

22 COCKEY MOOR ROAD,
BURY

PHASE 2 GEO-ENVIRONMENTAL
INVESTIGATION, RISK ASSESSMENT
AND REMEDIATION STRATEGY

Job Number: LKC 20 1870

Date: March 2021

Client: Mr S Postchi



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EXECUTIVE SUMMARY

Site Details

Site Location:	Number 22, north side of Cockey Moor Road, Bury. Centred at approximate National Grid Reference 377373E, 410416N
Site Area:	540m ² .
Current Land Use:	The site currently comprises: Unmaintained former garden area to the north. Rough, uneven ground in footprint of former building. Site has overgrown vegetation with shrubs and trees near the northern boundary. Area of tarmac from former driveway in southwest corner of site.
Proposed Development:	Planning Application No. 58590: Demolition of existing bungalow and erection of 2 storey replacement dwelling (application approved with conditions).
Purpose of Report:	Contamination and Geotechnical Assessment.

Preliminary Risk Assessment

PRA Details:	Undertaken by Worms Eye dated 21 st August 2014. Ref: Cockey Moor Road/BL8 2HB/PRA/GC.14.
History:	On site: north east part of site is a quarry from earliest mapping (1850). Quarry is marked as disused by 1893 mapping and infilled on site by 1929-30 mapping. Bungalow present by 1957 mapping. (Bungalow demolished by late 2018 ²). Offsite: Quarry (NW and SE, remains to NW by 1929-30 mapping), ponds (70m SE, 180m SE).
Geology / Hydrogeology:	Glacial Till (Unproductive Aquifer) over Pennine Lower Coal Measures (Secondary A Aquifer).
Mining:	No recorded mining on site. Coal seam offsite 100m SW, dips to SW clear of site. The site is not within a Development High Risk Area. Risk of mining subsidence is considered low and no further action was recommended outside of a watching brief.
Relevant Environmental Setting:	No recorded landfills within 250m of the site. Infilled features: quarry NE of site and N of site. 2no. ponds 70-180m SE. Coal seam offsite 100m SW, dips to SW clear of site. No groundwater abstractions recorded within influencing distance of site. Nearest surface water feature 57m SE. No rivers within 250m. Site is within Flood Zone 1. Site located within greenbelt land.
Preliminary Conceptual Model: PL=Pollutant Linkage	PL1 Direct Contact (Human Health): Moderate/ Low Risk (asbestos, metals, PAHs), Low Risk (Petroleum Hydrocarbons). PL2 Inhalation of Vapours: Low Risk (volatile contaminants). PL3 Gas: High Risk (hazardous and ground gas), Low Risk (Radon). PL4 Controlled waters: Moderate /Low Risk (mobile contaminants). PL5 Sulphate Attack: Moderate /Low Risk (sulphate). PL6 Water Pipelines: Moderate /Low Risk (organic contaminants). PL7 Phytotoxic: Low Risk (metals).
Recommendations:	Site Investigation was recommended to further assess all the above pollutant linkages.

Ground Investigation Work Undertaken

Date of Investigation:	16 th December 2020.
Intrusive Investigation Work Undertaken:	7no. window sample boreholes (WS101-WS107). 4no. dynamic probe tests (DP102, DP103, DP108 & DP109). 3no. hand excavated trial pits (HD101-HD103).
Monitoring Wells:	Installed in WS102, WS103 and WS105.
Soil Sampling:	5no. samples tested for metals, speciated PAHs, pH, sulphate, asbestos and SOM. 2no. samples tested for pH and sulphate.
Monitoring:	6no visits over 3-month period.
Insitu and Laboratory Geotechnical Testing:	SPTs, DPs, pocket penetrometers, plasticity.

Ground Conditions and Geotechnical Assessment

Location	General Ground conditions	Allowable Bearing Pressure	Anticipated Foundation Type	Other Considerations
Central and north of site	Made Ground GRAVEL and CLAY (including ash and clinker) to approx. 5m->7mbgl. SPT tests met with refusal on Sandstone at base of exploratory holes. Groundwater at depths of between 3.10m and 4.20mbgl	No reliance should be placed on the Bearing Pressure that the Made Ground can support. 600kN/m ² on Sandstone.	Piled foundation solution end bearing upon sandstone bedrock. Sleeving should be used at shallow depth to ensure the piles are not affected by negative skin friction. A ground improvement option through the use of vibro stone columns may be a viable alternative.	Made Ground CLAY recorded as low plasticity. Temporary supports of excavations may be required. Detailed design should be carried out by structural engineer. Concrete Requirements DS-1s AC-1.
South of site.	0.30m of Made Ground sand or clay over firm to stiff very sandy gravelly CLAY to 1.65mbgl. SPT tests met with refusal on Sandstone at base of exploratory holes.	The natural clay strata provided pocket penetrometer reading of 61.31-73.58kPa (medium strength). 600kN/m ² on Sandstone.		

Contamination Risk Assessment

The table below shows a summary of the risk assessments undertaken for each pollutant linkage, the revised conceptual model and recommendation for either remediation and / or further investigation.

Pollutant Linkage	Risk	Recommendations
1 - Contaminants posing a risk to site users current residents, future residents, site users and offsite receptors via dermal contact, ingestion and inhalation (of soil, dust, fibres and vegetables).	Moderate	- Elevated arsenic, lead and PAHs identified across the site (in the proposed gardens). - Recommendations: Remediation (environmental cover system) required in garden areas. Alternatively, further sampling in the gardens will allow for a larger dataset for statistical analysis and may remove / limit the need for remediation.
	Low	- No ACM identified. - No olfactory or visual evidence of gross petroleum hydrocarbon contamination. - Recommendations: No remediation required.
2 Volatile contaminants posing a risk to site users current residents, future residents, site users and offsite receptors via the inhalation of vapours.	Low	- No elevated volatile compounds, such as naphthalene identified. Maximum PID reading recorded 0.3ppm. - Recommendations: No remediation required.
3 Gas posing a risk to buildings and site users current residents, future residents, site users and offsite receptors via the migration of gas into building causing explosion and asphyxiation.	Moderate/ Low	- Site is classified as CS1 / NHBC Green. - Low risk as low flow rates and no elevated methane and carbon dioxide recorded. - Recommendations: No gas protection measures required.
4 Mobile contamination posing a risk to controlled waters via the migration through permeable strata.	Low	- Although slightly elevated metals and PAHs identified, given the environmental settings and ground conditions encountered not considered to pose a significant risk to the underlying aquifers - Recommendation: No remediation required.

5	Sulphate posing a risk to building via direct contact (sulphate attack).	Very Low	- No elevated sulphate identified in soils. Recommendation: No remediation required.
6	Organic contaminants posing a risk to water pipes.	Moderate	- Organic contamination (naphthalene) identified at potable pipe depth of 0.75-1.35mbgl in HD103. Recommendations: UU risk assessment to be completed. The site will likely require barrier piping.
7	Phytotoxic metals posing a risk to flora via root uptake.	Low	- Elevated zinc and copper identified. Recommendations: Remediation associated with PL1 will be more than sufficient.

The results show that all the samples tested are classified as NON-HAZARDOUS WASTE

Recommendations and Remedial Strategy

The table below shows the remediation and validation requirements for the site. This information should be documented in a Site Completion Report for submission to the local authority.

PL	Remediation Requirements	Validation Requirements
ALL	<u>Earthworks Inspections / Unexpected Contamination</u> 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. Should asbestos be identified during groundworks, precautions should be taken to ensure the safety of the construction workers and nearby land users. It would be advisable to introduce an asbestos management strategy in line with CIRIA C733 ¹ .	Log of work undertaken including photographs. Details of any sampling undertaken and validation of any potential additional remedial work.
1 and 7	<u>Option 1</u> <u>Environmental Cover System</u> As made ground is relatively deep across the site, it is unlikely to be viable to remove the contaminated soils. Therefore, an environmental cover system is recommended as follows: Private Back Gardens: 600mm thick environmental cover system comprising: <u>Either</u> 100mm physical break layer (MOT type 1 material, 20-30mm, minimal fines) and at least 500mm comprising clean inert fill and sufficient topsoil for a growing medium. <u>Or</u> geotextile membrane and at least 600mm comprising clean inert fill and sufficient topsoil for a growing medium. Private Front Garden / Shared Landscaping: 300mm thick environmental cover system comprising: <u>Either</u> 100mm physical break layer (MOT type 1 material, 20-30mm, minimal fines) and at least 200mm comprising clean inert fill and sufficient topsoil for a growing medium. <u>Or</u> geotextile membrane and at least 300mm comprising clean inert fill and sufficient topsoil for a growing medium. The subsoil layer can be replaced by additional topsoil. A diagram of a typical environmental cover system is shown in Appendix H. <u>Option 2</u> <u>Further Soil Sampling</u>	Measuring depth of environmental cover system using a staff and providing photographic evidence. Photographic evidence of the granular physical break or geotextile layer will also be collected. Chemical validation of imported soils: See Table 9-2.

¹ CIRIA (2014), "Asbestos in Soil and Made Ground: A Guide to Understanding and Managing Risks". C733.

	Undertake more sampling in the garden areas to provide a larger dataset for statistical analysis. This may allow for either none or limited remediation (Option 1) if soil results are favourable. Please note there is no guarantee results will be favourable and advise a cost benefit analysis is undertaken if this option is to be considered.	
5	<u>Sulphate Resistant Concrete</u> No sulphate resistant concrete is required (DS-1 AC-1s).	N/A
6	<u>Potable Water Pipes</u> It is recommended that a UU Risk Assessment is undertaken once the location and depth of potable water pipes are known. The site may require barrier piping depending upon the pipeline route	Delivery Notes of Pipe Material. Photographs of the Installed Pipe.
<u>Grubbing Out of In-Ground Structures</u> It is recommended that in-ground structures are grubbed out as part of the groundworks. In-ground structures expected across the site associated with the former building.		
<u>Re-use of site won material</u> 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 ²): 5,000 tonnes (c. 2,500m ³) <u>treatment</u> of crushed concrete / stone. 1,000 tonnes (c. 500 ³) <u>use of</u> non-hazardous soil 5,000 tonnes (c. 2,500m ³) <u>use of</u> clays, sand, gravel, brick, concrete, stone etc. 50,000 tonnes (c. 25,000m ³) <u>use of</u> 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.		
<u>Health and Safety Considerations</u> 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 ³) should be adopted by all workers involved with site enabling and construction works.		
<u>Piling in Contaminated Land</u> It is understood that the building may be piled into the bedrock. This may provide a preferential pathway for contaminants to the Secondary A 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 ⁴ .		

The remediation recommended in the table above should be validated to ensure it has been carried out appropriately. This should be documented in a Completion/Validation Report and submitted to the local authority for completion.

² <https://www.gov.uk/guidance/waste-exemptions-using-waste>

³ HSE (1991). "Protection of Workers and the General Public During Development of Contaminated Land" London HMSO.

⁴ Environment Agency (2001) Piling and Penetrative Ground Improvement Methods on Land Affected by Contamination: Guidance on Pollution Prevention.

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1 Introduction

1.1 Background

LK Consult Ltd (LKC) has been commissioned by Mr S Postchi to carry out a Phase 2 Geo-Environmental Investigation, Risk Assessment and Remediation Strategy for 22 Cockey Moor Road, Bury. The investigation was undertaken in support of a current planning application (reference number 58590) for the demolition of existing bungalow and erection of 2 storey replacement dwelling.

The following work has previously been undertaken:

- Preliminary Risk Assessment (desk study) report, undertaken by Worms Eye (Ref: Cockey Moor Road/BL82HB/PRA/GC.14, dated 21st August 2014).

This investigation has been undertaken to confirm the ground conditions below the site and to allow a contamination and geotechnical assessment to be undertaken. Due to cracking evident in the northeast corner of the former bungalow on site indicative of subsidence, it is strongly recommended that a structural engineer designs the foundations to ensure that the proposed residential dwelling is not affected by differential settlement.

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

1.2 Site Details

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

Location	North west of junction between Starling Road and Cockey Moor Road. National Grid Reference 377270E 410420N.
Area	540m ² .
Topography	155 metres above ordnance datum (AOD). Gentle slope down to the south east.
Land Use	<u>Site</u> Rectangular plot surfaced in demolition rubble from former residential dwelling. <u>Surrounding Area</u> South: Cockey Moor Road. Residential properties beyond. North: Open field. East: Residential property. West: Residential property.
Proposed Development	1no. residential dwelling with driveway and front and rear garden.

Table 1-1. Summary of site details.

2 Previous Work

2.1 Summary of Existing Information

A PRA report (Ref: Cockey Moor Road/BL82HB/PRA/GC.14, dated 21st August 2014) has previously been undertaken by Worms Eye and is summarised in Section 2.2.

The conceptual model (Section 2.3) has been updated to be in line with LKC current risk assessment methodology.

2.2 Site History

The site history is summarised below in Table 2-1.

Historical Land Uses	On site: north east part of site is a quarry from earliest mapping (1850). Quarry is marked as disused by 1893 mapping and infilled on site by 1929-30 mapping. Bungalow present by 1957 mapping (Bungalow demolished by late 2018 ²). Offsite: Quarry (NW and SE, remains to NW by 1929-30 mapping), ponds (70m SE, 180m SE).
Site Reconnaissance	Undertaken in 2014, cracks noted in NE of existing building (outer wall, internal walls of kitchen).
Landfill Sites	No recorded landfills within 250m of the site. Infilled features: quarry NE of site and N of site. 2no. ponds 70-180m SE.
Geology	Superficial: Glacial Till (shallow depth likely present on site). Bedrock: Pennine Lower Coal Measures (mudstone, siltstone, sandstone). Coal seam offsite 100m SW, dips to SW clear of site.
Hydrogeology	Superficial: Secondary Undifferentiated Aquifer. Bedrock: Secondary A Aquifer. No groundwater abstractions recorded.
Hydrology	Nearest surface water feature 57m SE. No rivers within 250m.
Flooding	Flood Zone 1.
Coal Mining	Within coal reporting area. Not within a development high risk area.
Radon	<1% homes in area above action level; no radon protection measures required.
Preliminary UXO ¹	Low Risk.
Sensitive Sites	Site located within greenbelt land.
Contamination risks	Human health: risk in garden areas. Asbestos roofing noted in garage. Controlled Waters: risk to Secondary A Aquifer from infilled quarry. Ground Gas: low to moderate gas generation assumed, potential risk.
Geotechnical risks	Proposed foundations: Risk of differential settlement. Traditional strip footings unsuitable.

Table 2-1: Summary of the Worms Eye PRA (Desk Study)

Notes:

¹ Freely available UXO mapping.

² Google Earth Historical Satellite Imagery.

2.3 LKC Preliminary Contamination Conceptual Model

The preliminary contamination conceptual model in the Worms Eye report has been updated to be in line with LKC current risk assessment methodology (detailed below). The model is based on the contamination sources, pathways and receptors identified in the original report. LKC also consider the following should be considered:

- Migration of water and gas through preferential pathways (culvert, work coal seams, fault).
- Potable water supply and concrete foundations could be receptors.

The preliminary contamination conceptual model using contaminant-pathway-receptor linkages based on guidance in LMRM⁵ has been summarised in Table 2-2.

