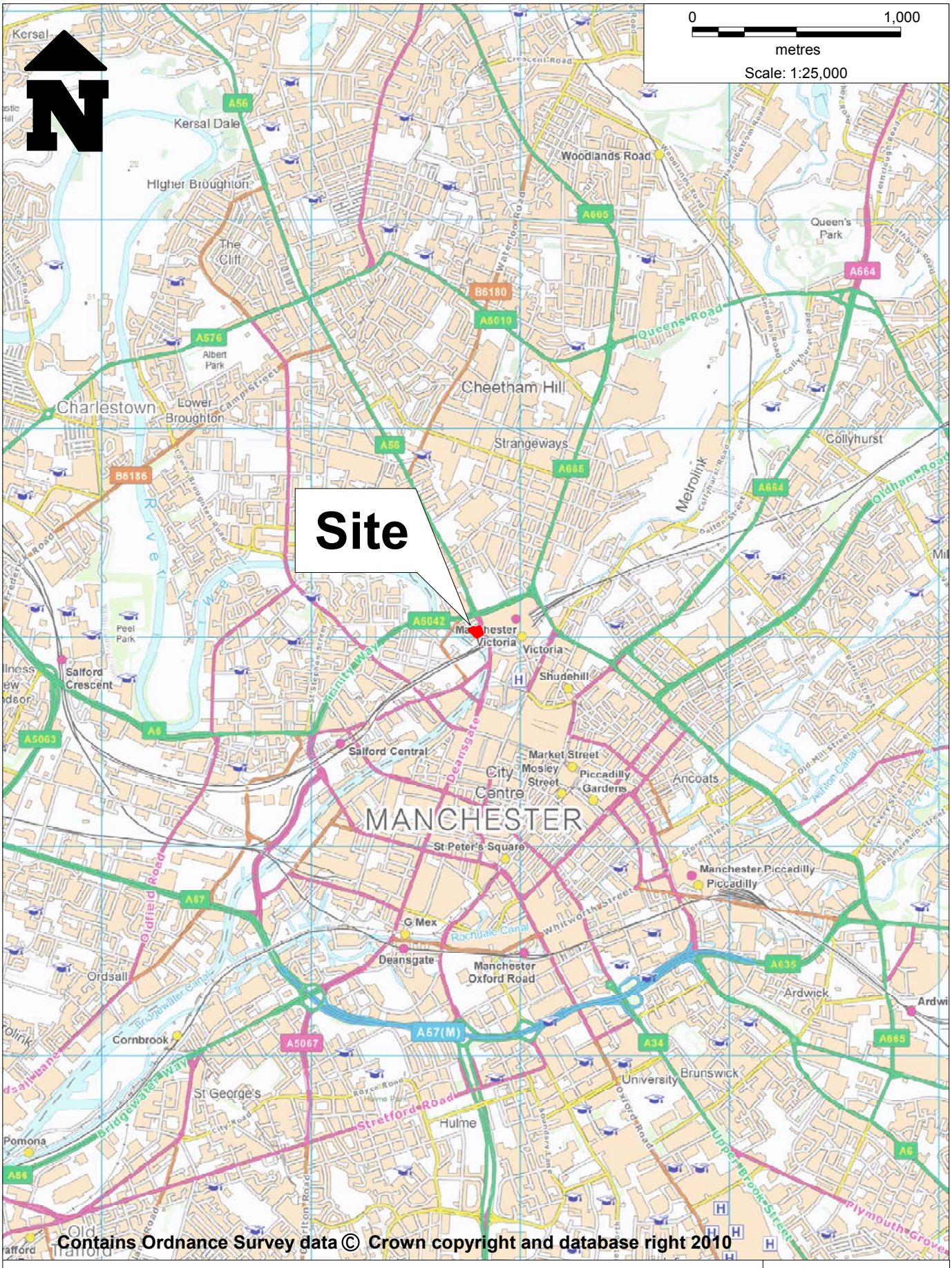
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Appendix A: Figures
Appendix B: Profile Logs
Appendix C: Certificates of Analysis

Disclaimer

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Appendix A – Figures

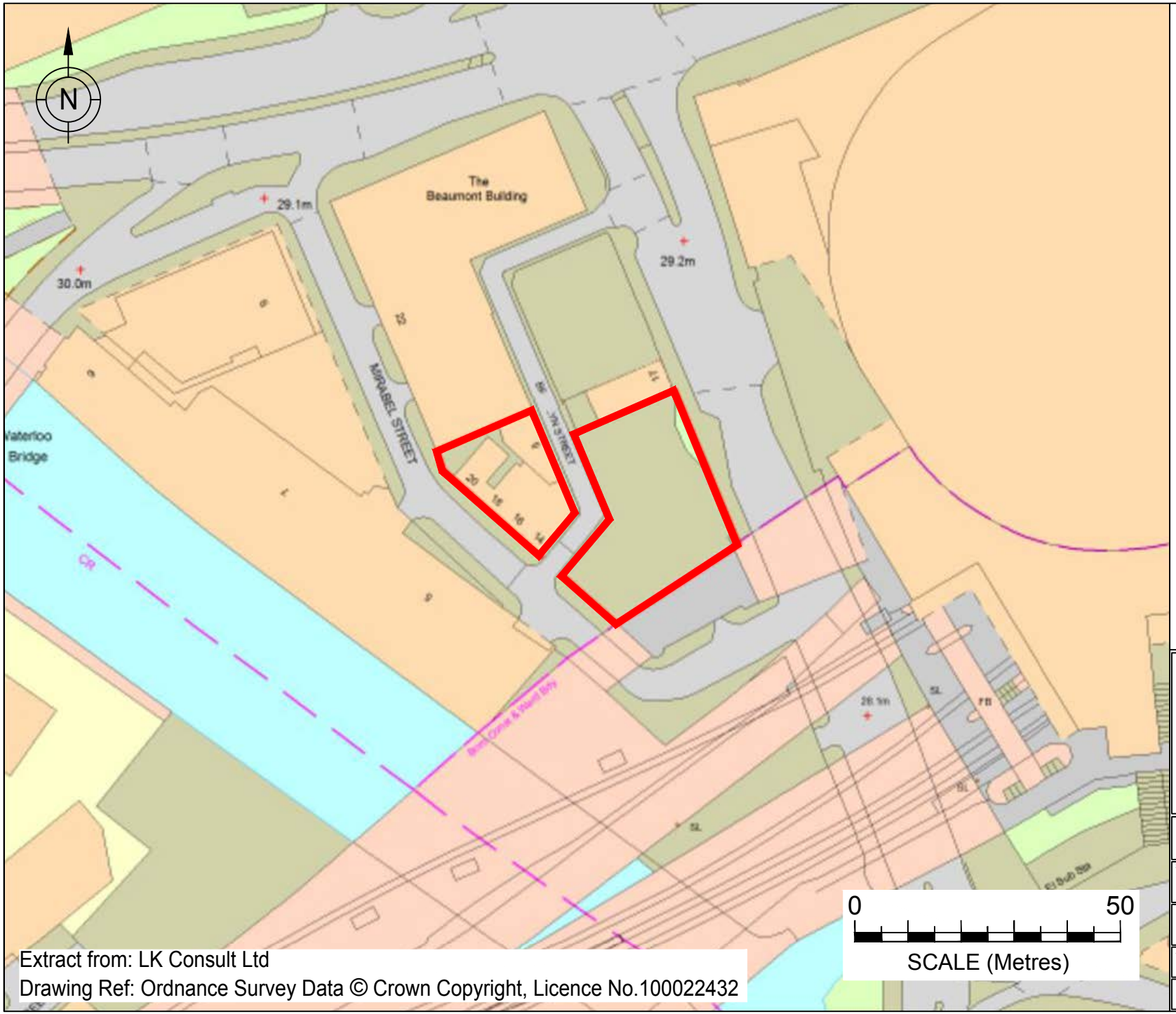


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Figure 1: Site Location Plan, Mirabel House, Great Ducie Street, Manchester

Drawn: June 2018 Scale: 1:25,000 @ A4 (see scale bar)