The aim of the conceptual model is to provide a preliminary assessment of the likelihood of a pollutant linkage for each potential combination of contaminant, pathway and receptor. A conceptual model can be used to make an informed decision on the contamination risks associated with the site and determine what site investigation work is required.

The preliminary contamination conceptual model has identified seven generic potential pollutant linkages. Each linkage is described along with an assessment of the risk based upon guidance on probabilities and consequences outlined in CIRIA C552⁶.

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

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

Where the risk falls into the moderate/low risk, LKC will undertake an assessment to establish what category the pollutant linkage will fall into (i.e. moderate or low risk will be chosen).

Where LKC identifies a moderate or higher risk, intrusive work or precautionary remedial measures will be recommended.

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

It should be noted that there may be risk from short term exposure from contaminated soil to site workers during development work. The Preliminary Contamination Conceptual Model deals with long term exposure to key receptors associated with the future use of the site. Acute risks can be easily mitigated by good environmental management of the site during site works. Standard health and safety precautions (as per HSE guidance⁷) should be adopted by all workers involved with site enabling and construction works. Therefore, this receptor is not considered in the contamination conceptual model.

2.4 Recommendations

Based upon the Preliminary Contamination Conceptual Model a site investigation including gas monitoring was recommended to assess the potential pollutant linkages further.

⁵ Land Contamination Risk Management (LCRM) <https://www.gov.uk/government/publications/land-contamination-risk-management-lcrm>

⁶ CIRIA (2001). "Contaminated land risk assessment: A guide to good practice". C552.

⁷ HSE (1991). "Protection of Workers and the General Public During Development of Contaminated Land" London HMSO.

PL	Pathway	Receptor	Contaminants of Concern (CoC)	Probability	Consequence	Risk	Recommendations
1	- Dermal contact. - Inhalation of soil, fibres and dust. - Ingestion of soils, dust, vegetables, soil attached to vegetables. - 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.	Low Likelihood (given site history, site conditions and proposed end use)	Medium	Moderate / Low (low assumed as significant source not anticipated)	Low density intrusive investigation required. Soil analysis of CoC, subject to ground conditions encountered.
2	- Inhalation of vapours. - Migration via permeable strata and preferential pathways.	- Future site users. - Offsite receptors.	- Volatile contaminants (TPHCWG, SVOC, VOCs).	Unlikely (given site history, site conditions and proposed end use)	Medium	Low	Low density 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.	- Ground / hazardous gas (carbon dioxide, methane).	Likely (given viable gas source and viable pathway)	Severe	High	Deep made ground likely, but unknown composition. Gas monitoring or gas protection measures required.
			- Radon	Unlikely (as <1% of homes above action level)	Medium	Low	(<1%) No protective measures are necessary in the construction of new dwellings or extensions.
4	- Surface run-off. - Migration via permeable strata and preferential pathways. - Perched waters migration.	- Groundwater (Secondary Undifferentiated and Secondary A Aquifers).	- Mobile contaminants such as metals, PAHs, petroleum hydrocarbons.	Low Likelihood (only minimal mobile contamination anticipated)	Medium	Moderate / Low (moderate assumed until ground conditions confirmed)	Intrusive investigation required. Groundwater sampling, subject to ground conditions encountered. Analysis of CoC.
5	- Sulphate attack on concrete.	- Building structure.	- Sulphate.	Likely (given site history, site conditions, geology and direct contact / pathway)	Mild	Moderate / Low (moderate assumed until ground conditions confirmed)	Intrusive investigation required. Soil analysis of CoC, subject to ground conditions encountered.
6	- Ingestion of tainted water supply.	- Future site users. - Water pipes.	- Organic contaminants such as petroleum hydrocarbons, naphthalene.	Low Likelihood (although some contamination may be present, significant contamination not expected at pipeline depth)	Medium	Moderate / Low (moderate risk assumed until ground conditions confirmed)	Intrusive investigation required. Soil analysis of CoC, subject to ground conditions encountered.
7	- Direct contact (plant uptake).	- Flora.	- Phytotoxic contaminants such as heavy metals.	Likely (given site history, site conditions and proposed end use)	Minor	Low	Low density intrusive investigation required. Soil analysis of CoC, subject to ground conditions encountered.

Table 2-2. Preliminary Contamination Conceptual Model.

Notes: PL = Pollutant Linkage.

3 Ground Investigation

3.1 Site Investigation Design and Methodology

In order to assess the ground conditions at the site and to investigate the potential pollutant linkages identified in the preliminary contamination conceptual model an intrusive investigation was undertaken.

The investigation was carried out on 16th December 2020 and comprised the following:

- 7no. window sample boreholes drilled to 5-6 metres below ground level (mbgl) (ref. WS101-WS107).
- 4no. Dynamic Probing, drilled to 2.10-7.00mbgl (ref. DP102, DCP103, DCP108 and DCP109).
- 3no. hand pits (using hand auger / spade) excavated to 1.10-1.20mbgl (ref. HD101 to HD103).

The locations were chosen to allow a good spread across the site as well as target areas of concern.

The dynamic probes were undertaken to allow rapid on-site assessment of the strength of the ground below 5-6mbgl. This data was used to determine the depth and lateral extent of the former quarry on site. It should be noted that the type of strata cannot be confirmed during these tests.

Table 3-1 details the targeted and general coverage (non-targeted) site investigation locations. All site investigation locations are shown in Figure 3.

Site Investigation Locations	Rationale
WS102, WS103, WS105, DP102, DP103, HD101, HD102	Former quarry area. Location of former and proposed residential building.
DP108, DP109, HD103	Proposed rear garden area.
WS101, WS104, WS106, WS107	Former quarry access track and proposed front garden.
	Site area outside of former quarry area and general site coverage.

Table 3-1: Summary of sampling locations.

The number of site investigation points corresponds to approximately one location per 25m square centres (non-targeted work). This is considered to be an appropriate sampling density and is in line with BS10175⁸ for a 'main investigation'.

3.2 Well Installations

3no. (WS102, WS103 and WS105) of the boreholes were installed with monitoring wells for gas and groundwater monitoring. Monitoring wells were installed in accordance with BS10175 and CIRIA C665⁹ 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.

The response zones for the window sample boreholes were installed along the entire length of the borehole.

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

⁸ British Standard (2017). "Investigation of Potentially Contaminated Sites – Code of Practice." BS10175:2017.

⁹ CIRIA (2007). "Assessing Risks Posed by Hazardous Ground Gases to Buildings." CIRIA C665.

It should be noted that all boreholes were installed in the area of the former quarry within the footprint of the proposed building to allow onsite gas monitoring and groundwater monitoring (if required).

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 investigation¹⁰.

Soil was collected for onsite testing. 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 for total volatile organic compounds (TVOCs) using a PhoCheck Tiger photoionisation detector (PID). Results of the PID readings are presented on the profile logs (Appendix B). The on-site monitoring was carried out in line CIRIA C665¹¹ to aid in screening samples for volatile analysis.

Soil samples of approximately 500g were recovered in amber jars, amber vials for volatile analysis and plastic tubs. All the samples were labelled and stored in cool boxes prior to being collected by courier at the end of the day for delivery to the Chemtest laboratory in Newmarket for chemical testing. If collection was not possible the same day then samples were stored in the sample storage fridge at the LK Group offices below 4°C. Samples were tracked using appropriate Chain of Custody forms provided by Chemtest.

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.

¹⁰ EA (2000). "Technical Aspects of Site Investigation. Volumes 1 & 2 Text Supplements Research and Development Technical Report." P5-065/Tr.

¹¹ CIRIA (2007). "Assessing Risks Posed by Hazardous Ground Gases to Buildings." CIRIA C665.

Suites and Contaminants	No. Samples	Location & Depth	Justification
Metals / metalloids, pH, water soluble sulphate, speciated PAHs, SOM and asbestos screen.	5	WS102 ES1 0.0-0.5m WS102 ES2 0.5-1.0m HD101 ES1 0.0-0.5m HD102 ES2 0.4-0.9m HD103 ES1 0.0-0.5m	A basic suite with a broad selection of contaminants tested on samples across the site where no significant evidence of contamination was identified (except for clinker, ash and coal) and no TVOCs identified from the PID tests. These samples are representative of the proposed garden areas where potential exposure is possible.

Table 3-2. Summary of soil sample testing undertaken.

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; PAH=polycyclic aromatic hydrocarbons, SOM=Soil Organic Matter.

3.3.2 Water Sampling / Leaching Testing

Groundwater sampling / 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) with minimal mobile contamination anticipated. Further action was recommended only if significant soil contamination was identified on site.

Mobile contamination exceedances were minimal in the soil samples analysed, with the source likely to be from a relatively insoluble form (pottery/ash/clinker). Clay was identified below site which will limit migration and no significant receptors were identified within influencing distance of 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 Gas Monitoring

All the installed boreholes have been monitored for gas. 6no. visits have been undertaken over a three month period.

Monitoring was undertaken using a Geotechnical Instruments GA5000 in accordance with the monitoring protocol outlined in CIRIA C665¹² (flow rate measured first). The monitoring will aim to be undertaken over a range of weather conditions (including low and falling barometric pressure and heavy rain) to demonstrate worst-case conditions.

The gas monitoring results are reproduced in full in Appendix E.

3.5 Geotechnical Testing

3.5.1 In-situ Onsite Geotechnical Testing

In-situ geotechnical tests were performed in the boreholes to determine the depth to rockhead and locate the edge of the former quarry. The following tests were undertaken:

¹² CIRIA (2007). "Assessing Risks Posed by Hazardous Ground Gases to Buildings." CIRIA C665.

- Standard Penetration Tests (SPTs) were performed in the window sample boreholes at approximately 1m intervals, generally within the natural strata.
- Pocket Penetrometer tests (giving undrained shear strength) were performed in the window sample boreholes (to a maximum depth of 3mbgl) and hand pits at approximately 1m intervals, within the natural clay strata.
- Continuous equivalent SPTs were performed in the dynamic probes (strata not determined).

The SPT and pocket penetrometer readings are provided within the profile logs (Appendix B).

3.5.2 Laboratory Geotechnical Testing

Soil samples taken during the investigation were collected in tubs and bulk bags and sent to Murray Rix Laboratories and Chemtest 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.

Suites and Contaminants	No. Samples	Location	Justification
BRE SD1 Short Suite	2	WS103 0.2-1.0m WS105 2.5m	Additional samples of made ground taken across the site to assess the pH and sulphate for geotechnical purposes. pH and water-soluble sulphate are also included in Suite 5.
Atterberg Limits (plasticity testing)	3	WS101 1.2-1.65m WS104 0.5-1.0m WS107 0.5-1.0m	A selection of clay samples across the site were tested for Atterberg Limits to assess their shrinkability potential associated with current and proposed trees.

Table 3-3. Summary of geotechnical testing undertaken.

4 Ground Conditions

4.1 Geology – Generalised Sequence

The ground conditions in the south of the site comprised made ground underlain by natural sandy gravelly clay and sandstone bedrock. Made ground was encountered to depths of >5.00mbgl in the north of the site. A summary section of the logs is provided in Plate 4-1, with additional comments below.

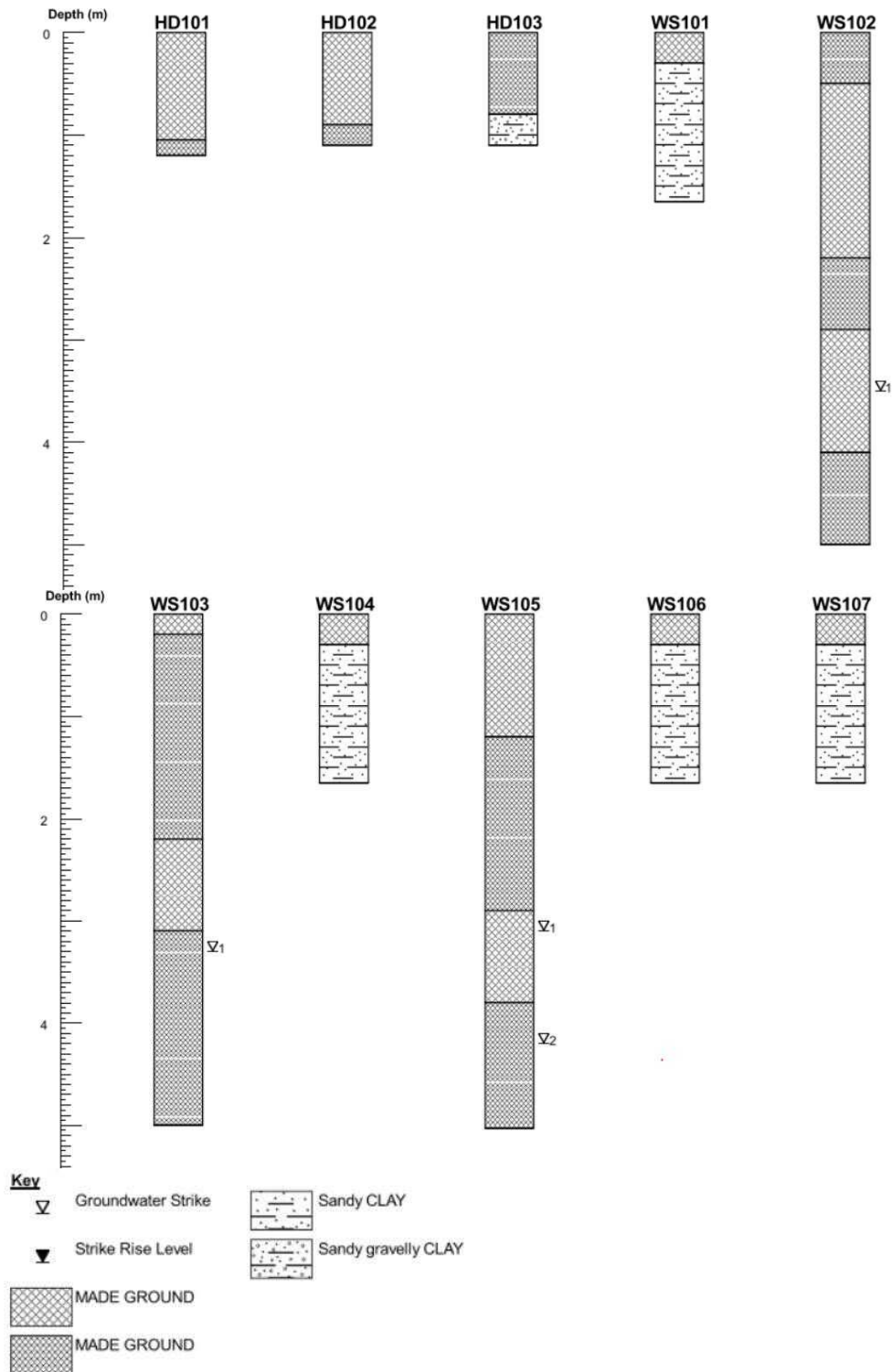


Plate 4-1: Summary of ground conditions.

Please note the quarry was bottomed by the DP at a maximum depth of 7mbgl (see Table 4.3).