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KEY

Site Boundary

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

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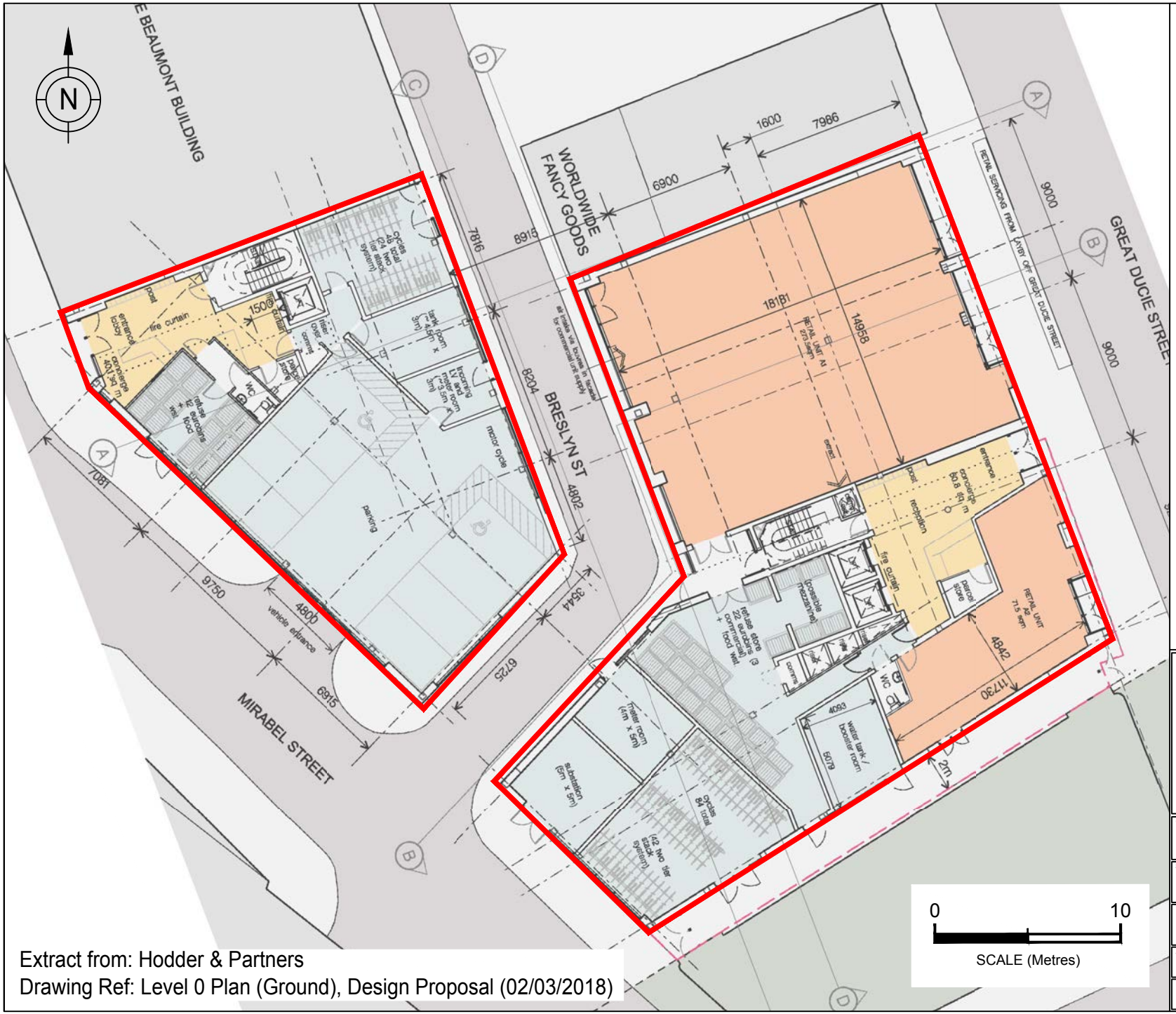
Client: Torsion Construction Ltd

Site: Mirabel House, Great Ducie Street, Manchester

Title: Site Boundary Plan

Job No.:	Scale (See Scale Bar):	Figure:	Revision:
LKC 21 1684	1:1000 @ A4	2	

Drawn By:	Checked By:	Drawn:
AC	CB	Jun 2018



Extract from: Hodder & Partners
Drawing Ref: Level 0 Plan (Ground), Design Proposal (02/03/2018)

KEY

Site Boundary

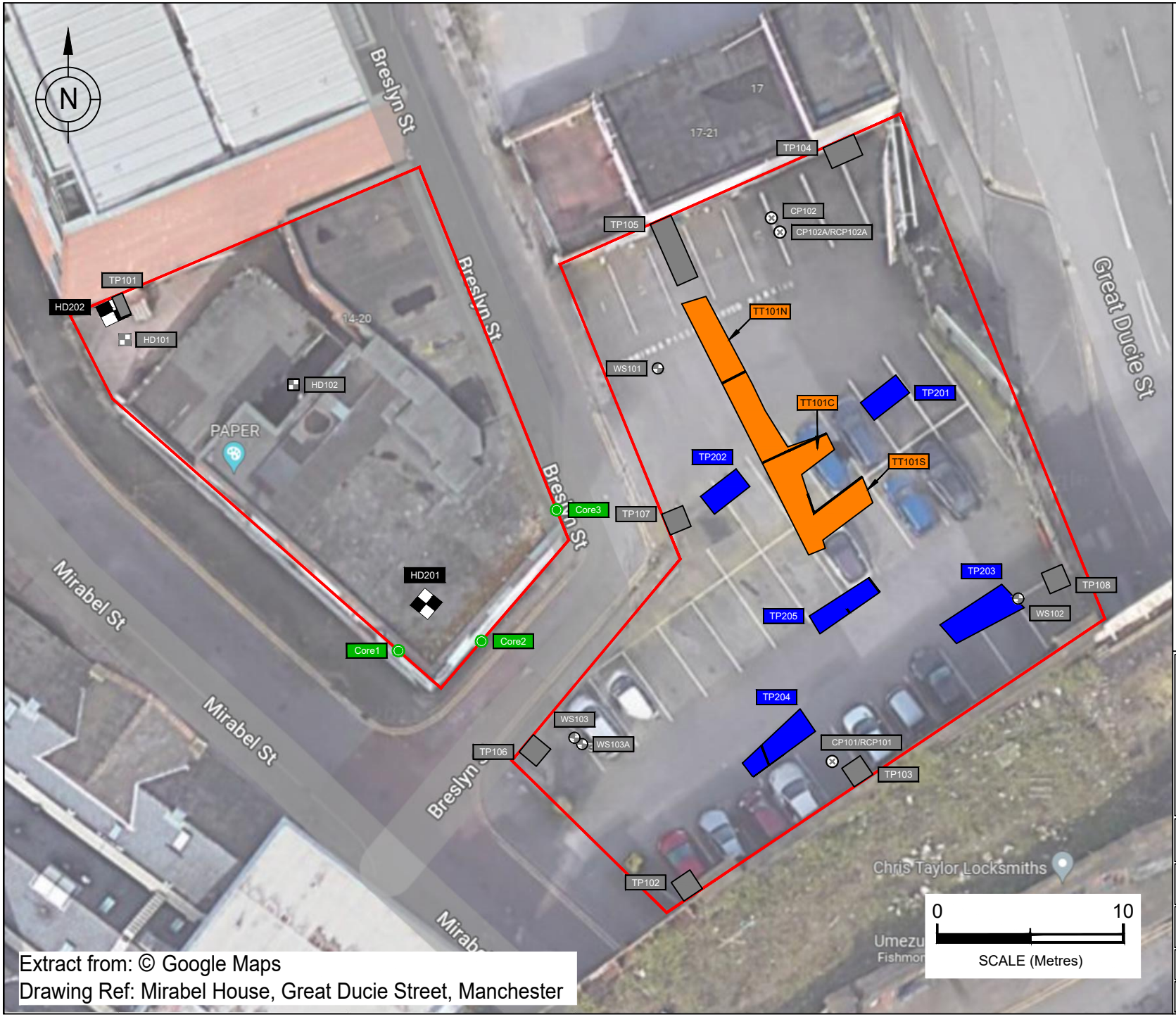
Sampling Locations and features annotated by LK Consult Ltd are approximate and are based upon observed measurements unless otherwise stated. Do not scale from this drawing and work from marked dimensions only. All dimensions and features should be confirmed on site by the Contractor. Where this drawing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

LK CONSULT LIMITED

Client:	Torsion Construction Ltd
Site:	Mirabel House, Great Ducie Street, Manchester
Title:	Proposed Site Use

Job No.:	Scale (See Scale Bar):	Figure:	Revision:
LKC 21 1684	See Scale Bar	3	

Drawn By:	Checked By:	Drawn:
AC	CB	Jun 2018



KEY

- Site Boundary
- Trial Trench (TT) Refer to 3no. separate logs TT101N (north), TT101C (centre), TT101S (south)
- Trial Pit (TP)
- Hand Dug Trial Pit (HD)
- Core (Through External Walls)
- Location of Walls (Approximate)
- Trial Pit (TP) (LKC December 2022)
- Window Sample Borehole (WS) (LKC 2021)
- Hand Dug Trial Pit (HD) (LKC 2021)
- Cable Percussive Borehole (CP) with Rotary Follow-On Where Indicated (RCP) (LKC 2021)

NOTE:

TP101 = 0.3m x 0.8m
TP102 = 0.9m x 1.2m
TP103 = 0.9m x 1.2m
TP104 = 1.0m x 1.3m
TP105 = 1.0m x 3.0m
TP106 = 1.2m x 1.2m
TP107 = 1.2m x 1.2m
TP108 = 1.2m x 1.2m

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: Torsion Construction Ltd

Site: Mirabel House, Great Ducie Street, Manchester

Title: Site Investigation Location Plan

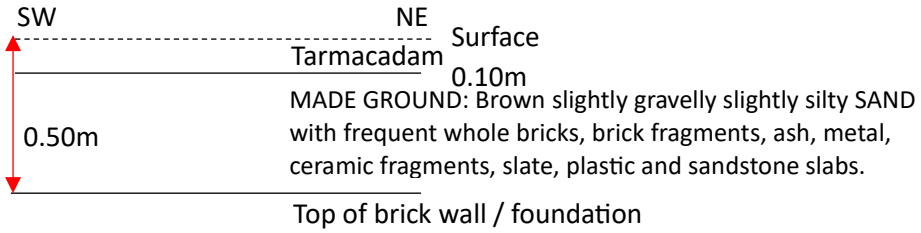
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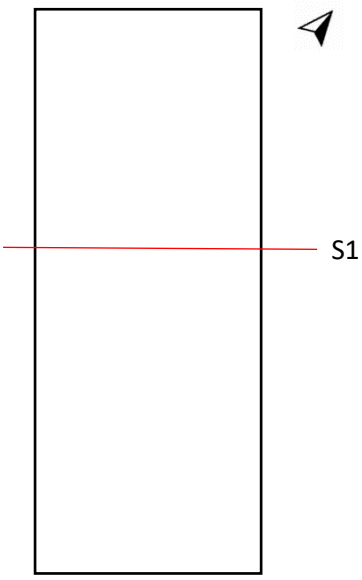
Appendix B – Profile Logs

Mirabel House, Great Ducie Street, Manchester

TT101N (north)



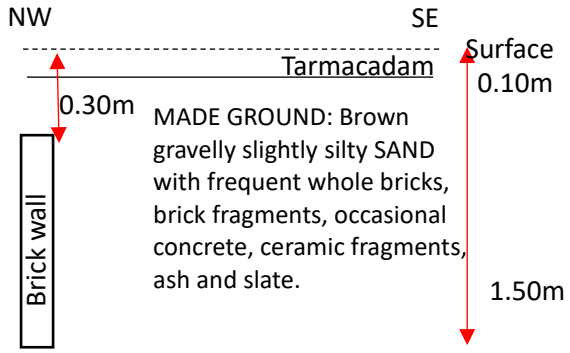
TT101N (north) Cross section S1. Not to scale.



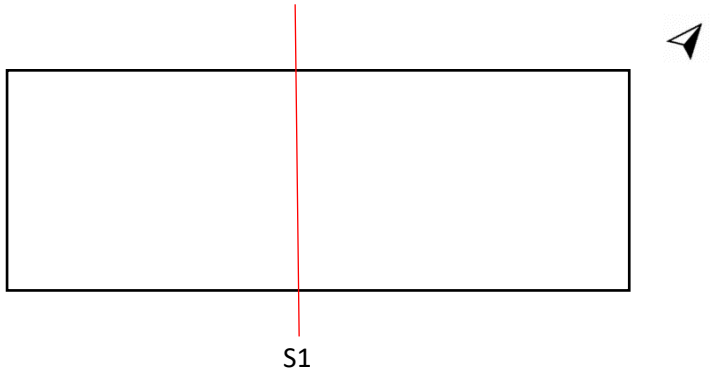
TT101N plan view. Not to scale.

Mirabel House, Great Ducie Street, Manchester

TT101C (centre)



TT101C (centre) Cross section S1. Not to scale.



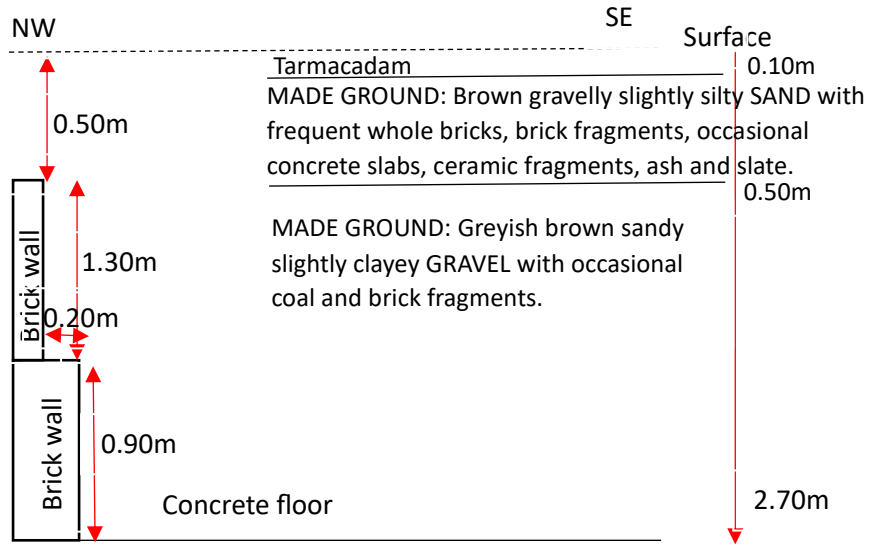
TT101C plan view. Not to scale.



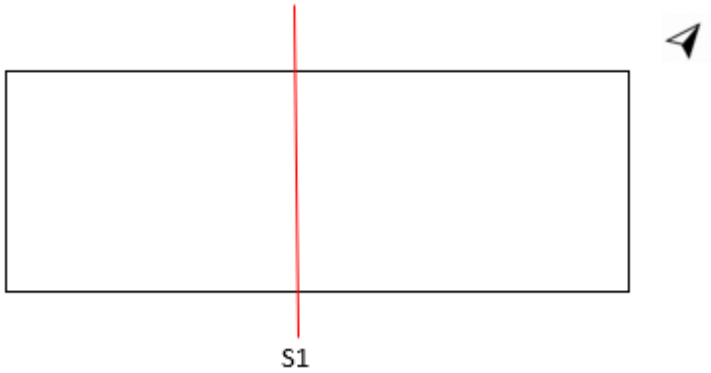
Brick wall visible in north western wall of pit.

Mirabel House, Great Ducie Street, Manchester

TT101S (south)



TT101S (south) Cross section S1. Not to scale.



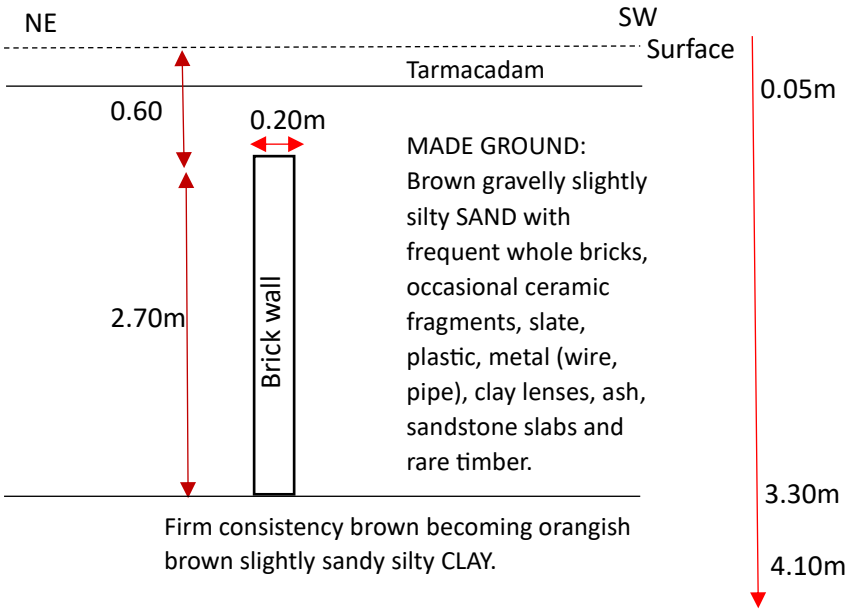
TT101S (south) plan view. Not to scale.