Additional information on ground conditions:

Former quarry (WS/DP102, WS/DP103, WS105, DP109, HD101 & HD102)

- Sandy gravelly SILT with brick, pottery, plastic, metal, coal, ash and clinker to 1.20mbgl to 3.10mbgl, underlain by reworked CLAY and sandstone GRAVEL.
- Made ground was recorded to 5.00mbgl in WS102, WS103 and WS105, with SPT/DP refusal between 5.03-7.00mbgl.
- DP109 was undertaken close to the quarry edge, with refusal at 5.90mbgl.
- The reworked CLAY strata provided pocket penetrometer readings between 36.78-49.05 kPa (low to medium strength).

Former quarry access road (HD103 & DP108)

- HD103: sandy clayey GRAVEL with brick, concrete, ash, clinker and plastic fragments to 0.80mbgl underlain very sandy clay, hand tool refusal at 1.10mbgl on very dense strata, possible SANDSTONE.
- DP108: refusal at 2.10mbgl on probable SANDSTONE, assumed to be the depth of the former access road to the quarry.
- The natural clay strata provided pocket penetrometer reading of 61.31kPa (medium strength).

Remainder of the site (WS101, WS104, WS106 & WS107)

- Generally comprised reworked clay to 0.30mbgl, underlain by very sandy/gravelly CLAY to 1.65mbgl. Refusal at 1.65mbgl on probable SANDSTONE bedrock.
- The natural clay strata provided pocket penetrometer reading of 61.31-73.58kPa (medium strength).

Former building foundations

The site was noted to have trenches in the location of the former building's footprint/foundations.

The remnants of concrete footings were noted at shallow depth (0.3mbgl) in the southwest of the site.

Brickwork was identified in the centre and east of the site, likely to be associated with the former building. The depth of the brickwork extended to below 0.65mbgl.

Location of former quarry

Figure 3 illustrates the area in the north of site which is assumed to be the former quarry. Based on the results of the site investigation, the edge has been adjusted slightly from the historical mapping overlay and is shown in Figure 3.

Given sudden change in the depth to SPT refusal between WS107 and WS105 it is assumed there is a shear sandstone rock face at this location. The refusal depths recorded in HD103, DP108, DP109 and WS103 show a decline from the south of the

site to the former quarry in the north (Figure 4). Upon reviewing the historical maps, it is likely the decline is associated with the former access road.

4.2 Groundwater

4.2.1 Groundwater Levels

Groundwater was recorded in WS102, WS103 and WS105 between 3.10-4.20mbgl. In addition, groundwater monitoring within the borehole wells has been undertaken on six occasions. Water encountered at the base of two of the monitoring wells is considered to be perched.

Results are summarised in Table 4-1.

BH/TP	Water Strike Depths (mbgl)	Well Response Zone (mbgl)	No. of Monitoring Visits	Monitoring Depths (mbgl)			Sample Taken?	Evidence of Contam?
				Min	Max	Base		
WS101	Dry	-	-	-	-	-	N	N
WS102	3.50	0.80-3.80 (MG)	2	Dry	3.7	3.69-3.75	N	N
WS103	3.30	0.80-3.80(MG)	2	Dry	3.68	3.66-3.68	N	N
WS104	Dry	-	-	-	-	-	N	N
WS105	3.10, 4.20	1.00-3.00 (MG)	2	Dry	Dry	2.96-3.00	N	N
WS106	Dry	-	-	-	-	-	N	N
WS107	Dry	-	-	-	-	-	N	N
HD101	Dry	-	-	-	-	-	N	N
HD102	Dry	-	-	-	-	-	N	N
HD103	Dry	-	-	-	-	-	N	N

Table 4-1: Summary of water strike depths within boreholes and trial pits.

Response Zones:

MG=Made Ground.

4.3 In-Situ Geotechnical Testing

4.3.1 Standard Penetration Tests

In-situ standard penetration tests (SPTs) were undertaken, in made ground and natural ground. The results are summarised in Table 4-2 and provided within the profile logs in Appendix B.

Approximate Depth (mbgl)	SPT 'N' Values						
	WS101	WS102	WS103	WS104	WS105	WS106	WS107
1-2	50 (C/SS)	-	-	50 (C/SS)	2 (MG)	50 (C/SS)	50 (C/SS)
2-3	-	-	-	-	3 (MG)	-	-
3-4	-	-	-	-	11 (MG)	-	-
4-5	-	-	-	-	20 (MG)	-	-
5-6	-	-	-	-	50 (MG/SS)	-	-
GW Level	Dry	3.50	3.30		3.10, 4.20		

Table 4-2: Summary of SPT (N) values.

Notes:

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

Groundwater level based on strikes during investigation and monitoring data.

4.3.2 Dynamic Probing

Dynamic probing (DP) was carried out to confirm the depth to refusal (taken to be the top of the bedrock). Full DP results are presented in Appendix B. Depths to refusal are shown on Table 4-3.

Borehole	Depth to Refusal (m)
WS102	7.00
WS103	6.90
DP108	2.10
DP109	5.90

Table 4-3: Summary of Dynamic Probe results.

Dynamic probing (DP) was carried out from ground level at base of a hand excavated pit and recorded equivalent 'N' values (3 DP blows = 1 'N' values). Results are provided in Appendix B and summarised in Table 4-4.

Approximate Depth (mbgl)	Equivalent 'N' Values			
	WS102	WS103	DP108	DP109
0.3	-	-	4	-
0.6	-	-	9	-
0.9	-	-	4	-
0.3	-	-	5	-
0.6	-	-	9	-
0.9	-	-	18	-
1.0	3	3	7	3
1.3	2	2	10	9
1.6	0	4	31	9
1.9	2	7	50*	1
2.2	3	2	-	0
2.5	3	3	-	0
2.8	2	4	-	0
3.1	3	1	-	1
3.4	2	3	-	5
3.7	3	5	-	4
4	2	5	-	1
4.3	5	4	-	1
4.6	9	3	-	2
4.9	21	20	-	3
5.2	24	15	-	3
5.5	13	4	-	50*
5.8	7	2	-	50*
6.1	15	1	-	-
6.4	12	8	-	-
6.7	50*	50*	-	-

Table 4-4: Summary of equivalent 'N' values from dynamic probing.

*=N value is recorded as refusal, actual results may exceed this.

4.3.3 Pocket Penetrometer Readings

Hand shear vane readings, recording undrained shear strength (USS), were taken within the clay strata. The results are summarised in Table 4-5 and provided within the profile logs in Appendix B.

Approximate Depth (mbgl)	Average Undrained Shear Strength (kN/m ²)						
	WS101	WS102	WS103	WS104	WS105	WS106	WS107
0-1	61.31	-	-	61.31	-	73.58	61.31
1-2	-	-	-	-	36.78	-	-
2-3	-	36.78	-	-	36.78	-	-
3-4	-	-	49.05	-	-	-	-
4-5	-	-	-	-	49.05	-	-
GW Level	Dry	3.50	3.30	Dry	3.10-4.20	Dry	Dry

Table 4-5: Summary of average pocket penetrometer readings.

Notes:

Groundwater level based on strikes during investigation and monitoring data.

Pocket penetrometer readings can be influenced by coarse material including coarse silt.

4.4 Geotechnical Laboratory Testing

4.4.1 Atterberg Limits

Representative samples of natural clay were subjected to Atterberg Limits (plasticity) and Moisture Content testing. Results are presented in Appendix D and summarised in Table 4-6.

Table 4-6 also includes the modified plasticity index as detailed in Chapter 4.2-D5 of the NHBC standards (modified plasticity index = plasticity index x % less than 425µm sieve / 100%).

Location	Depth (mbgl)	Moisture Content (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Class	Passing 425 micron (%)	Modified Plasticity Index (%)
WS101	1.20-1.65	13	32	10	22	CL	78	17.2
WS104	0.5-1.0	15	30	12	18	CL	75	13.5
WS107	0.5-1.0	16	32	12	20	CL	81	16.2

Table 4-6: Summary of plasticity index testing.

The modified plasticity index is between 13.5% and 17.16%. This characterises the clay as having a low volume change potential.

4.4.2 Sulphate and pH

Water soluble sulphate and pH tests were carried out on soil samples. Partial results are presented in Appendix C and summarised in Table 4-7. Additional results will be shown in the full phase 2 report.

Strata	pH	Sulphate (g/l)
Made Ground	6.2-8.5	<0.01-0.21

Table 4-7: Summary of pH and sulphate results.

5 Geotechnical Assessment

5.1 Proposed Development

It is understood that the proposed development will comprise a two-storey detached residential house with associated gardens and infrastructure. Details of the proposed loadings are not known and therefore a line loading of 75kN/m has been assumed for preliminary assessment purposes only.

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

The depths of any underground engineering works (sewers etc.) are unknown and therefore have not been taken into account in the following assessment. It is considered that any such works will be designed so as not to have an effect on, or compromise, proposed foundations or ground stability.

5.2 Summary of Ground Conditions

Ground conditions identified at the site are detailed in Section 4.1 and essentially comprises an infilled sandstone quarry with depth to rockhead c.1.65mbgl in the south of the site, becoming deeper along the route of the former access road to a maximum proven depth of 7 (WS102 / DP102). The former quarry has been infilled with GRAVEL and CLAY and contains anthropogenic materials including brick, ash, clinker and pottery.

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 Works. 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.
- » Buried structures and old foundations can be anticipated on site. 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 Strip Foundations

It is considered that the Made Ground is not suitable for a founding material due to the variation in depth and inherent variability of the material. Foundation options are therefore:

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

These options are discussed below:

5.4.2 Ground Improvement

The use of ground improvement techniques such as vibro granular columns will allow shallow foundations to be utilised within the Made Ground. The vibro granular columns should provide a bearing capacity of around 150kN/m² but will also remove variability within the Made Ground. Specialist advice should be sought from a suitably experience contractor with regard to allowable bearing capacity and settlements.

5.4.3 Piled Foundations

Consideration has been given to the use of piled foundations. For preliminary purposes given the variable granular and cohesive nature of the Made Ground it is recommended that end bearing piles, socketed into the sandstone should be considered. The depth to the sandstone in the south of the site in the area that was not subject to quarrying is around 1.70m bgl. In the centre and north of the site the depth to the sandstone increases dramatically to c. 7.00mbgl due to the historic quarrying. Sandstone should be capable of supporting an allowable bearing capacity of 600kN/m².

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.

Dure to the significant depths of Made Ground encountered across the site consideration must be given to the potential for negative skin friction and pile sleeves may be required to negate these effects.

Recommendation

Vibro granular columns may provide the most cost effective solution but given the significant depths of the Made Ground may not provide the most reliable solution. End bearing piles socketed within the sandstone offer the most reliable foundation solution. It is recommended that specialist contractors are consulted before selecting the most suitable foundation solution.

5.5 Ground Floor Slabs

Due to the presence of substantial thickness' of Made Ground across the site it is considered that ground bearing floor slabs, whilst viable, will require detailed design to accommodate variability of the formation and account for differential settlement. New home warranty providers, such as NHBC or LABC will require a suspended floor where Made Ground is in excess of 600mm.

5.6 Drainage

The presence of substantial depths of Made Ground across the site may result in settlement. It is therefore recommended that drain runs are designed using steeper gradients and flexible joints to allow for some differential settlement.

5.7 Concrete Durability

Based upon the results of the chemical analyses summarised in Table 4-7 it is considered that 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).

5.8 Excavations

Site observations indicated that excavations should be feasible in the near surface with normal plant, however obstructions can be anticipated in the near surface including former foundations. It is anticipated that any obstructions will be grubbed out during the reduced level dig for the sub structure works.

Some of the exploratory holes were observed to be unstable during drilling and the Made Ground deposits included granular strata containing perched groundwater. The short and long term stability of near vertically sided excavations can therefore not be guaranteed and random and sudden instability within these soils should be anticipated.

Due to the variability of the Made Ground it is considered that all excavations are supported or battered back in accordance with guidance contained in CIRIA R97¹³. Groundwater seepages were noted in several exploratory holes, however, these were minor and it considered that conventional sump pumping should be adequate.

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 R97 utilised.
- » It is considered that de-watering may be required, especially following periods of heavy rainfall. Removal of surface water and water within trenches should be possible with conventional sump pumping. Discharge of any water should be agreed with the relevant regulatory body and be undertaken under a trade effluent discharge, where required. Measures to remove silt and suspended solids may be required and consideration should be given to provision of space for settling tanks or an attenuation pond.
- » Where access to confined spaces is required appropriate mitigation measures should be addressed within the Construction Stage Health and Safety Plan. Particular account should be taken of the gas results.
- » The presence of potential contamination and mitigation measures should be addressed as part of the Construction Stage Health and Safety Plan and should

¹³ CIRIA Report 97 – Trenching Practice – Second Edition (2001 revision)

include measures to design out the risks, reduce their impact and finally the use of Personnel Protective Equipment (PPE).

6 Generic Risk Assessment

6.1 Introduction

Current good practice requires that the findings from a site investigation should be evaluated on a site-specific basis, using a risk-based approach. Risk assessment involves identification and evaluation of the hazards presented by the concentrations of contaminants measured followed by an evaluation of the risks which are associated with these hazards (LMRM¹⁴). 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).
- LQM Suitable 4 Use Levels (S4ULs).
- ATRISK Soil Screening Values (SSVs) and CL:AIRE Generic Assessment Criteria (GACs).

C4SLs were published in 2013^{15,16}. The recent change to the contaminated land guidance has changed the evaluation of risk from 'minimal' (referred to as Health Criteria values (HCVs))¹⁷ used to generate Soil Guideline Values (SGVs) to 'low' (referred to as Lowest Level of Toxicological Concern (LLTCs)). The policy companion document and supporting letter by Defra, dated 3rd September 2014, states that C4SLs '*could be used under the planning regime, as well as within Part 2A*'. Based on these comments LKC considers the justifications and assumptions used to generate 'low' risk are suitable for the planning regime.

Where no C4SLs have been generated LKC will use the LQM S4ULs¹⁸. Similar assumptions and land uses to C4SLs have been used. However, toxicological information has been based on 'minimal risk' as per previous guidelines and assumptions^{19,20,21,22}.

If contaminants are not present as C4SLs and S4ULs then LKC will use ATRISK SSVs or CL:AIRE GACs²³. These follow the 'minimal' risk principle and more stringent exposure parameters and will be conservative.

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

¹⁴ Land Contamination Risk Management (LCRM) <https://www.gov.uk/government/publications/land-contamination-risk-management-lcrm>

¹⁵ Defra (2014). "SP1010: Development of Category 4 Screening Levels and Assessment of Land Affected by Contamination – Policy Companion Document."

¹⁶ CL:AIRE (2013). "SP1010: Development of Category 4 Screening Levels and Assessment of Land Affected by Contamination – Final project Report."

¹⁷ EA (2008). "Human Health Toxicological Assessment of Contaminants in Soils." Science Report – SC050021/SR2.

¹⁸ LQM (2014). "The LQM/CIEH S4ULs for Human Health Risk Assessment."

¹⁹ EA (2008). "Updated Technical Background to the CLEA Model." Science Report – SC050021/SR3.

²⁰ EA (2008). "Human Health Toxicological Assessment of Contaminants in Soils." Science Report – SC050021/SR2.

²¹ EA (2008). "A Review of Body Weight and Height Data used within the Contaminated Land Exposure Assessment Model (CLEA)." Project SC050021/Technical Review 1.