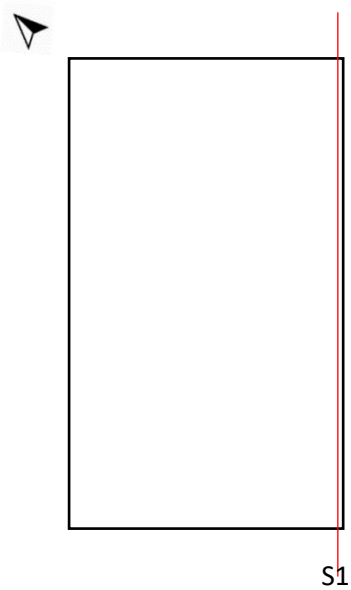
Brick wall visible in north western wall of pit and concrete floor visible.

Mirabel House, Great Ducie Street, Manchester

TP204



TP204 Cross section S1. Not to scale.



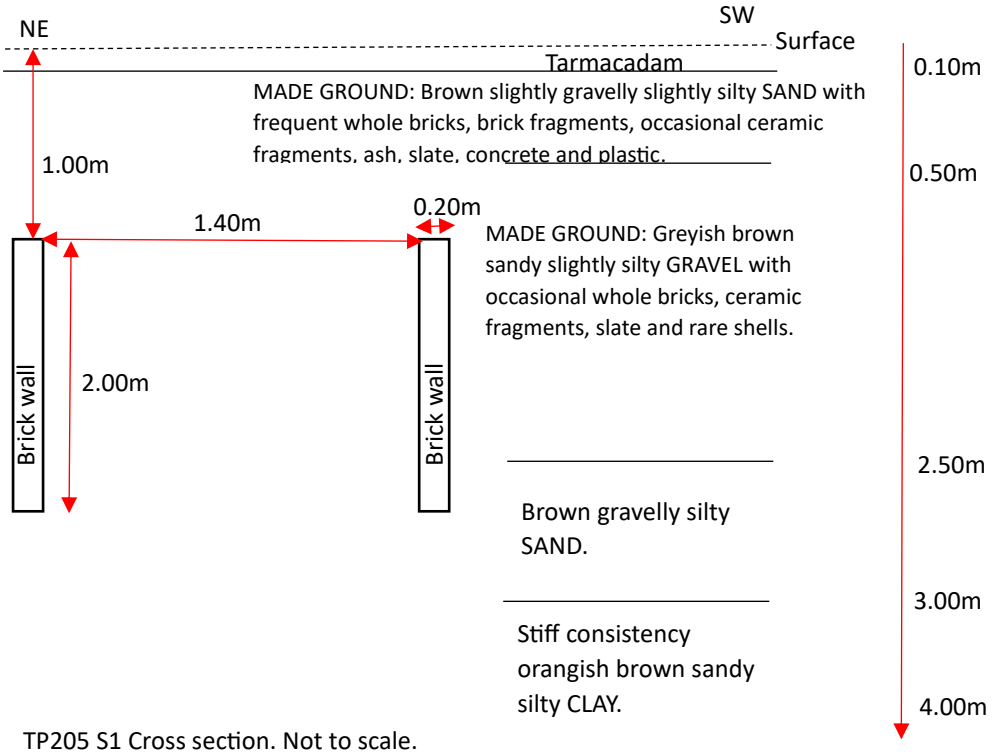
TP204 plan view. Not to scale.



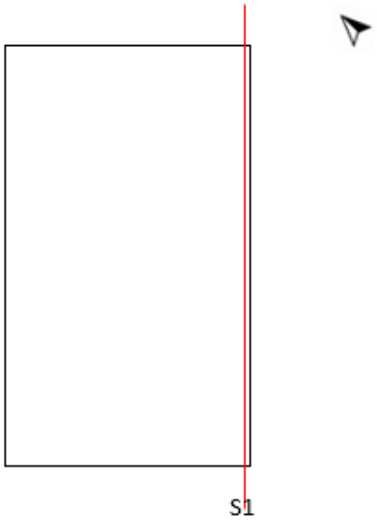
Brick wall visible on south eastern wall of TP204.

Mirabel House, Great Ducie Street, Manchester

TP205



TP205 S1 Cross section. Not to scale.



TP205 plan view Not to scale.



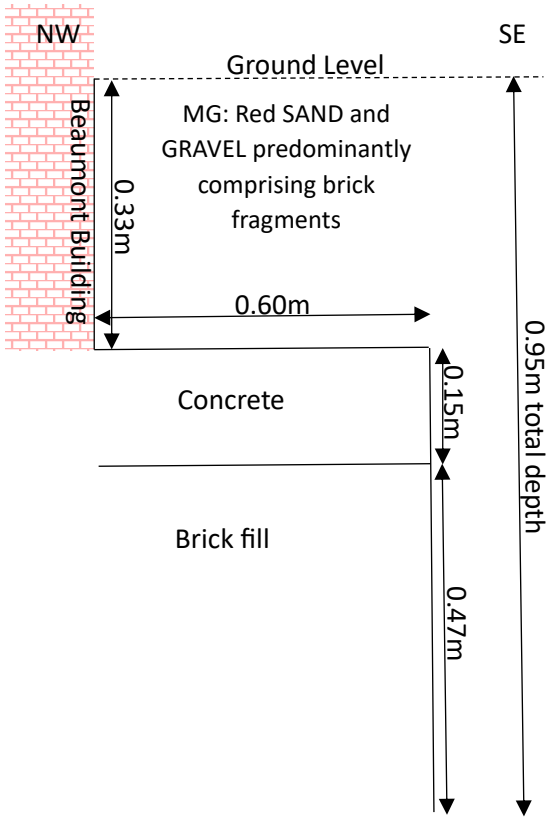
View of brick wall in south eastern wall of TP205.



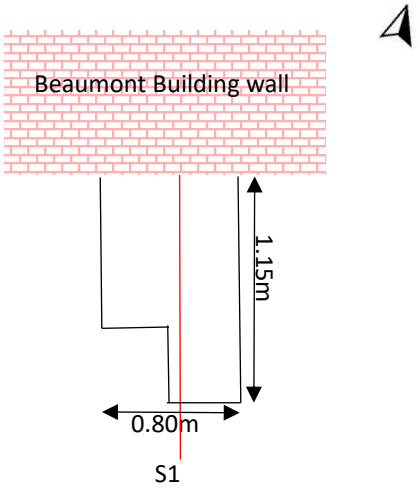
View of brick wall along north eastern wall of TP205.

LKC 21 1684 Mirabel House, Great Ducie Street, Manchester

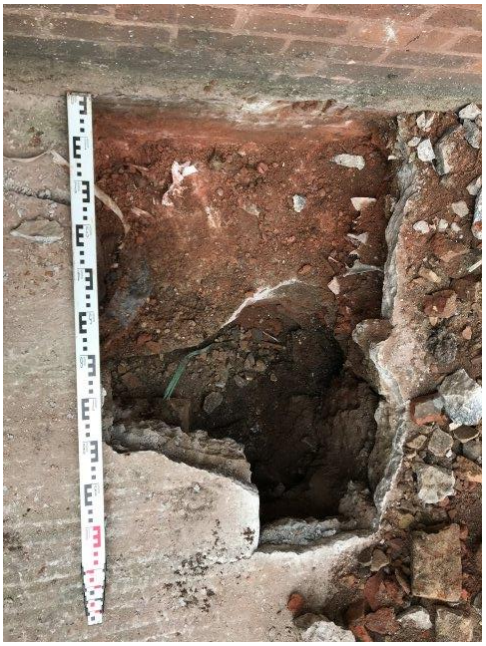
HD202 (foundation pit)



HD202 cross section S1. Not to scale.



HD202 plan view. Not to scale.