²² EA (2009). "Compilation of Data for Priority Organic Pollutants for Derivation of Soil Guideline Values." Science report SC050021/SR7.

²³ CL:AIRE (2009). "The Soil Generic Assessment Criteria for Human Health Risk Assessment."

PAHs^{24,25} and naphthalene the most volatile and soluble²⁶. The new 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 negligible²⁷. For B(a)P to be used as a surrogate marker it should follow the profile described by the HPA (2008)²⁸ and CL:AIRE (2013). Naphthalene will be treated separately using the LQM S4ULs.

The proposed development is for a residential house with private garden therefore the assessment criteria for residential with plant uptake has been used.

All criteria have been generated using the CLEA V1.06 model²⁹ 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 is provided in Appendix F. ATRISK SSVs and CL:AIRE GACs were not required for this dataset and have not been included.

B(a)P as Surrogate Marker

Based on the above assumption for PAHs, LKC undertook an assessment of the 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.*³⁰, 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.

²⁴ EA (2002). "Contaminants in Soils: Collation of Toxicological Data and Intake Values for Humans. Benzo[a]pyrene." R&D Publication TOX2.

²⁵ USEPA (1984). "Health Effects Assessment of Polycyclic Aromatic Hydrocarbons (PAHs). EPA 540/1-86-013."

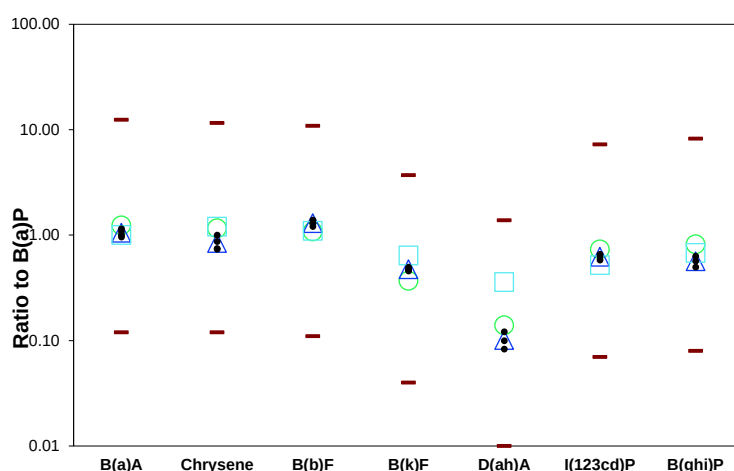
²⁶ EA (2003). "Review of the Fate and Transport of Selected Contaminants in the Soil Environment." Draft technical report P5- 079/TR1.

²⁷ CL:AIRE (2013). "SP1010: Development of Category 4 Screening Levels and Assessment of Land Affected by Contamination – Final project Report."

²⁸ HPA (2010). "HPA Contaminated Land Information Sheet: Risk Assessment Approaches for Polycyclic Aromatic Hydrocarbons (PAHs)." Version 3.

²⁹ EA (2008). "CLEA Software (Version 1.05) Handbook." Science Report – SC050021/SR4.

³⁰ Culp, S; Gaylor, D; Sheldon, W; Goldstein, L and Beland, F (1998). "A Comparison of Tumours Induced by Coal Tar and Benzo-a-pyrene in a 2-Year Bioassay." Carcinogenesis. Vol 19, no. 1, pp. 117-124.



Graph 6-1: The ratio of PAH to B(a)P in soil for all available data at the site based on 4no. samples (where values were >LOD to allow the calculation of a ratio).

Notes:

B(a)P = Benzo(a)pyrene; D(ah)A = Dibenzo(ah)anthracene; B(a)A = Benzo(a)anthracene; B(b)F = Benzo(b)fluoranthene; B(k)F = benzo(k)fluoranthene; I(123cd)P = Indeno(123cd)pyrene; B(ghi)P = Benzo(ghi)perylene
 ● = Ratio to B(a)P for all data ○ = Mean ratio to B(a)P for Culp data △ = Mean ratio to B(a)P from all data at the site; □ = Mean ratio to B(a)P for UK data presented by HPA ■ = Upper and Lower limits (order of magnitude from Culp data)

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

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

6.2.2 Soil Results Comparison against Assessment Criteria

All analysis sheets are presented in Appendix C. All the data has been compared to relevant assessment criteria and pertinent results are presented in Table 6-1.

Contaminant	Units	No. of samples	Elevated Results	Sample Location	Criteria	Source of Criteria
Metals						
Arsenic	mg/kg	5	72	HD101 0.0-0.5m	37	C4SL
Lead	mg/kg	5	430	HD101 0.0-0.5m	200	C4SL
PAHs						
Benzo(a)pyrene	mg/kg	5	13	HD103 0.0-0.5m	5	C4SL
GENERAL						
pH	pH	7	Range 6.2 to 8.5			
SOM	%	7	Range 2.4 to 9.1			

Table 6-1: Summary of elevated and pertinent analytical results.

Notes:

Only results that exceeded assessment criteria have been shown and results from **all depths** are noted. Results have been compared to the nearest appropriate SOM.

No asbestos was identified in any soil samples analysed.

Elevated results have been identified for Arsenic (HD101), Lead (HD101) and B(a)P (HD103).

6.2.3 *Direct Contact Risk – Pollutant Linkage 1*

Elevated PAHs (BaP) and metals (arsenic and lead) have been identified on site; given the limited number of samples tested and the prevalence of the made ground strata across the site, the contamination is considered to be present in the proposed garden areas (front and rear).

The source of the PAH contamination is expected to be the ash and clinker within the made ground; the pottery noted in the made ground is likely to be source of the elevated metal concentrations.

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

The probability of PAH and metal contamination affecting site users is likely. With a medium consequence, the risk is considered to be moderate, and remediation is recommended or further soil sampling to generate a larger dataset.

No asbestos was identified in any of the samples; therefore, the probability of asbestos affecting site users is considered to be unlikely. With a moderate consequence, the risk is low and remediation is not required. However, as a precaution, construction workers should be and vigilant for any suspected ACM during groundworks (discussed further in Section 9.1).

No visual or olfactory evidence of petroleum hydrocarbon contamination was observed in the soil during the site investigation. The probability of petroleum hydrocarbons affecting site users is considered to be unlikely. With a moderate consequence, the risk is low and remediation is not required.

6.2.4 *Risk from Inhalation of Vapours – Pollutant Linkage 2*

No visual / olfactory evidence of volatile contaminants was identified during the investigation. The PID did not detect any TVOCs. Confirmatory sampling did not detect elevated volatile contamination, such as naphthalene in the soil samples analysed.

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

6.3 **Gas Risk Assessment**

6no. gas monitoring visits have been undertaken on the study site over a three month period. Gas monitoring results in full are presented in Appendix E. Following guidance set out in CIRIA C665³¹ and BS8485³² peak methane and carbon dioxide concentrations have been used in the gas risk assessment. In addition, and as per guidance, flow rates were measured first.

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

³¹ CIRIA (2007). "Assessing Risks Posed by Hazardous Ground Gases to Buildings." CIRIA C665.

³² BSI (2015). "Code of Practice for the Characterisation and Remediation from Ground Gas in Affected Developments." BS8485:2015.

Boreholes	Visit	CH ₄ (%v/v)	CO ₂ (%v/v)	O ₂ (%v/v)	H ₂ S (ppm)	CO (ppm)	Flow (l/h)	Groundwater (mbgl)	Pressure (mb)
WS102	1	<0.1	4.3 (4.1)	16.6	<0.11	2.0	0.1	Dry	985(r/f)
	2	<0.1	2.9	18.1	<0.1	1.0	<0.1	Dry	1004(r)
	3	<0.1	2.9	17.1	<0.1	<0.1	0.2	3.7	995 (r)
	4	<0.1	2.9	18.1	<0.1	<0.1	<0.1	Dry	1004 (r/f)
	5	<0.1	2.4	18.4	<0.1	<0.1	0.1	Damp	998 (f)
	6	<0.1	2.3	18.8	<0.1	<0.1	<0.1	Dry	1006 (s)
WS103	1	<0.1	2.5	19.7	<0.1	1.0	-0.1	Dry	987(r/f)
	2	<0.1	1.6	19.7	<0.1	<0.1	<0.1	Dry	1005(r)
	3	<0.1	1.2	19.2	<0.1	<0.1	<0.1	3.68	994 (r)
	4	<0.1	1.6	19.7	<0.1	<0.1	<0.1	Dry	1005 (r/f)
	5	<0.1	1.4	19.9	<0.1	<0.1	0.1	Dry	998 (f)
	6	<0.1	0.9	20.1	<0.1	<0.1	<0.1	Dry	1007 (s)
WS105	1	<0.1	0.3	21.2	<0.1	6.0	<0.1	Dry	986(r/f)
	2	<0.1	0.3	21.0	<0.1	<0.1	0.1	Dry	1005(r)
	3	<0.1	0.9	20.1	<0.1	<0.1	<0.1	Dry	993 (r)
	4	<0.1	0.3	21.0	<0.1	<0.1	<0.1	Dry	1005 (r/f)
	5	<0.1	0.6	20.5	<0.1	<0.1	0.1	Dry	998 (f)
	6	<0.1	1.7	19.6	<0.1	<0.1	<0.1	Dry	1007 (s)

Table 6-2: Summary of gas monitoring.

Notes:

If concentrations / flow is zero, then equipment detection limits are assumed.

Table shows peak concentrations of CH₄, CO₂, O₂, H₂S and CO.

Where peak CO₂ differs significantly to the steady, steady is shown in brackets.

Bold where CO₂ exceeds 5%v/v and CH₄ exceeds 1%v/v.

Atmospheric pressure (over past 24hrs): r/f=rising then falling, r=rising, f=falling, s=steady.

Low flow rates (maximum of 0.2l/hr recorded at WS102) was recorded in all boreholes during both high and low atmospheric pressure visits. Maximum methane and carbon dioxide concentrations were recorded at <0.1%v/v and 4.3%v/v respectively.

Carbon monoxide was >1.0ppm in boreholes WS102 and WS105. The maximum concentration was recorded as 6.0ppm (WS105). This did not appear to correlate with significant oxygen depletion in any of these locations.

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

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

Gas Screening Value

In accordance with CIRIA C665³³, a Gas Screening Value (GSV) may be calculated. Assuming worst-case scenario maximum gas concentrations and flow for each borehole have been used to calculate the GSV. The GSV can be used to determine the characteristic situation (CS).

Table 6-3 shows the maximum GSV for each borehole and the appropriate characteristic situation (based on GSV only). Maximum GSVs for methane and carbon dioxide at all three boreholes are below the threshold for CS1 / NHBC Green.

³³ CIRIA (2007). "Assessing Risks Posed by Hazardous Ground Gases to Buildings." CIRIA C665.

Boreholes	Max GSV (l/hr)	CS / TL
WS102	0.0086	CS1 / NHBC Green
WS103	0.0025	CS1 / NHBC Green
WS105	0.0017	CS1 / NHBC Green

Table 6-3: Summary of worst-case Gas Screening Values (GSV).

Notes:

CS – Characteristic Situation; TL= Traffic Light.

From the data collected it appears the gas generation of the material infilled c. 90 years ago is inert and not generating significant gas concentrations and at negligible flow rates. Profile logs were provided to 5mbgl and follow on DPs reached the sandstone bedrock at the deepest point at 7mbgl. The deeper material is not considered to be different to the upper strata.

Based on the above LKC consider the probability of carbon dioxide and methane gas affecting site users and buildings as unlikely. Assuming a severe consequence, there is a moderate/low risk. Given the minimal gas concentrations and flow rates, a low risk is considered most appropriate and no remediation (gas protection measures) are required.

6.4 Controlled Water Assessment

A Secondary A Aquifer and a Secondary Undifferentiated Aquifer is located within the bedrock and superficial deposits, respectively. No rivers or streams were located within a 250m radius of the site. The PRA identified a moderate/low risk with respect to controlled waters as minimal mobile contamination was anticipated.

No evidence of significant mobile contamination was identified on the site. Although elevated metals and PAHs were identified within the soils, the source is anticipated to mainly relate to ash and clinker noted within the made ground. Contamination associated with ash and clinker is not anticipated to be mobile due to the residual crystalline nature of the matrix.

The site investigation did not identify any significant sources of likely mobile contamination within the soils. 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 Additional Risk Assessments

6.5.1 Concrete (Pollutant Linkage 5)

As stated in Section 5.7, the subsurface concrete can be designed in accordance with Design Sulphate Class DS-1 AC-1s.

The probability of elevated sulphate affecting the concrete is unlikely. With a mild consequence, the risk is very low and no remediation (sulphate resistant concrete) is required.

6.5.2 Potable Water Supply (Pollutant Linkage 6)

Soil results were compared to United Utilities (UU) guidelines for the selection of potable water pipes in land potentially affected by contamination³⁴. Only contaminants of concern, based on the preliminary conceptual model and ground conditions encountered, were analysed. The following contaminants were not considered to be a risk and therefore not included in the analysis suites: speciated petroleum hydrocarbons, chlorinated compounds, BTEX compounds, phenols, cresols, ethers, nitrobenzene, ketones, aldehydes and amines.

The following elevated contaminants were identified:

- » Elevated TVOCs (inc. naphthalene) in made ground in the south of the site (one sample).

Once details of the pipeline location and depths are known a UU Risk Assessment should be undertaken. If pipework is to be installed in the southern part of the site barrier pipework may be required.

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

6.5.3 Phytotoxicity (Pollutant Linkage 7)

Soil results were compared to phytotoxic guideline values as outlined in BS3882³⁵.

Elevated zinc (maximum concentration 500mg/kg) and copper (maximum concentration 230mg/kg) were identified. The probability of phytotoxic contaminants affecting vegetation is considered to be likely. With a minor consequence, the risk (pollutant linkage 7) is anticipated to be low. Although the risk is low, some remediation is recommended. The remediation associated with PL1 (cover system) will be more than sufficient for PL7.

6.6 Revised Contamination Conceptual Model

The preliminary contamination conceptual model (Table 2-2) 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 6-4.

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.

³⁴ UU(2011). "United Utilities Water Supplementary Guidance for the Selection of Water Pipes in Land Potentially Affected by Contamination."

³⁵ BS (2015). "Specifications for Topsoil and Requirements for Use." BS3882:2015.

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

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

Further details of the remedial proposals and a remedial option appraisal are given in Section 9.1.

Pollutant Linkage	Pathway	Receptor	Contaminant	Probability	Consequence	Risk	Assessment
PL1	-Dermal contact. -Inhalation of soil, fibres and dust. -Ingestion of soils, dust, vegetables, soil attached to vegetables. -Windblown dust.	-Current residents. -Future residents. -Site users. -Offsite receptors.	- Heavy metals. - PAHs.	Likely	Medium	Moderate	-Likely probability as elevated metals (arsenic and lead) and PAHs identified in the made ground across the site which could come into contact with site users in gardens / soft landscaping areas. -Recommendation*1 *2: Remediation required. An environmental cover system is required in gardens / soft landscaping areas. Alternatively, further sampling in the gardens will allow for a larger dataset for statistical analysis and may remove / limit the need for remediation.
			-Petroleum hydrocarbons. -ACM	Unlikely	Medium	Low	-Unlikely probability as no ACM identified. No visual or olfactory evidence of petroleum hydrocarbons identified in soils on site. -Recommendation: No remediation required.
PL2	-Inhalation of vapours. -Migration through permeable strata and preferential pathways.	-Current residents. -Future residents. -Site users.	Volatile Contaminants	Unlikely	Medium	Low	-No elevated volatile compounds, such as naphthalene identified. Maximum PID reading recorded as 0.3ppm on site. -Recommendation: No remediation required.
PL3	-Inhalation of gas. -Migration through permeable strata and preferential pathways. -Explosion in confined spaces (methane only).	-Current residents. -Future residents. -Buildings. -Offsite land users.	-Carbon dioxide, Methane	Unlikely	Severe	Moderate / Low	-Site classified as CS1 / NHBC Green. -Low risk as low flow rates and no elevated methane and carbon dioxide recorded. -Recommendation: No gas protection measures required.
PL4	-Surface Run-off. -Migration through permeable strata and preferential pathways -Perched waters migration.	-Groundwater Secondary Undifferentiated Strata (superficial). -Secondary A Aquifer (bedrock).	- Mobile contaminants: - Metals and PAHs.	Unlikely	Medium	Low	-Although slightly elevated metals and PAHs identified in the soil, given the environmental settings and ground conditions encountered these are not considered to pose a significant risk to the underlying Secondary A and Undifferentiated Aquifers. -Recommendation: No remediation required.

Table 6-4: Revised Contamination Conceptual Model.

Notes

*1 Although no ACM identified, contractors should be vigilant during earthworks of any potential ACM. This is discussed further in Section 9.1.

*2 The conceptual model only takes into consideration the future use of the site and long-term exposure. Consideration should also be given to the short-term exposure of construction workers and nearby land users to ACM containing soils during groundworks. This is discussed further in Section 9.1.

Pollutant Linkage	Pathway	Receptor	Contaminant	Probability	Consequence	Risk	Assessment
PL5	- Sulphate attack on concrete.	- Building structure.	- Sulphate	Unlikely	Mild	Very Low	- No elevated sulphate identified in soils. - Recommendation: No remediation required.
PL6	- Ingestion of tainted water supply.	- Future site users (via potable water).	Organic Contaminants: - Naphthalene.	Likely	Medium	Moderate	- Likely probability as elevated naphthalene encountered which could permeate water pipes and contaminate water supply. - Recommendation: UU risk assessment undertaken. Barrier piping likely to be required in south of site, but is dependent upon the pipeline route.
PL7	- Direct Contact (plant uptake).	- Flora.	Phytotoxic Contaminants: - Zinc and copper.	Likely	Minor	Low	- Elevated zinc and copper identified, which may be taken up by flora in soft landscaping / gardens. - Recommendation: Given risk to flora, some remediation is recommended. Remediation associated with PL1 will be more than sufficient.

Table 6-4 (continued): Revised Contamination Conceptual Model.

Notes

*1 Although no ACM identified, contractors should be vigilant during earthworks of any potential ACM. This is discussed further in Section 9.1

*2 The conceptual model only takes into consideration the future use of the site and long-term exposure. Consideration should also be given to the short-term exposure of construction workers and nearby land users to ACM containing soils during groundworks. This is discussed further in Section 9.1.

7 Waste Disposal Assessment

The soil contamination results as presented in Appendix C have been used to help determine the waste classification of material for off-site disposal.

As an initial screen the soil results were inputted into Hazwaste Online™. This is a web-based facility that allows an assessment waste as either hazardous or non-hazardous waste based on relevant guidance and legislation^{36, 37, 38, 39, 40, 41, 42, 43, 44}.

Hazwaste Online™. has been designed to cover, amongst other waste types, the European Waste List of Waste (LoW) code number 17 "Construction and Demolition Waste (Including Excavated Soil from Contaminated Sites)".

Where less than limits of detection (LOD) were recorded, the value of the LOD was inputted.

Where applicable, appropriate metal species based on hazard statements/ molecular weight, site history, ground conditions and likely species present in soils were used (e.g. metal oxides relating to an ash based source).

The results show that all the samples tested are classified as NON-HAZARDOUS WASTE and LoW code "17-05-04 - soil and stones other than those mentioned in 17 05 03" is suitable. The Hazwaste Online™ output sheets are provided in Appendix G.

³⁶ EA (2018). "Guidance on the Classification and Assessment of Waste (1st Edition v1.1)". Technical Guidance WM3.

³⁷ CLP Regulation - Regulation 1272/2008/EC of 16 December 2008.

³⁸ 1st ATP - Regulation 790/2009/EC of 10 August 2009

³⁹ Correction to 1st ATP - Regulation 758/2013/EU of 7 August 2013

⁴⁰ WFD Annex III replacement - Regulation 1357/2014/EU of 18 December 2014

⁴¹ Revised List of Wastes 2014 - Decision 2014/955/EU of 18 December 2014

⁴² 13th ATP - Regulation (EU) 2018/1480 of 4 October 2018

⁴³ POPs Regulation 2004 - Regulation 850/2004/EC of 29 April 2004

⁴⁴ 2nd ATP to POPs Regulation - Regulation 757/2010/EU of 24 August 2010

8 Conclusions

8.1 Geotechnical

Geotechnical observations and conclusions are detailed in Table 8-1 below:

Proposed Development	- Demolition of existing bungalow and erection of 2 storey replacement dwelling.
General Ground conditions / Geotechnical Testing	<u>Former quarry (WS/DP102, WS/DP103, WS105, DP109, HD101 & HD102):</u> - Sandy gravelly SILT with brick, pottery, plastic, metal, coal, ash and clinker to 1.20mbgl to 3.10mbgl, underlain by reworked CLAY and sandstone GRAVEL. - Made ground was recorded to 5.00mbgl in WS102, WS103 and WS105, with SPT/DP refusal between 5.03-7.00mbgl. - DP109 was undertaken close to the quarry edge, with refusal at 5.90mbgl. - The reworked CLAY stratas provided pocket penetrometer readings between 36.78-49.05 kPa (low to medium strength). <u>Former quarry access road (HD103 & DP108):</u> - HD103: sandy clayey GRAVEL with brick, concrete, ash, clinker and plastic fragments to 0.80mbgl underlain very sandy clay, hand tool refusal at 1.10mbgl on very dense strata, possible SANDSTONE. - DP108: refusal at 2.10mbgl on probable SANDSTONE, assumed to be the depth of the former access road to the quarry. - The natural clay strata provided pocket penetrometer reading of 61.31kPa (medium strength). <u>Remainder of the site (WS101, WS104, WS106 & WS107):</u> - Generally comprised reworked clay to 0.30mbgl, underlain by very sandy/gravelly CLAY to 1.65mbgl. Refusal at 1.65mbgl on probable SANDSTONE bedrock. - The natural clay strata provided pocket penetrometer reading of 61.31-73.58kPa (medium strength). - SANDSTONE bedrock encountered. - Groundwater encountered between 3.10-4.20mbgl (WS102, WS103 and WS105).
Anticipated Foundation Type	- Ground conditions below the proposed building are variable with varying depths of made ground (1.7m-7.0mbgl). - Traditional shallow foundations are not expected to be suitable for the proposed development given the ground conditions encountered. Differential settlements are likely to affect the proposed building especially where it crosses between the unworked and the quarried area. It is recommended that the new residence is supported on the underlying sandstone utilising end bearing piles. An allowable bearing capacity of 600kN/m² should be applied to the sandstone. Sleeving should be used at shallow depth to ensure the piles are not affected by negative skin friction. - A ground improvement option through the use of vibro stone columns may be a viable alternative. - The appointed specialist piling contractor will be able to optimise pile design such as pile grouping per pile cap, pile diameter & pile spacing, installation methodology, pile cap settlement, and socket lengths to suit from the SI data.
Shallow Groundwater	- Shallow groundwater identified on the site at depths of between 3.10m and 4.20mbgl and is considered representative of perched pockets within the Made Ground.
Concrete Requirements	- Based on BRE Digest 2005 ⁴⁵ – DS-1 AC-1s recommended.
Services	- Services – consideration to the presence of services running through the site. Services may need to re-routed.
Temporary support of excavation	- Due to the variability of the Made Ground it is considered that all excavations are supported or battered back in accordance with guidance contained in CIRIA R97
Plasticity	- A low volume change potential for the Made Ground CLAY has been calculated for the site.

Table 8-1: Geotechnical Assessment

⁴⁵ BRE (2005). "Concrete in Aggressive Ground." Special Digest 1.

8.2 Contamination Assessment

A revised contamination conceptual model has been produced by LKC which is summarised in Table 8-2 below (more detailed model provided in Section 5).

Pollutant Linkage		Risk	Recommendations
1	Contaminants posing a risk to site users current residents, future residents, site users and offsite receptors via dermal contact, ingestion and inhalation (of soil, dust, fibres and vegetables).	Moderate	- Elevated arsenic, lead and PAHs identified across the site (in the proposed gardens). Recommendations: Remediation (environmental cover system) required in garden areas. Alternatively, further sampling in the gardens will allow for a larger dataset for statistical analysis and may remove / limit the need for remediation.
		Low	- No ACM identified. - No olfactory or visual evidence of gross petroleum hydrocarbon contamination. Recommendations: No remediation required.
2	Volatile contaminants posing a risk to site users current residents, future residents, site users and offsite receptors via the inhalation of vapours.	Low	- No elevated volatile compounds, such as naphthalene identified. Maximum PID reading recorded 0.3ppm. Recommendations: No remediation required.
3	Gas posing a risk to buildings and site users current residents, future residents, site users and offsite receptors via the migration of gas into building causing explosion and asphyxiation.	Moderate/ Low	- Site is classified as CS1 / NHBC Green. - Low risk as low flow rates and no elevated methane and carbon dioxide recorded. Recommendations: No gas protection measures required.
4	Mobile contamination posing a risk to controlled waters via the migration through permeable strata.	Low	- Although slightly elevated metals and PAHs identified, given the environmental settings and ground conditions encountered not considered to pose a significant risk to the underlying aquifers Recommendation: No remediation required.
5	Sulphate posing a risk to building via direct contact (sulphate attack).	Very Low	- No elevated sulphate identified in soils. Recommendation: No remediation required.
6	Organic contaminants posing a risk to water pipes.	Moderate	- Organic contamination (naphthalene) identified at potable pipe depth of 0.75-1.35mbgl in HD103. Recommendations: UU risk assessment to be completed. The site will likely require barrier piping.
7	Phytotoxic metals posing a risk to flora via root uptake.	Low	- Elevated zinc and copper identified. Recommendations: Remediation associated with PL1 will be more than sufficient.

Table 8-2: Summary Risk Table.

Remedial recommendations are presented in Section 9.1.

9 Recommendations and Remedial Strategy

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.

9.1 Remediation and Validation Recommendations

PL	Remediation Requirements	Validation Requirements
ALL	<u>Earthworks Inspections / Unexpected Contamination</u> 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. Should asbestos be identified during groundworks, precautions should be taken to ensure the safety of the construction workers and nearby land users. It would be advisable to introduce an asbestos management strategy in line with CIRIA C733 ⁴⁶ .	Log of work undertaken including photographs. Details of any sampling undertaken and validation of any potential additional remedial work.

Table 9-1: Further work, remediation and validation requirements

Notes: See Table 6-4 for pollutant linkage (PL) details.

⁴⁶ CIRIA (2014). "Asbestos in Soil and Made Ground: A Guide to Understanding and Managing Risks". C733.

1 and 7	Option 1 <u>Environmental Cover System</u> As made ground is relatively deep across the site, it is unlikely to be viable to remove the contaminated soils. Therefore, an environmental cover system is recommended as follows: Private Back Gardens: 600mm thick environmental cover system comprising: <u>Either</u> 100mm physical break layer (MOT type 1 material, 20-30mm, minimal fines) and at least 500mm comprising clean inert fill and sufficient topsoil for a growing medium. <u>Or</u> geotextile membrane and at least 600mm comprising clean inert fill and sufficient topsoil for a growing medium. Private Front Garden / Shared Landscaping: 300mm thick environmental cover system comprising: <u>Either</u> 100mm physical break layer (MOT type 1 material, 20-30mm, minimal fines) and at least 200mm comprising clean inert fill and sufficient topsoil for a growing medium. <u>Or</u> geotextile membrane and at least 300mm comprising clean inert fill and sufficient topsoil for a growing medium. The subsoil layer can be replaced by additional topsoil. A diagram of a typical environmental cover system is shown in Appendix H. Option 2 <u>Further Soil Sampling</u> Undertake more sampling in the garden areas to provide a larger dataset for statistical analysis. This may allow for either none or limited remediation (Option 1) if soil results are favourable. Please note there is no guarantee results will be favourable and advise a cost benefit analysis is undertaken if this option is to be considered.	Measuring depth of environmental cover system using a staff and providing photographic evidence. Photographic evidence of the granular physical break or geotextile layer will also be collected. Chemical validation of imported soils: See Table 9-2.
5	<u>Sulphate Resistant Concrete</u> No sulphate resistant concrete is required (DS-1 AC-1s).	N/A
6	<u>Potable Water Pipes</u> It is recommended that a UU Risk Assessment is undertaken once the location and depth of potable water pipes are known. The site may require barrier piping depending upon the pipeline route	Delivery Notes of Pipe Material. Photographs of the Installed Pipe.
<u>Grubbing Out of In-Ground Structures</u> It is recommended that in-ground structures are grubbed out as part of the groundworks. In-ground structures expected across the site associated with the former building.		

Table 9-1 (continued): Further work, remediation and validation requirements

Notes: See Table 6-4 for pollutant linkage (PL) details.

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 ⁴⁷):

5,000 tonnes (c. 2,500m³) treatment of crushed concrete / stone.

1,000 tonnes (c. 500³) use of non-hazardous soil

5,000 tonnes (c. 2,500m³) use of clays, sand, gravel, brick, concrete, stone etc.

50,000 tonnes (c. 25,000m³) use of bituminous material to be used in roadways.

A Materials Management Plan (MMP) with recourse to the CL:AIRE Code of 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.

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 guidance⁴⁸) should be adopted by all workers involved with site enabling and construction works.

Piling in Contaminated Land

It is understood that the building may be piled into the bedrock. This may provide a preferential pathway for contaminants to the Secondary A 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 Agency⁴⁹.

Table 9-1 (continued): Further work, remediation and validation requirements

Notes: See Table 6-4 for pollutant linkage (PL) details.

9.2 Validation of Subsoil / Topsoil

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

A summary of the required imported material sampling requirements is presented in Table 9-2. Ideally, the material should be sampled at source to prevent double handling if soil fails, with confirmatory sampling undertaken on importation to site. 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.

⁴⁷ <https://www.gov.uk/guidance/waste-exemptions-using-waste>

⁴⁸ HSE (1991). "Protection of Workers and the General Public During Development of Contaminated Land" London HMSO.

⁴⁹ Environment Agency (2001) Piling and Penetrative Ground Improvement Methods on Land Affected by Contamination: Guidance on Pollution Prevention.