LK GROUP	**LK CONSULT LTD** Eton Business Park, Eton Hill Road, Radcliffe, M26 2ZS Tel: 0161 763 7200 web: www.thelkgroup.com	**Site** Mirabel House, Great Ducie Street, Manchester	**Trial Pit Number** **HD201**
Excavation Method Hand excavated trial hole to 1.20mbgl.	**Dimensions** 0.30m x 0.30m x 1.20m	**Ground Level (mOD)**	**Client** Torsion Construction	**Job Number** LKC 21 1684
	Location	**Dates** 08/03/2023	**Engineer** LKC	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					0.04	CONCRETE.		
0.04-0.15	ES PID=0.1ppm				(0.11)			
0.15-0.60	ES PID=0.1ppm				0.15	MADE GROUND: Red sandy GRAVEL. Sand is fine to coarse. Gravel is fine to coarse subangular to angular of brick.		
					(0.45)	MADE GROUND: Dark brown slightly gravelly sandy CLAY with frequent coal, occasional ash and brick fragments. Sand is fine to coarse. Gravel is fine to coarse of ash, brick and coal.		
0.60-1.20	ES PID=0.1ppm				0.60	Brownish orange very clayey SAND. Sand is fine to coarse.		
					(0.60)			
					1.20	Complete at 1.20m		



Remarks

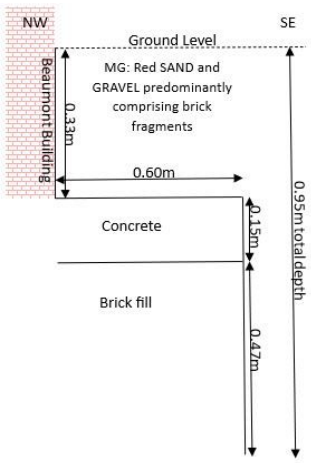
Trial hole stable and dry.

Scale (approx)	Logged By	Figure No.
1:20	RP	LKC 21 1684.HD201

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LK CONSULT LTD Eton Business Park, Eton Hill Road, Radcliffe, M26 2ZS Tel: 0161 763 7200 web: www.thelkgroup.com		**Site** Mirabel House, Great Ducie Street, Manchester	**Trial Pit Number** **HD202**
Excavation Method Hand excavated trial hole to 0.95mbgl.	**Dimensions** 0.80m x 1.15m x 0.95m **Location**	**Ground Level (mOD)** **Dates** 08/03/2023	**Client** Torsion Construction **Engineer** LKC	**Job Number** LKC 21 1684 **Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					0.05	CONCRETE with plastic membrane at base.		
					(0.90)	MADE GROUND: Red SAND and GRAVEL predominantly comprising brick fragments. Sand is fine to coarse. Gravel is fine to coarse subangular to angular.		
					0.95	Complete at 0.95m		



Remarks

Trial hole stable and dry.

Scale (approx)	Logged By	Figure No.
1:20	RP	LKC 21 1684.HD202

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LK CONSULT LTD Eton Business Park, Eton Hill Road, Radcliffe, M26 2ZS Tel: 0161 763 7200 web: www.thelkgroup.com		**Site** Mirabel House, Great Ducie Street, Manchester	**Trial Pit Number** **TP201**
Excavation Method Machine excavated pit to 1.20mbgl.	**Dimensions** 1.00m x 1.50m x 1.10m **Location**	**Ground Level (mOD)** **Dates** 08/03/2023	**Client** Torsion Construction **Engineer** LKC	**Job Number** LKC 21 1684 **Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					0.10	MADE GROUND: Tarmacadam.		
					(1.10)	MADE GROUND: Brown gravelly slightly silty SAND with frequent whole bricks, brick fragments, occasional concrete slabs, ceramic fragments, metal (pipe, wire), ash and slate. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded comprising sandstone.		
					1.20	Complete at 1.20m		



Remarks

Trial pit unstable, made ground collapsing between 0.10-1.20mbgl.
Pit dry.
No brick foundations / walls encountered.

Scale (approx)	Logged By	Figure No.
1:40	EM	LKC 21 1684.TP201

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LK CONSULT LTD Eton Business Park, Eton Hill Road, Radcliffe, M26 2ZS Tel: 0161 763 7200 web: www.thelkgroup.com		**Site** Mirabel House, Great Ducie Street, Manchester	**Trial Pit Number** **TP202**
Excavation Method Machine excavated pit to 1.10mbgl.	**Dimensions** 1.20m x 1.50m x 1.10m **Location**	**Ground Level (mOD)** **Dates** 08/03/2023	**Client** Torsion Construction **Engineer** LKC	**Job Number** LKC 21 1684 **Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					0.10	MADE GROUND: Tarmacadam.		
					(1.00)	MADE GROUND: Brown slightly gravelly slightly silty SAND with frequent whole bricks, brick fragments, occasional metal (pipe, wires), concrete slabs, plastic, ash, slate and sub-angular sandstone cobbles. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded comprising sandstone.		
					1.10	Complete at 1.10m		



Remarks

Trial pit unstable, made ground collapsing between 0.10-1.10mbgl.
Pit dry.
No brick foundations / walls encountered.

Scale (approx)	Logged By	Figure No.
1:40	EM	LKC 21 1684.TP202

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LK CONSULT LTD

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

Site	Trial Pit Number
Mirabel House, Great Ducie Street, Manchester	TP203

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Machine excavated pit to 3.20mbgl.	1.20m x 2.00m x 3.20m		Torsion Construction	LKC 21 1684
	Location	**Dates**	**Engineer**	**Sheet**
		08/03/2023	LKC	1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					0.08	MADE GROUND: Tarmacadam.		
					(0.72)	MADE GROUND: Brown slightly gravelly slightly silty SAND with frequent brick fragments, occasional whole bricks, ceramic fragments, ash, slate, concrete fragments and rare metal. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded comprising sandstone.		
					0.80	MADE GROUND: Dark greyish brown sandy slightly clayey GRAVEL with occasional coal, brick fragments, rare sandstone slabs and concrete fragments. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded comprising sandstone and mudstone. Blue plastic membrane present at 0.80mbgl.		
					(2.40)			
					3.20	Complete at 3.20m		



Remarks

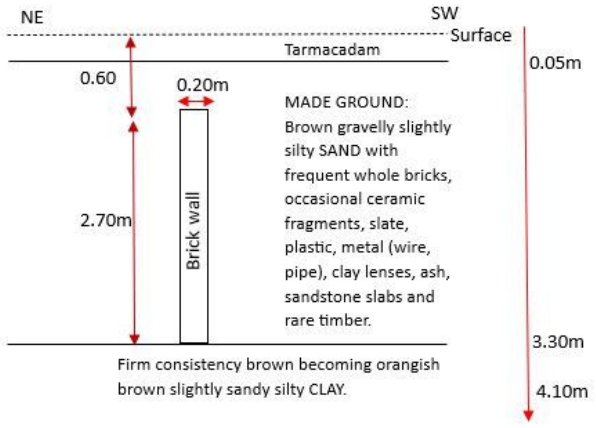
Trial pit unstable, made ground collapsing from 0.80mbgl.
Strata between 0.80-3.20mbgl slightly damp.
No brick foundations / walls encountered.

Scale (approx)	Logged By	Figure No.
1:40	EM	LKC 21 1684.TP203

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LK GROUP	**LK CONSULT LTD** Eton Business Park, Eton Hill Road, Radcliffe, M26 2ZS Tel: 0161 763 7200 web: www.thelkgroup.com	**Site** Mirabel House, Great Ducie Street, Manchester	**Trial Pit Number** **TP204**
Excavation Method Machine excavated pit to 4.10mbgl.	**Dimensions** 2.00m x 1.50m x 4.10m	**Ground Level (mOD)**	**Client** Torsion Construction	**Job Number** LKC 21 1684
	Location	**Dates** 08/03/2023	**Engineer** LKC	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					0.05	MADE GROUND: Tarmacadam.		
						MADE GROUND: Brown gravelly slightly silty SAND with frequent whole bricks, occasional ceramic fragments, slate, plastic, metal (wire, pipe), clay lenses, ash, sandstone slabs and rare timber. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded comprising sandstone. Decreasing whole brick content with depth. Brick wall runs approximately SSW-NNE through the pit. Top of wall encountered at 0.60mbgl. Base of wall encountered at 3.30mbgl. Thickness of wall approximately 0.20m.		
					(3.25)			
					3.30	Firm consistency brown becoming orangish brown slightly sandy silty CLAY. Sand is fine to medium.		
					(0.80)			
					4.10	Complete at 4.10m		



TP204 Cross section S1. Not to scale.

Remarks

Pit dry and stable.
Refer to separate document for cross section.
Brick wall visible in side wall of pit on photograph.

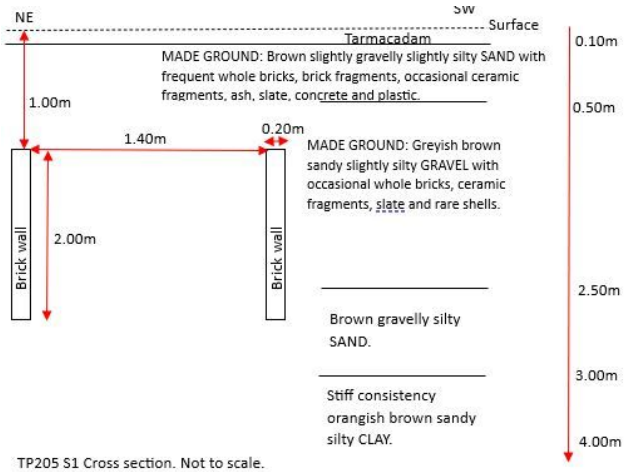
Scale (approx)	Logged By	Figure No.
1:40	EM	LKC 21 1684.TP204

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LK GROUP	**LK CONSULT LTD** Eton Business Park, Eton Hill Road, Radcliffe, M26 2ZS Tel: 0161 763 7200 web: www.thelkgroup.com	**Site** Mirabel House, Great Ducie Street, Manchester	**Trial Pit Number** **TP205**

Excavation Method	**Dimensions**	**Ground Level (mOD)**	**Client**	**Job Number**
Machine excavated pit to 4.00mbgl.	2.70m x 1.00m x 4.00m		Torsion Construction	LKC 21 1684
	Location	**Dates** 08/03/2023	**Engineer** LKC	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					0.10	MADE GROUND: Tarmacadam.		
					(0.40)	MADE GROUND: Brown slightly gravelly slightly silty SAND with frequent whole bricks, brick fragments, occasional ceramic fragments, ash, slate, concrete and plastic. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded comprising sandstone.		
					0.50	MADE GROUND: Greyish brown sandy slightly silty GRAVEL with occasional whole bricks, ceramic fragments, slate and rare shells. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded comprising sandstone and mudstone. Brick wall runs along adjacent to north eastern wall of pit. Top of wall encountered at 1.00mbgl. Base of wall encountered at 2.60mbgl. Brick wall visible in south eastern wall of pit. Top of wall encountered at 1.00mbgl. Base of wall encountered at 3.00mbgl. Thickness approximately 0.20m.		
					(2.00)			
					2.50	Brown gravelly silty SAND. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded comprising sandstone. Strata is damp.		
					(0.50)			
					3.00	Stiff consistency orangish brown sandy silty CLAY. Sand is fine to medium. Clay is friable.		
					(1.00)			
					4.00	Complete at 4.00m		



TP205 S1 Cross section. Not to scale.

Remarks

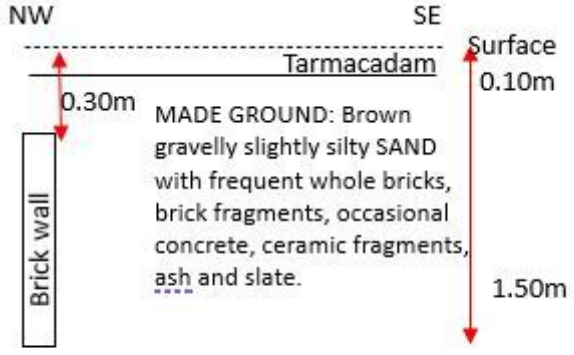
Pit dry.
Pit unstable, made ground collapsing from 0.50mbgl.
Brick wall visible in south eastern wall of pit in photograph.
Refer to separate document for cross section.

Scale (approx)	**Logged By**	**Figure No.**
1:40	EM	LKC 21 1684.TP205

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LK GROUP	**LK CONSULT LTD** Eton Business Park, Eton Hill Road, Radcliffe, M26 2ZS Tel: 0161 763 7200 web: www.thelkgroup.com	**Site** Mirabel House, Great Ducie Street, Manchester	**Trial Pit Number** **TT101C**
Excavation Method Trial Pit	**Dimensions**	**Ground Level (mOD)**	**Client** Torsion Construction	**Job Number** LKC 21 1684
	Location	**Dates** 08/03/2023	**Engineer** LKC	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					0.10	MADE GROUND: Tarmacadam.		
					(1.40)	MADE GROUND: Brown gravelly slightly silty SAND with frequent whole bricks, brick fragments, occasional concrete, ceramic fragments, ash and slate. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded comprising sandstone. Wall encountered at 0.30mbgl running approximately south west - north east. Base of wall not encountered as made ground collapsing into pit. Cables run along wall at approximately 0.80mbgl.		
					1.50	Complete at 1.50m		



TT101C (centre) Cross section S1. Not to scale.

Remarks

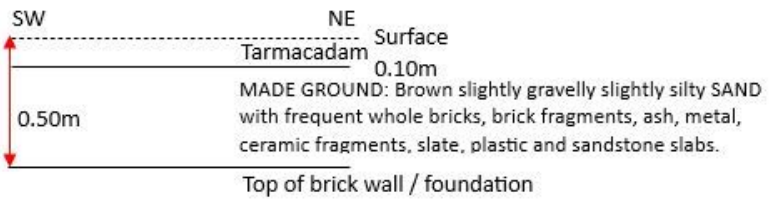
Log refers to central area of TT101.
Pit dry.
Pit unstable, made ground collapsing from 0.10mbgl.
Refer to separate document for cross section.

Scale (approx)	Logged By	Figure No.
1:40	EM	LKC 21 1684.TT101C

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LK GROUP	**LK CONSULT LTD** Eton Business Park, Eton Hill Road, Radcliffe, M26 2ZS Tel: 0161 763 7200 web: www.thelkgroup.com	**Site** Mirabel House, Great Ducie Street, Manchester	**Trial Pit Number** **TT101N**
Excavation Method Trial Pit	**Dimensions**	**Ground Level (mOD)**	**Client** Torsion Construction	**Job Number** LKC 21 1684
	Location	**Dates** 08/03/2023	**Engineer** LKC	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					0.10	MADE GROUND: Tarmacadam.		
					(0.40)	MADE GROUND: Brown slightly gravelly slightly silty SAND with frequent whole bricks, brick fragments, ash, metal, ceramic fragments, slate, plastic and sandstone slabs. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded comprising sandstone. Brick foundation runs along base of northern area of TT101 at 0.50mbgl to location of wall on sketch SI location plan.		
					0.50	Complete at 0.50m		



TT101N (north) Cross section S1. Not to scale.

Remarks

Log of northern area of TT101.
Trench dry and stable.
Refer to separate document for cross section and plan view.

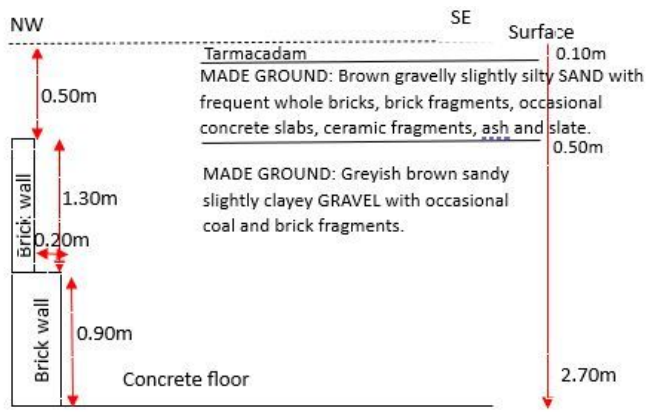
Scale (approx)	Logged By	Figure No.
1:40	EM	LKC 21 1684.TT101N

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LK GROUP	**LK CONSULT LTD** Eton Business Park, Eton Hill Road, Radcliffe, M26 2ZS Tel: 0161 763 7200 web: www.thelkgroup.com	**Site** Mirabel House, Great Ducie Street, Manchester	**Trial Pit Number** **TT101S**

Excavation Method	**Dimensions**	**Ground Level (mOD)**	**Client**	**Job Number**
Trial Pit			Torsion Construction	LKC 21 1684
	Location	**Dates** 08/03/2023	**Engineer** LKC	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					0.10	MADE GROUND: Tarmacadam.		
					(0.40)	MADE GROUND: Brown gravelly slightly silty SAND with frequent whole bricks, brick fragments, occasional concrete slabs, ceramic fragments, ash and slate. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded comprising sandstone.		
					0.50	MADE GROUND: Greyish brown sandy slightly clayey GRAVEL with occasional coal and brick fragments. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded comprising mudstone and sandstone. Strata is damp. Blue plastic membrane at 0.50mbgl. Brick wall encountered at approximately 0.50mbgl and runs along northern section of pit. Wall steps out by 0.20m at 1.80mbgl. Base encountered at 2.70mbgl.		
					(2.20)			
					2.70	Concrete floor encountered at 2.70mbgl.		
						Complete at 2.70m		



TT101S (south) Cross section S1. Not to scale.