Material Type	Source	Suite of Analysis	Sampling Rate*
Topsoil	Greenfield	Suite A	1 sample per 50m³
	Brownfield / Unknown	Suite B	
Subsoil	Brownfield / Unknown	Suite B	1 sample per 150m³
	Site won natural material / greenfield	Suite A	
	First Generation i.e. quarried sand (subsoil) or stone (break layer)	No testing is required. Certification of material provenance is required.	
Physical Stone Break Layer	Recycled Stone (6F2 / screened)	Suite B	1 sample per 500m³

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 BS3882⁵⁰). LKC advise this information is provided by the supplier before material is imported onto site.

Imported material to be used in gardens will be compared against residential with plant uptake criteria (as used in the contamination risk assessment (Section 6-1)). Appropriate remedial target criteria are presented in Appendix F.

9.3 Site Completion Report

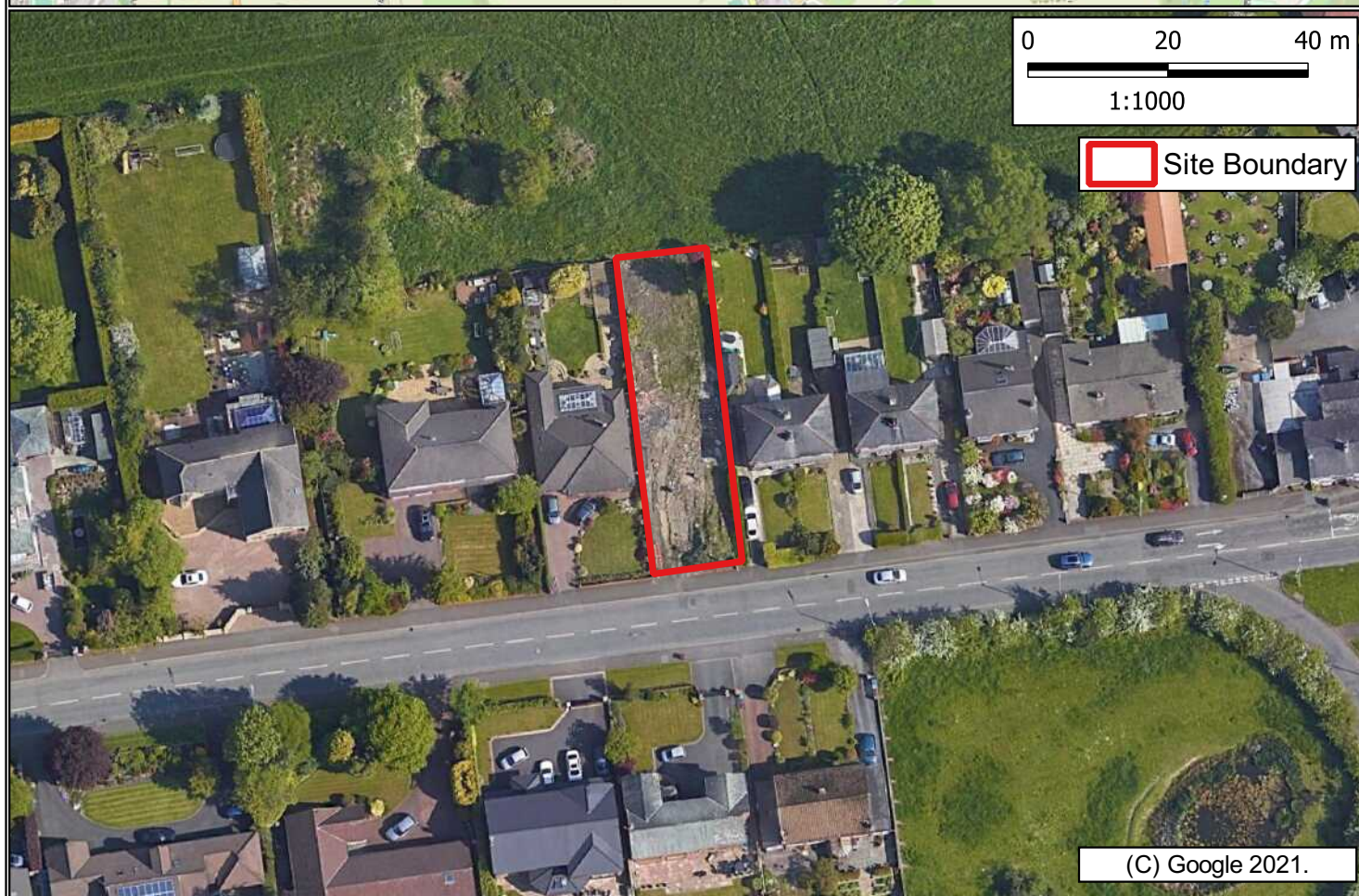
It is recommended that any remediation carried out on the site is validated by a third party and suitable documentary evidence provided in a Site Completion Report, such as photographs, consignment documents and analytical results. This should include as a minimum:

- » Provision of waste transfer documents.
- » If Option 1: Environmental capping layer: Validation of environmental cover system.
- » If Option 2: Scope further site investigation to obtain a larger dataset for statistical analysis. Please note if a larger number of exceedances Option 1 would still be required.
- » Verification testing of all imported soil for garden and soft landscaping areas.
- » Information on the installation of protective pipes and / or sterile trenches.
- » Details of any unexpected contamination identified onsite, suitably risk assessed and / or validated.

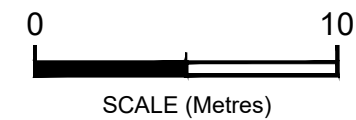
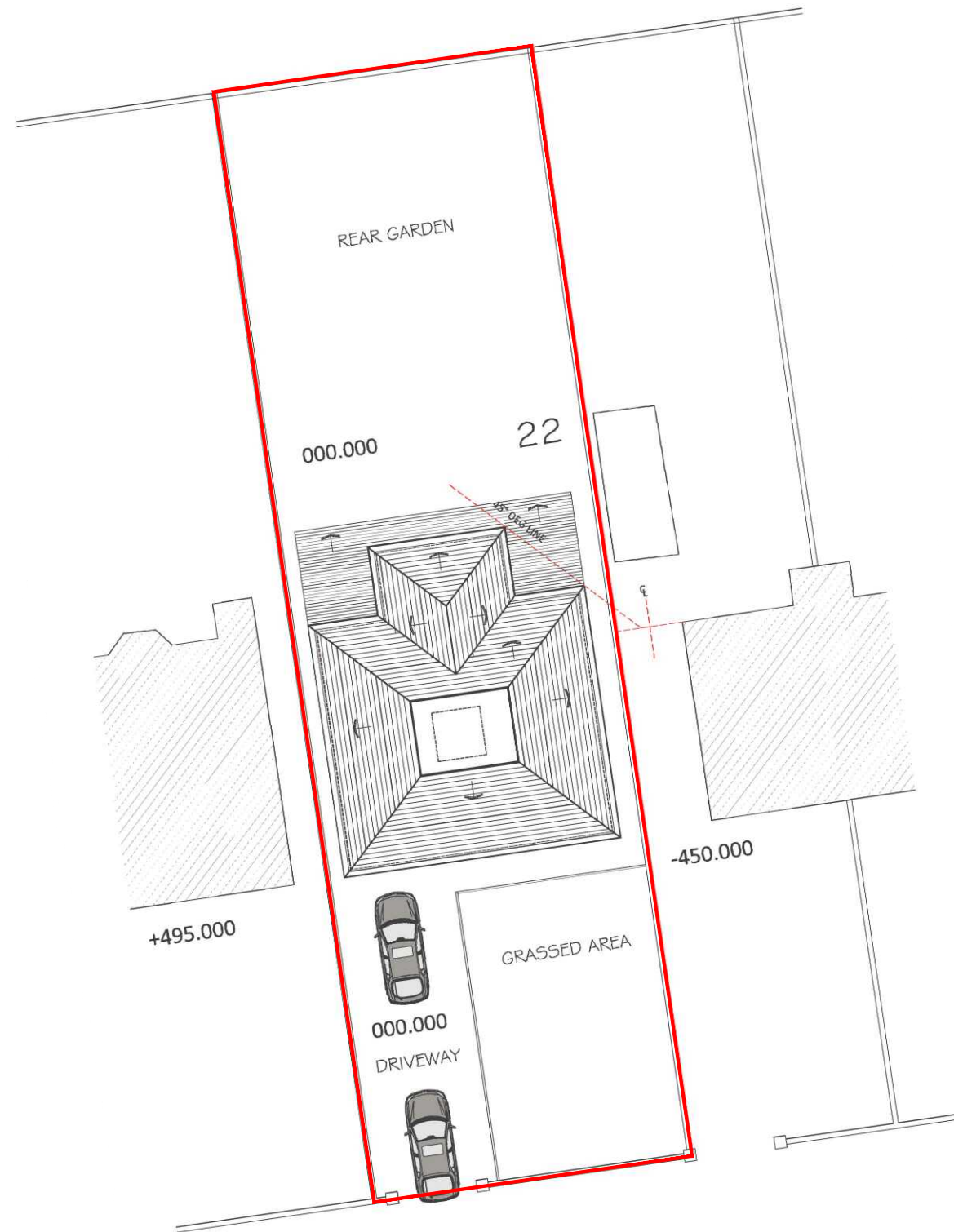
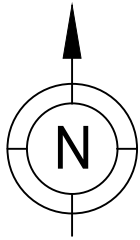
The Site Completion Report will assist the Local Authority in the discharge of any future relevant planning condition and will also be of use to solicitors acting on behalf of any prospective conveyancer who may have concerns over the former use of the site.

⁵⁰ BS (2015). "Specifications for Topsoil and Requirements for use." BS3882:2015.

Figures



Client: Mr S Postchi				Title: Site Location & Boundary Plan			
Site: 22 Cockey Moor Road, Bury				Scale (see scale bar): 1:25,000 & 1:1,000 @ A4			
Job No.: LKC 20 1870	Drawn By: HF	Checked By: EK	Drawn: March 2021	Figure: 1	Revision:		



KEY

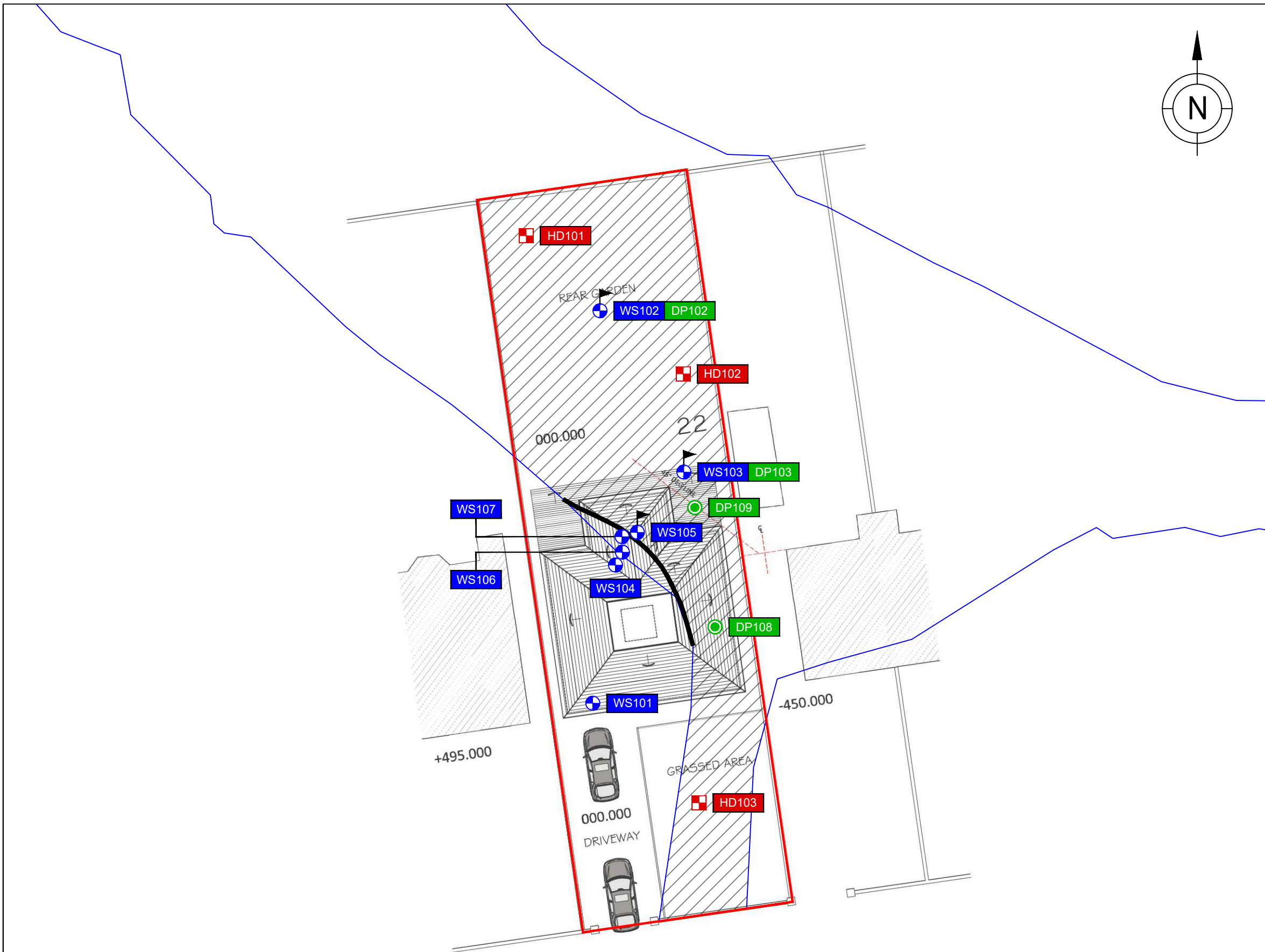


Sampling Locations and features annotated by LK Consult Ltd are approximate and are based upon observed measurements unless otherwise stated. Do not scale from this drawing and work from marked dimensions only. All dimensions and features should be confirmed on site by the Contractor. Where this drawing 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:			
Mr S Postchi			
Site:			
22 Cockey Moor Road, Radcliffe			
Title:			
Proposed Development Plan			
Job No.:	LKC 20 1870	Scale (See Scale Bar):	1:250 @ A3
Drawn By:	AC	Checked By:	EK
		Drawn:	Dec 2020
			2

Extract from: Compass Architectural Consultants
Drawing Ref: Proposed Site Plan, No.04, Rev:D (11/06/2014)