Remarks

Log refers to southern area of TT101.
Pit dry and stable.
Refer to separate document for cross section.

Scale (approx)	**Logged By**	**Figure No.**
1:40	EM	LKC 21 1684.TT101S

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Appendix C – Certificates of Analysis

Ella Mcleod
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: 23-03404

Site Reference:	Mirabel House, Great Ducie Street, Manchester
Project / Job Ref:	LKC 21 1684
Order No:	LKC211684-CC
Sample Receipt Date:	13/03/2023
Sample Scheduled Date:	13/03/2023
Report Issue Number:	1
Reporting Date:	21/03/2023

Authorised by:

Kevin Old
Operations Director

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

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

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

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

Soil Analysis Certificate						
DETS Report No: 23-03404	**Date Sampled**	08/03/23				
LK Consult Limited	**Time Sampled**	None Supplied				
Site Reference: Mirabel House, Great Ducie Street, Manchester	**TP / BH No**	HD201				
Project / Job Ref: LKC 21 1684	**Additional Refs**	ES				
Order No: LKC211684-CC	**Depth (m)**	0.15 - 0.60				
Reporting Date: 21/03/2023	**DETS Sample No**	640206				

Determinand	**Unit**	**RL**	**Accreditation**					
Asbestos Screen (S)	N/a	N/a	**ISO17025**	Not Detected				
pH	pH Units	N/a	**MCERTS**	7.5				
Total Cyanide	mg/kg	< 1	NONE	< 1				
Free Cyanide	mg/kg	< 1	NONE	< 1				
W/S Sulphate as SO_4 (2:1)	mg/l	< 10	**MCERTS**	191				
W/S Sulphate as SO_4 (2:1)	g/l	< 0.01	**MCERTS**	0.19				
Organic Matter (SOM)	%	< 0.1	**MCERTS**	6.1				
Arsenic (As)	mg/kg	< 2	**MCERTS**	18				
W/S Boron	mg/kg	< 1	NONE	< 1				
Cadmium (Cd)	mg/kg	< 0.2	**MCERTS**	< 0.2				
Chromium (Cr)	mg/kg	< 2	**MCERTS**	15				
Chromium (hexavalent)	mg/kg	< 2	NONE	< 2				
Copper (Cu)	mg/kg	< 4	**MCERTS**	51				
Lead (Pb)	mg/kg	< 3	**MCERTS**	231				
Mercury (Hg)	mg/kg	< 1	**MCERTS**	1.3				
Nickel (Ni)	mg/kg	< 3	**MCERTS**	19				
Selenium (Se)	mg/kg	< 2	**MCERTS**	< 2				
Vanadium (V)	mg/kg	< 1	**MCERTS**	26				
Zinc (Zn)	mg/kg	< 3	**MCERTS**	57				
Total Phenols (monohydric)	mg/kg	< 2	NONE	< 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)

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

Soil Analysis Certificate - Speciated PAHs						
DETS Report No: 23-03404	**Date Sampled**	08/03/23				
LK Consult Limited	**Time Sampled**	None Supplied				
Site Reference: Mirabel House, Great Ducie Street, Manchester	**TP / BH No**	HD201				
Project / Job Ref: LKC 21 1684	**Additional Refs**	ES				
Order No: LKC211684-CC	**Depth (m)**	0.15 - 0.60				
Reporting Date: 21/03/2023	**DETS Sample No**	640206				

Determinand	Unit	RL	Accreditation					
Naphthalene	mg/kg	< 0.1	MCERTS	< 0.1				
Acenaphthylene	mg/kg	< 0.1	MCERTS	< 0.1				
Acenaphthene	mg/kg	< 0.1	MCERTS	< 0.1				
Fluorene	mg/kg	< 0.1	MCERTS	< 0.1				
Phenanthrene	mg/kg	< 0.1	MCERTS	< 0.1				
Anthracene	mg/kg	< 0.1	MCERTS	< 0.1				
Fluoranthene	mg/kg	< 0.1	MCERTS	< 0.1				
Pyrene	mg/kg	< 0.1	MCERTS	< 0.1				
Benzo(a)anthracene	mg/kg	< 0.1	MCERTS	< 0.1				
Chrysene	mg/kg	< 0.1	MCERTS	< 0.1				
Benzo(b)fluoranthene	mg/kg	< 0.1	MCERTS	< 0.1				
Benzo(k)fluoranthene	mg/kg	< 0.1	MCERTS	< 0.1				
Benzo(a)pyrene	mg/kg	< 0.1	MCERTS	< 0.1				
Indeno(1,2,3-cd)pyrene	mg/kg	< 0.1	MCERTS	< 0.1				
Dibenz(a,h)anthracene	mg/kg	< 0.1	MCERTS	< 0.1				
Benzo(ghi)perylene	mg/kg	< 0.1	MCERTS	< 0.1				
Total EPA-16 PAHs	mg/kg	< 1.6	MCERTS	< 1.6				

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Soil Analysis Certificate - TPH LQM Banded						
DETS Report No: 23-03404	**Date Sampled**	08/03/23				
LK Consult Limited	**Time Sampled**	None Supplied				
Site Reference: Mirabel House, Great Ducie Street, Manchester	**TP / BH No**	HD201				
Project / Job Ref: LKC 21 1684	**Additional Refs**	ES				
Order No: LKC211684-CC	**Depth (m)**	0.15 - 0.60				
Reporting Date: 21/03/2023	**DETS Sample No**	640206				

Determinand	Unit	RL	Accreditation					
Aliphatic >C5 - C6 : HS_1D_MS_AL	mg/kg	< 0.01	NONE	< 0.01				
Aliphatic >C6 - C8 : HS_1D_MS_AL	mg/kg	< 0.05	NONE	< 0.05				
Aliphatic >C8 - C10 : EH_CU_1D_AL	mg/kg	< 2	MCERTS	< 2				
Aliphatic >C10 - C12 : EH_CU_1D_AL	mg/kg	< 2	MCERTS	< 2				
Aliphatic >C12 - C16 : EH_CU_1D_AL	mg/kg	< 3	MCERTS	< 3				
Aliphatic >C16 - C35 : EH_CU_1D_AL	mg/kg	< 10	MCERTS	< 10				
Aliphatic >C35 - C44 : EH_CU_1D_AL	mg/kg	< 10	NONE	< 10				
Aliphatic (C5 - C44) : HS_1D_MS+EH_CU_1D_AL	mg/kg	< 30	NONE	< 30				
Aromatic >C5 - C7 : HS_1D_MS_AR	mg/kg	< 0.01	NONE	< 0.01				
Aromatic >C7 - C8 : HS_1D_MS_AR	mg/kg	< 0.05	NONE	< 0.05				
Aromatic >C8 - C10 : EH_CU_1D_AR	mg/kg	< 2	MCERTS	< 2				
Aromatic >C10 - C12 : EH_CU_1D_AR	mg/kg	< 2	MCERTS	< 2				
Aromatic >C12 - C16 : EH_CU_1D_AR	mg/kg	< 2	MCERTS	< 2				
Aromatic >C16 - C21 : EH_CU_1D_AR	mg/kg	< 3	MCERTS	< 3				
Aromatic >C21 - C35 : EH_CU_1D_AR	mg/kg	< 10	MCERTS	< 10				
Aromatic >C35 - C44 : EH_CU_1D_AR	mg/kg	< 10	NONE	< 10				
Aromatic (>C5 - C44) : HS_1D_MS+EH_CU_1D_AR	mg/kg	< 30	NONE	< 30				
Total >C5 - C44 : HS_1D_MS+EH_CU_1D_Total	mg/kg	< 60	NONE	< 60				