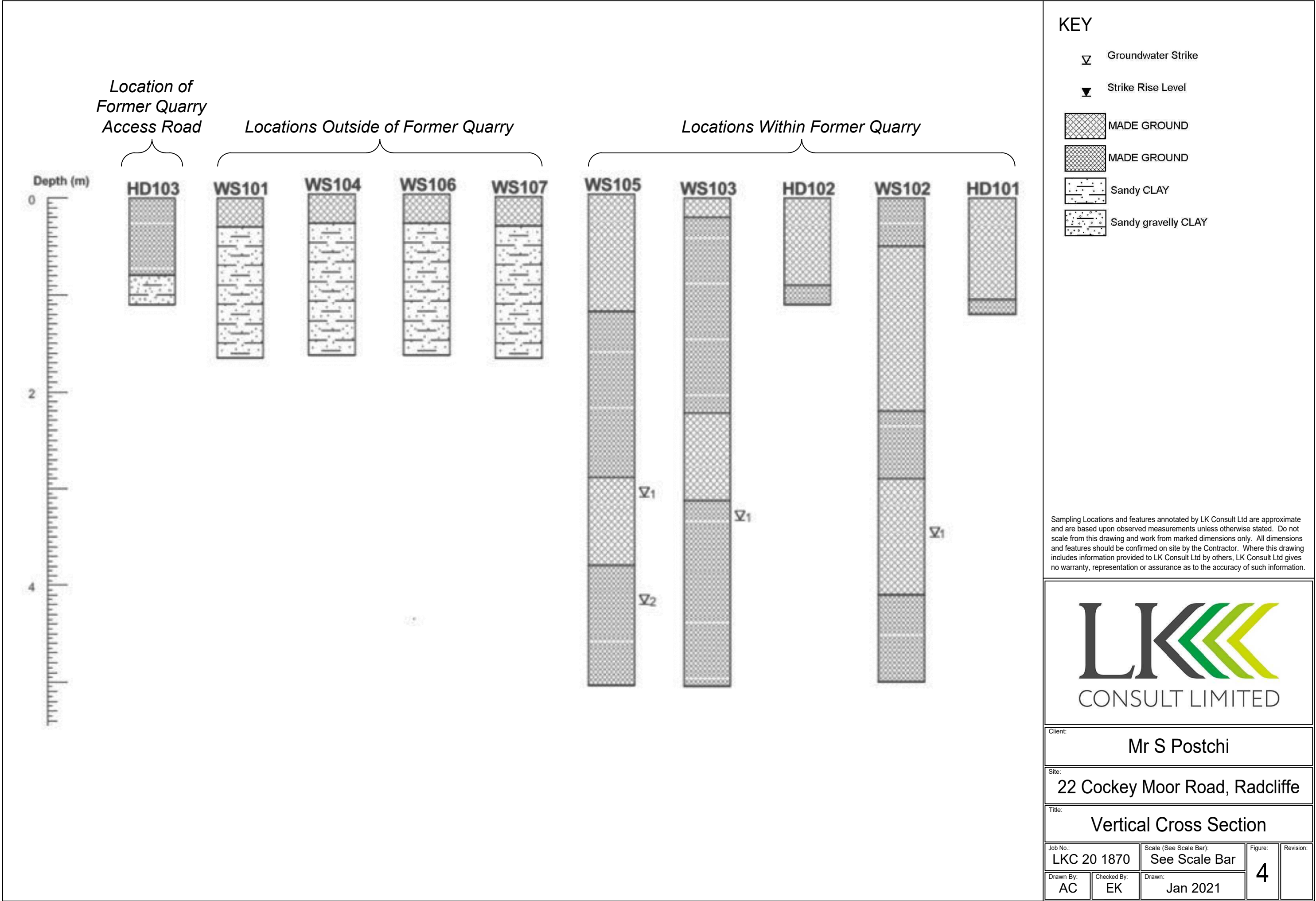
- KEY**
- Site Boundary
 - Window Sample Borehole (WS)
 - Monitoring Installation
 - Hand Dug Trial Pit (HD)
 - 10m Dynamic Probe (DP)
 - Approximate Former Sandstone Quarry Location (1893 Mapping)
 - Adjustment to Quarry Edge from Historical Mapping
 - Former Quarry Area (Including Access Road)

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:			
Mr S Postchi			
Site:			
22 Cockey Moor Road, Radcliffe			
Title:			
Site Investigation Location Plan			
Job No.:	Scale (See Scale Bar):	Figure:	Revision:
LKC 20 1870	1:250 @ A3	3	
Drawn By:	Checked By:	Date:	
AC	BR	Jan 2021	

Extract from: Compass Architectural Consultants
Drawing Ref: Proposed Site Plan, No.04, Rev:D (11/06/2014)



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 552⁵¹. 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 results 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.

⁵¹ CIRIA C552 (2001) Contaminated Land Risk Assessment - A Guide to Good Practice.

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

Window Sample Logs Hand Excavated Trial Pit Logs Dynamic Probes

Excavation Method

Drive-in Windowless Sampler

Dimensions
Ground Level (mOD)

154.00

Client

Mr S. Postchi

Job Number
LKC 20 1870

Location (Observed measurements)

377370 E 410405 N

Dates

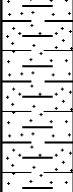
16/12/2020

Engineer

LKC

Sheet

1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.50-1.00 0.50-1.00	B1 PID = <0.1ppm PP 61.31 kPa			153.70	(0.30) 0.30	MADE GROUND: Brown sandy silty CLAY with occasional roots and brick fragments. Sand is fine to coarse.		
1.20-1.65 1.20-1.65	SPT N=50 X2		3,3/7,12,14,17	152.35	(1.35) 1.65	Firm to stiff consistency medium strength orangish brown very sandy CLAY. Sand is fine to coarse. Gravel is fine to coarse, angular to subangular comprising sandstone.		
						Complete at 1.65m		

Remarks

Borehole complete at 1.65mbgl.
SPT refusal at 1.65mbgl on very dense strata. Evidence of SANDSTONE in SPT sampler.
Location and elevation from handheld GPS.
Borehole dry and stable.
No monitoring well installed.

Scale (approx)

1:50

Logged By

BR

Figure No.

LKC 20 1870.WS101

Excavation Method

Drive-in Windowless Sampler

Dimensions

101mm to 3.00m

Ground Level (mOD)

154.00

Client

Mr S. Postchi

Job
Number
LKC 20 1870

Location (Observed measurements)

377371 E 410432 N

Dates

16/12/2020

Engineer

LKC

Sheet
1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
0.00-0.50	ES1 PID=0.2ppm				(0.50)	MADE GROUND: Blackish brown gravelly very sandy SILT with low brick cobble content, occasional plastic fragments, brick fragments and pottery fragments. Sand is fine to coarse. Gravel is fine to coarse, angular to subangular comprising mudstone, sandstone and granite.			
0.50-1.00	ES2 PID=0.1ppm			153.50	0.50				
					(1.70)	MADE GROUND: Reddish black sandy silty GRAVEL of predominantly ash, brick and clinker. Sand is fine to coarse. Gravel is fine to coarse, angular to subrounded comprising sandstone and mudstone.			
2.20-2.50	ES3 PID=<0.1ppm			151.80	2.20	MADE GROUND: Soft consistency low strength brownish orange sandy very gravelly CLAY with occasional rootlets. Sand is fine to coarse. Gravel is fine to coarse, angular to subangular comprising sandstone. Probable reworked natural.			
2.50-2.90	DB4 36.78 kPa				(0.70)				
2.90-3.00	ES5 PID=<0.1ppm			151.10	2.90	MADE GROUND: Loose orangeish brown sandy silty GRAVEL. Sand is fine to coarse. Gravel is fine to coarse, angular comprising sandstone. Probable reworked natural.			
3.50-4.00	DB6		Water strike(1) at 3.50m.		(1.20)			Σ1	
4.10-4.50	DB7			149.90	4.10	MADE GROUND: Yellowish grey silty sandy GRAVEL. Gravel is fine to coarse, angular comprising sandstone. Probable reworked natural.			
4.50-5.00	DB8				(0.90)				
				149.00	5.00	Complete at 7.00m			

Remarks

Borehole unstable, collapsed to 4.00mbgl.
Casing driven to 3.00mbgl.
Location and elevation from handheld GPS.
Groundwater encountered at 3.50-4.00mbgl.
WS location within former quarry area. Reworked natural noted to 5.00mbgl.
DP's undertaken from ground level, therefore no SPTs recorded. DP refusal at 7.00mbgl.
Monitoring well installed to 3.80mbgl.

Scale
(approx)

1:50

Logged
By

BR

Figure No.

LKC 20 1870.WS102

Excavation Method

Drive-in Windowless Sampler

Dimensions

101mm to 3.00m

Ground Level (mOD)

154.00

Client

Mr S. Postchi

Job
Number
LKC 20 1870

Location (Observed measurements)

377375 E 410430 N

Dates

16/12/2020

Engineer

LKC

Sheet
1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
0.20-1.00	DB1			153.80	(0.20) 0.20	MADE GROUND: Blackish brown gravelly very sandy SILT with low brick cobble content, occasional plastic fragments, brick fragments and pottery fragments. Sand is fine to coarse. Gravel is fine to coarse, angular to subangular comprising mudstone, sandstone and granite.			
					(2.00)	MADE GROUND: Black sandy silty GRAVEL predominantly comprising brick, ash, coal and clinker. Sand is fine to coarse. Gravel is fine to coarse, angular to subangular comprising mudstone, sandstone and granite.			
				151.80	2.20	MADE GROUND: Reddish brown sandy GRAVEL predominantly comprising ash, clinker, brick with occasional metal and plastic. Sand is fine to coarse. Gravel is fine to coarse, angular to subangular comprising sandstone.			
				150.90	(0.90)				
3.50-4.00	PP 49.05 kPa		Water strike(1) at 3.30m.		3.10	MADE GROUND: Soft to firm consistency medium strength reddish orange gravelly CLAY. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded comprising sandstone. Possible reworked natural. Firm consistency from 3.50mbgl.		Σ1	
					(1.90)	Gravel content increases with depth.			
4.50-5.00	DB2			149.00	5.00	Complete at 5.00m			

Remarks

Borehole unstable, collapsed to 4.00mbgl.
Casing driven to 3.00mbgl.
Location and elevation from handheld GPS.
Groundwater encountered at 3.30mbgl.
WS location within former quarry area. Reworked natural noted to 5.00mbgl.
DP's undertaken from ground level, therefore no SPTs recorded. DP refusal at 6.90mbgl.
Monitoring well installed to 3.80mbgl.

Scale
(approx)

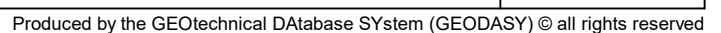
1:50

Logged
By

BR

Figure No.

LKC 20 1870.WS103



Excavation Method

Drive-in Windowless Sampler

Dimensions

101mm to 3.00m

Ground Level (mOD)

154.00

Client

Mr S. Postchi

Job
Number
LKC 20 1870

Location (Observed measurements)

377371 E 410420 N

Dates

16/12/2020

Engineer

LKC

Sheet
1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
1.20-1.65	SPT N=2		1,1/0,0,1,1	152.80	1.20	MADE GROUND: Brown sandy clayey GRAVEL with moderate sandstone, brick and concrete cobble content. Sand is fine to coarse. Gravel is fine to coarse, angular to subangular comprising sandstone, quartz and granite.			
1.20-1.65	X1								
1.50-2.00	DB2								
1.50-2.00	PP 36.78 kPa								
2.00-2.45	SPT N=3		0,0/0,1,1,1		(1.70)				
2.50-2.90	DB3			151.10	2.90	MADE GROUND: Soft consistency low strength sandy gravelly CLAY. Sand is fine to coarse. Gravel is fine to coarse, angular to subrounded comprising sandstone, coal and quartz. Probable reworked natural.			
2.50-2.90	PP 36.78 kPa								
3.00-3.45	SPT N=11		3,3/3,4,2,2		(0.90)	MADE GROUND: Yellow silty sandy GRAVEL. Sand is fine to coarse. Gravel is fine to medium, angular to subangular comprising sandstone. Probable reworked natural		∇1	
3.00-3.45			Water strike(1) at 3.10m.						
3.50-3.80	DB4			150.20	3.80	MADE GROUND: Soft to firm consistency medium strength very gravelly CLAY. Gravel is fine to coarse, angular to subangular comprising sandstone. Probable reworked natural.		∇2	
3.80-4.24	SPT 25*/135		15,10/8,4,4,4		(1.23)				
3.80-4.24	N=20								
4.50-5.00	PP 49.05 kPa		Water strike(2) at 4.20m.						
4.80-5.03	SPT 50/75		1,1/50	148.97	5.03	SPT refusal at 5.03mbgl on probable SANDSTONE bedrock.			
						Complete at 5.03m			

Remarks

Borehole unstable, collapsed to 4.00mbgl.
Casing driven to 3.00mbgl.
Location and elevation from handheld GPS.
Groundwater encountered at 3.10mbgl and 4.20mbgl.
WS location within former quarry area. Reworked natural noted to 5.00mbgl.
Sampler driven to 4.80mbgl, SPT refusal at 5.025mbgl in probable SANDSTONE bedrock. Evidence identified in SPT sampler.
Monitoring well installed to 3.80mbgl.

Scale
(approx)

1:50

Logged
By

BR

Figure No.

LKC 20 1870.WS105

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

22 Cockey Moor Road, Radcliffe

Number
WS106**Excavation Method**

Drive-in Windowless Sampler

Dimensions**Ground Level (mOD)**

154.00

Client

Mr S. Postchi

Job
Number
LKC 20 1870**Location** (Observed measurements)

377371 E 410418 N

Dates

16/12/2020

Engineer

LKC

Sheet

1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.50-1.00 0.50-1.00	B1 PP 73.58 kPa			153.70	(0.30) 0.30	MADE GROUND: Orangeish yellow gravelly silty SAND. Sand is fine to coarse. Gravel is fine to coarse, angular to subangular comprising sandstone and mudstone. Probable reworked natural.		
1.20-1.65 1.20-1.65	SPT N=50 X2		4, 10/10, 10, 15, 15	152.35	(1.35) 1.65	Firm to stiff consistency medium strength orange mottled grey gravelly very sandy CLAY. Sand is fine to coarse. Gravel is medium to coarse, angular comprising sandstone. Refusal at 1.65mbgl on very dense strata. Evidence of SANDSTONE in SPT sampler. Complete at 1.65m	 	

RemarksBorehole complete at 1.65mbgl.
SPT refusal at 1.65mbgl on very dense strata. Evidence of SANDSTONE in SPT sampler.
Location and elevation from handheld GPS.
Borehole dry and stable.
WS location outside of former quarry area.
No monitoring well installed.**Scale**
(approx)

1:50

Logged
By

BR

Figure No.

LKC 20 1870.WS106

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

22 Cockey Moor Road, Radcliffe

Number
WS107**Excavation Method**

Drive-in Windowless Sampler

Dimensions**Ground Level (mOD)**

154.00

Client

Mr S. Postchi

Job
Number
LKC 20 1870**Location** (Observed measurements)

377371 E 410420 N

Dates

16/12/2020

Engineer

LKC

Sheet
1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.50-1.00 0.50-1.00	B1 PP 61.31 kPa			153.70	(0.30) 0.30	MADE GROUND: Orangish yellow gravelly silty SAND with occasional brick fragments. Sand is fine to coarse. Gravel is fine to coarse, angular to subangular comprising sandstone and mudstone. Probable reworked natural.		
1.20-1.65 1.20-1.65	SPT N=50 X2		4, 10/10, 10, 15, 15	152.35	(1.35) 1.65	Firm to stiff consistency medium strength orange mottled grey gravelly very sandy CLAY. Sand is fine to coarse. Gravel is medium to coarse, angular comprising sandstone. Refusal at 1.65mbgl on very dense strata. Evidence of SANDSTONE in SPT sampler. Complete at 1.65m	 	

RemarksBorehole complete at 1.65mbgl.
SPT refusal at 1.65mbgl on very dense strata. Evidence of SANDSTONE in SPT sampler.
Location and elevation from handheld GPS.
Borehole dry and stable.
WS location outside of former quarry area.
No monitoring well installed.**Scale**
(approx)

1:50

Logged
By

BR

Figure No.