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Soil Analysis Certificate - BTEX / MTBE						
DETS Report No: 23-03404	**Date Sampled**	08/03/23				
LK Consult Limited	**Time Sampled**	None Supplied				
Site Reference: Mirabel House, Great Ducie Street, Manchester	**TP / BH No**	HD201				
Project / Job Ref: LKC 21 1684	**Additional Refs**	ES				
Order No: LKC211684-CC	**Depth (m)**	0.15 - 0.60				
Reporting Date: 21/03/2023	**DETS Sample No**	640206				

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

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Waste Acceptance Criteria Analytical Certificate - BS EN 12457/3

DETS Report No: 23-03404		**Date Sampled**	08/03/23			**Landfill Waste Acceptance Criteria Limits**		
LK Consult Limited		**Time Sampled**	None Supplied			**Inert Waste Landfill**	**Stable Non-reactive HAZARDOUS waste in non-hazardous Landfill**	**Hazardous Waste Landfill**
Site Reference: Mirabel House, Great Ducie Street, Manchester		**TP / BH No**	HD201					
Project / Job Ref: LKC 21 1684		**Additional Refs**	ES					
Order No: LKC211684-CC		**Depth (m)**	0.15 - 0.60					
Reporting Date: 21/03/2023		**DETS Sample No**	640206					
Determinand	**Unit**	**MDL**						
TOC[MU]	%	< 0.1	3.6			**3%**	5%	6%
Loss on Ignition[MU]	%	< 0.01	6.60			--	--	10%
BTEX[MU]	mg/kg	< 0.05	< 0.05			6	--	--
Sum of PCBs	mg/kg	< 0.1	< 0.1			1	--	--
Mineral Oil[MU]	mg/kg	< 10	< 10			500	--	--
Total PAH[MU]	mg/kg	< 1.7	< 1.7			100	--	--
pH[MU]	pH Units	N/a	7.5			--	>6	--
Acid Neutralisation Capacity	mol/kg (+/-)	< 1	< 1			--	To be evaluated	To be evaluated

Eluate Analysis	**2:1 mg/l**	**8:1 mg/l**		**Cumulative 10:1 mg/kg**	**Limit values for compliance leaching test using BS EN 12457-3 at L/S 10 l/kg (mg/kg)**		
Arsenic[U]	< 0.01	< 0.01		< 0.2	0.5	2	25
Barium[U]	0.03	< 0.02		0.2	20	100	300
Cadmium[U]	< 0.0005	< 0.0005		< 0.02	0.04	1	5
Chromium[U]	< 0.005	< 0.005		< 0.20	0.5	10	70
Copper[U]	< 0.01	< 0.01		< 0.5	2	50	100
Mercury[U]	< 0.0005	< 0.0005		< 0.005	0.01	0.2	2
Molybdenum[U]	0.025	0.013		0.1	0.5	10	30
Nickel[U]	< 0.007	< 0.007		< 0.2	0.4	10	40
Lead[U]	< 0.005	< 0.005		< 0.2	0.5	10	50
Antimony[U]	< 0.005	< 0.005		< 0.05	0.06	0.7	5
Selenium[U]	< 0.005	< 0.005		< 0.05	0.1	0.5	7
Zinc[U]	< 0.005	< 0.005		< 0.2	4	50	200
Chloride[U]	26	3		61	800	15000	25000
Fluoride[U]	0.6	0.6		6.1	10	150	500
Sulphate[U]	180	21		412	1000	20000	50000
TDS	439	115		1561	4000	60000	100000
Phenol Index	< 0.01	< 0.01		< 0.5	1	-	-
DOC	10.7	6.6		70.9	500	800	1000
Leach Test Information							
Sample Mass (kg)	0.21						
Dry Matter (%)	83.9						
Moisture (%)	19.2						
Stage 1							
Volume Eluate L2 (litres)	0.32						
Filtered Eluate VE1 (litres)	0.22						

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30°C. The Samples Descriptions page describes if the test is performed on the dried or as-received portion
Stated limits are for guidance only and DETS Ltd cannot be held responsible for any discrepencies with current legislation
M Denotes MCERTS accredited test
U Denotes ISO17025 accredited test

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Soil Analysis Certificate - Sample Descriptions	
DETS Report No: 23-03404	
LK Consult Limited	
Site Reference: Mirabel House, Great Ducie Street, Manchester	
Project / Job Ref: LKC 21 1684	
Order No: LKC211684-CC	
Reporting Date: 21/03/2023	

DETS Sample No	TP / BH No	Additional Refs	Depth (m)	Moisture Content (%)	Sample Matrix Description
640206	HD201	ES	0.15 - 0.60	16.1	Brown sandy clay with stones and brick

Moisture content is part of procedure E003 & is not an accredited test
Insufficient Sample I/S
Unsuitable Sample U/S

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MCERTS THE ENVIRONMENT AGENCY'S MONITORING CERTIFICATION SCHEME
UKAS TESTING 4480

Soil Analysis Certificate - Methodology & Miscellaneous Information

DETS Report No: 23-03404
LK Consult Limited
Site Reference: Mirabel House, Great Ducie Street, Manchester
Project / Job Ref: LKC 21 1684
Order No: LKC211684-CC
Reporting Date: 21/03/2023

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

D Dried
AR As Received

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Water Analysis Certificate - Methodology & Miscellaneous Information
DETS Report No: 23-03404
LK Consult Limited
Site Reference: Mirabel House, Great Ducie Street, Manchester
Project / Job Ref: LKC 21 1684
Order No: LKC211684-CC
Reporting Date: 21/03/2023

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

Key

F Filtered
UF Unfiltered

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List of HWOL Acronyms and Operators
DETS Report No: 23-03404
LK Consult Limited
Site Reference: Mirabel House, Great Ducie Street, Manchester
Project / Job Ref: LKC 21 1684
Order No: LKC211684-CC
Reporting Date: 21/03/2023

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

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

Parameter	Matrix Type	Suite Reference	Expanded Uncertainity Measurement	Unit
TOC	Soil	BS EN 12457	10.4	%
Loss on Ignition	Soil	BS EN 12457	16.9	%
BTEX	Soil	BS EN 12457	14.0	%
Sum of PCBs	Soil	BS EN 12457	21.1	%
Mineral Oil	Soil	BS EN 12457	9.0	%
Total PAH	Soil	BS EN 12457	17.9	%
pH	Soil	BS EN 12457	0.282	Units
Acid Neutralisation Capacity	Soil	BS EN 12457	18.0	%
Arsenic	Leachate	BS EN 12457	19.5	%
Barium	Leachate	BS EN 12457	12.2	%
Cadmium	Leachate	BS EN 12457	17.2	%
Chromium	Leachate	BS EN 12457	20.7	%
Copper	Leachate	BS EN 12457	14.1	%
Mercury	Leachate	BS EN 12457	16.7	%
Molybdenum	Leachate	BS EN 12457	13.3	%
Nickel	Leachate	BS EN 12457	14.0	%
Lead	Leachate	BS EN 12457	12.1	%
Antimony	Leachate	BS EN 12457	16.1	%
Selenium	Leachate	BS EN 12457	15.5	%
Zinc	Leachate	BS EN 12457	14.0	%
Chloride	Leachate	BS EN 12457	15.7	%
Fluoride	Leachate	BS EN 12457	19.1	%
Sulphate	Leachate	BS EN 12457	27.6	%
TDS	Leachate	BS EN 12457	10.0	%
Phenol Index	Leachate	BS EN 12457	12.9	%
DOC	Leachate	BS EN 12457	20.4	%
Clay Content	Soil	BS 3882: 2015	15.0	%
Silt Content	Soil	BS 3882: 2015	14.0	%
Sand Content	Soil	BS 3882: 2015	13.0	%
Loss on Ignition	Soil	BS 3882: 2015	16.9	%
pH	Soil	BS 3882: 2015	0.282	Units
Carbonate	Soil	BS 3882: 2015	12.0	%
Total Nitrogen	Soil	BS 3882: 2015	12.0	%
Phosphorus (Extractable)	Soil	BS 3882: 2015	24.0	%
Potassium (Extractable)	Soil	BS 3882: 2015	20.0	%
Magnesium (Extractable)	Soil	BS 3882: 2015	26.0	%
Zinc	Soil	BS 3882: 2015	19.8	%
Copper	Soil	BS 3882: 2015	23.2	%
Nickel	Soil	BS 3882: 2015	32.6	%
Available Sodium	Soil	BS 3882: 2015	23.0	%
Available Calcium	Soil	BS 3882: 2015	23.0	%
Electrical Conductivity	Soil	BS 3882: 2015	10.0	%