LKC 20 1870.WS107

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

22 Cockey Moor Road, Radcliffe

**Trial Pit
Number****HD101****Excavation Method**

Trial Pit

Dimensions

0.2m x 0.2m x 1.2m.

Ground Level (mOD)

154.00

Client

Mr S. Postchi

**Job
Number**

LKC 20 1870

Location (Observed measurements)

377368 E 410435 N

Dates

16/12/2020

Engineer

LKC

Sheet

1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-0.50	ES1 PID = 0.2ppm					MADE GROUND: Blackish brown gravelly very sandy SILT with occasional bands of reworked clay, low brick cobble content, occasional rootlets, plastic fragments, brick fragments and pottery fragments. Sand is fine to coarse. Gravel is fine to coarse, angular to subangular comprising mudstone, sandstone and granite. Clay content increases with depth.		
0.50-1.00	ES2 PID = <0.1ppm				(1.05)			
1.05-1.20	ES3 PID = 0.1ppm			152.95 152.80	(0.15) 1.20	MADE GROUND: Reddish black sandy silty GRAVEL of predominantly ash, brick and clinker. Sand is fine to coarse. Gravel is fine to coarse, angular to subrounded comprising sandstone and mudstone. Complete at 1.20m		

No image available

RemarksHand excavated pit was dry and stable.
Natural ground was not encountered, complete at 1.20mbgl.
Location and elevation from handheld GPS.**Scale (approx)**

1:50

Logged By

BR

Figure No.

LKC 20 1870.HD101

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

22 Cockey Moor Road, Radcliffe

**Trial Pit
Number****HD102****Excavation Method**

Trial Pit

Dimensions

0.2m x 0.2m x 1.1m.

Ground Level (mOD)

154.00

Client

Mr S. Postchi

**Job
Number**

LKC 20 1870

Location (Observed measurements)

377375 E 410430 N

Dates

16/12/2020

Engineer

LKC

Sheet

1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-0.40	ES1 PID = 0.3ppm					MADE GROUND: Blackish brown gravelly very sandy SILT with bands of reworked clay, low brick cobble content, occasional rootlets brick fragments and pottery fragments. Sand is fine to coarse. Gravel is fine to coarse, angular to subangular comprising mudstone, sandstone and granite. Clay content increases below 0.40mbgl. MADE GROUND: Reddish black sandy silty GRAVEL of predominantly ash, brick and clinker. Sand is fine to coarse. Gravel is fine to coarse, angular to subrounded comprising sandstone and mudstone. Complete at 1.10m		
0.40-0.90	ES2 PID = 0.1ppm				(0.90)			
0.90-1.10	ES3 PID = 0.1ppm			153.10 152.90	0.90 (0.20) 1.10			

No image available

RemarksHand excavated pit was dry and stable.
Natural ground was not encountered, hand tool refusal at 1.10mbgl on very dense brick cobbles.
Location and elevation from handheld GPS.**Scale (approx)**

1:50

Logged By

BR

Figure No.

LKC 20 1870.HD102

Excavation Method

Trial Pit

Dimensions

0.2m x 0.2m x 1.1m.

Ground Level (mOD)

154.00

Client

Mr S. Postchi

**Job
Number**

LKC 20 1870

Location (Observed measurements)

377377 E 410401 N

Dates

16/12/2020

Engineer

LKC

Sheet

1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-0.30	ES1 PID = 0.1ppm					MADE GROUND: Blackish brown sandy clayey GRAVEL with bands of reworked clay, low brick and concrete cobble content, frequent rootlets, occasional ash, clinker and plastic fragments. Sand is fine to coarse. Gravel is fine to coarse, angular to subangular comprising sandstone, quartz and coal. Clay content increases below 0.30mbgl. Firm to stiff consistency medium strength orangeish brown gravelly very sandy CLAY. Sand is fine to coarse. Gravel is fine to coarse. comprising sandstone. Complete at 1.10m	 	
0.30-0.80	ES2 PID = 0.1ppm				(0.80)			
0.50-1.00	PP 62 kPa			153.20	0.80			
0.80-1.10	ES3 PID = <0.1ppm			152.90	(0.30) 1.10			

No image available

Remarks

Location and elevation from handheld GPS.
Hand excavated pit dry and stable.
Pinch bar refusal at 1.10mbgl on very dense strata, possible SANDSTONE bedrock.
Hand excavated pit undertaken in location of former quarry access road.
Compacted brick and sandstone gravel identified within pit.

Scale (approx)

1:50

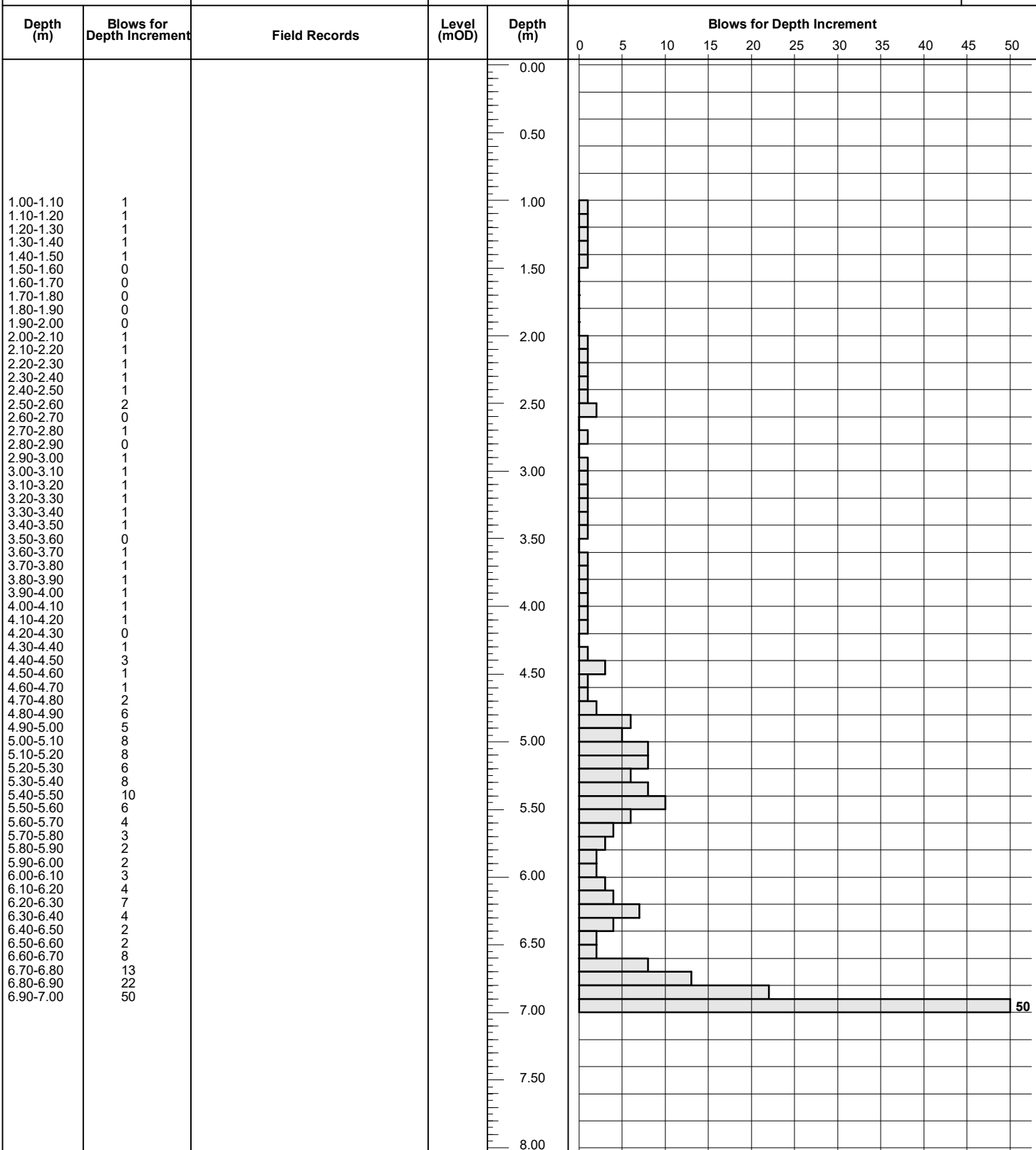
Logged By

BR

Figure No.

LKC 20 1870.HD103

Method Dynamic Probing	Cone Dimensions	Ground Level (mOD)	Client Mr S. Postchi	Job Number LKC 20 1870
	Location	Dates 01/12/2020	Engineer LKC	Sheet 1/1


Remarks

Scale (approx)	Logged By
1:40	
Figure No.	
LKC 20 1870.DP101	

Method Dynamic Probing	Cone Dimensions	Ground Level (mOD)	Client Mr S. Postchi	Job Number LKC 20 1870
	Location	Dates 01/12/2020	Engineer LKC	Sheet 1/1

Depth (m)	Blows for Depth Increment	Field Records	Level (mOD)	Depth (m)	Blows for Depth Increment										
					0	5	10	15	20	25	30	35	40	45	50
				0.00											
				0.50											
1.00-1.10	1			1.00											
1.10-1.20	1														
1.20-1.30	1														
1.30-1.40	0														
1.40-1.50	1														
1.50-1.60	1			1.50											
1.60-1.70	0														
1.70-1.80	1														
1.80-1.90	3														
1.90-2.00	4														
2.00-2.10	1			2.00											
2.10-2.20	2														
2.20-2.30	1														
2.30-2.40	0														
2.40-2.50	1														
2.50-2.60	1			2.50											
2.60-2.70	1														
2.70-2.80	1														
2.80-2.90	1														
2.90-3.00	1														
3.00-3.10	2			3.00											
3.10-3.20	0														
3.20-3.30	1														
3.30-3.40	0														
3.40-3.50	1														
3.50-3.60	0			3.50											
3.60-3.70	2														
3.70-3.80	2														
3.80-3.90	1														
3.90-4.00	2			4.00											
4.00-4.10	1														
4.10-4.20	2														
4.20-4.30	2														
4.30-4.40	2														
4.40-4.50	1			4.50											
4.50-4.60	1														
4.60-4.70	0														
4.70-4.80	0														
4.80-4.90	3														
4.90-5.00	6			5.00											
5.00-5.10	7														
5.10-5.20	7														
5.20-5.30	7														
5.30-5.40	6														
5.40-5.50	2			5.50											
5.50-5.60	1														
5.60-5.70	1														
5.70-5.80	2														
5.80-5.90	1														
5.90-6.00	1			6.00											
6.00-6.10	0														
6.10-6.20	0														
6.20-6.30	0														
6.30-6.40	1														
6.40-6.50	2			6.50											
6.50-6.60	3														
6.60-6.70	3														
6.70-6.80	2														
6.80-6.90	50			7.00											50
				7.50											
				8.00											

Remarks
Scale (approx)

1:40

Logged By
Figure No.

LKC 20 1870.DP103



LK CONSULT LTD

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

Site

22 Cockey Moor Road, Radcliffe

Probe
Number

DP108

Method

Dynamic Probing

Cone Dimensions

Ground Level (mOD)

Client

Mr S. Postchi

Job
Number

LKC 20 1870

Location

Dates

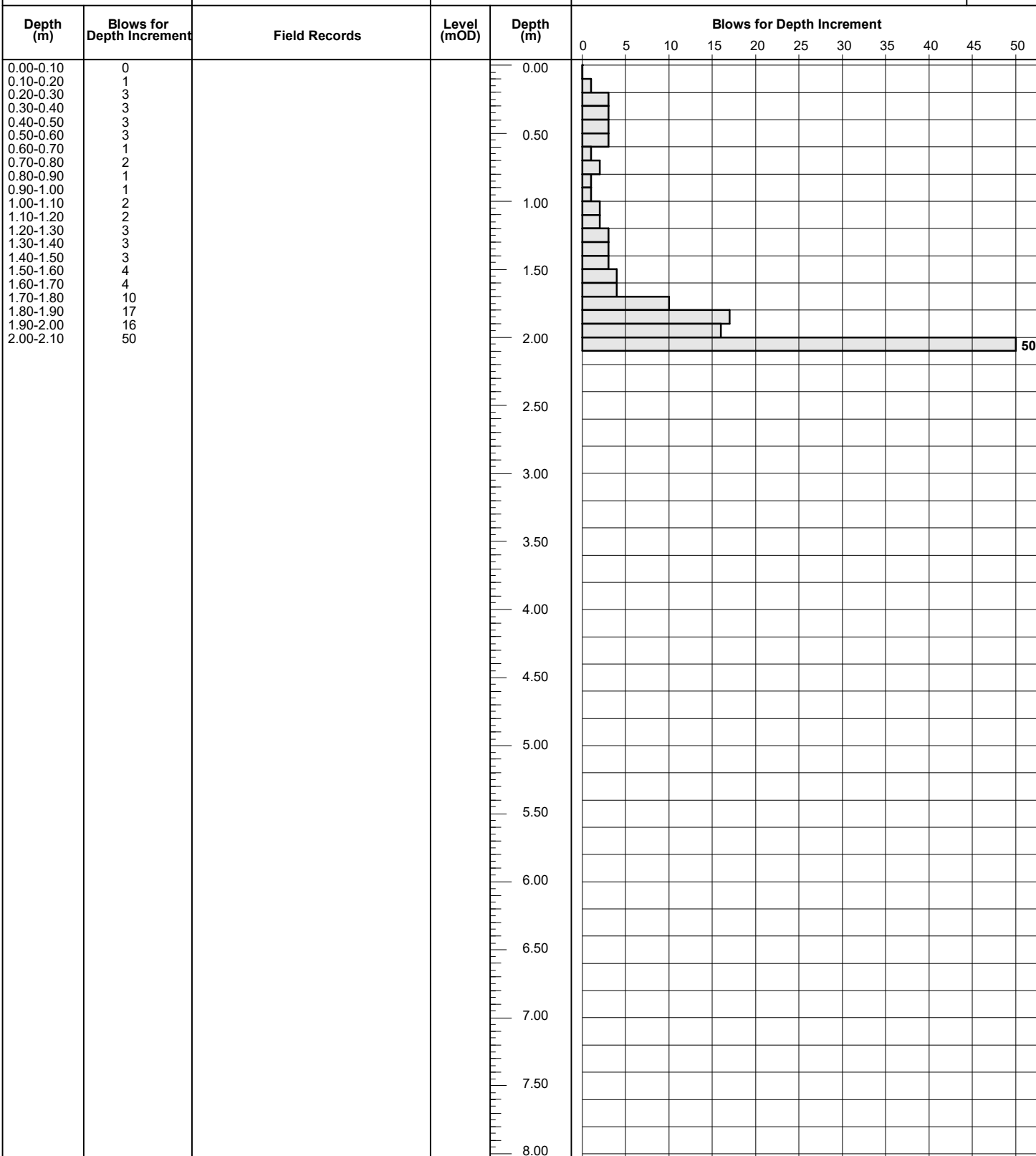
01/12/2020

Engineer

LKC

Sheet

1/1



Remarks

Scale
(approx)

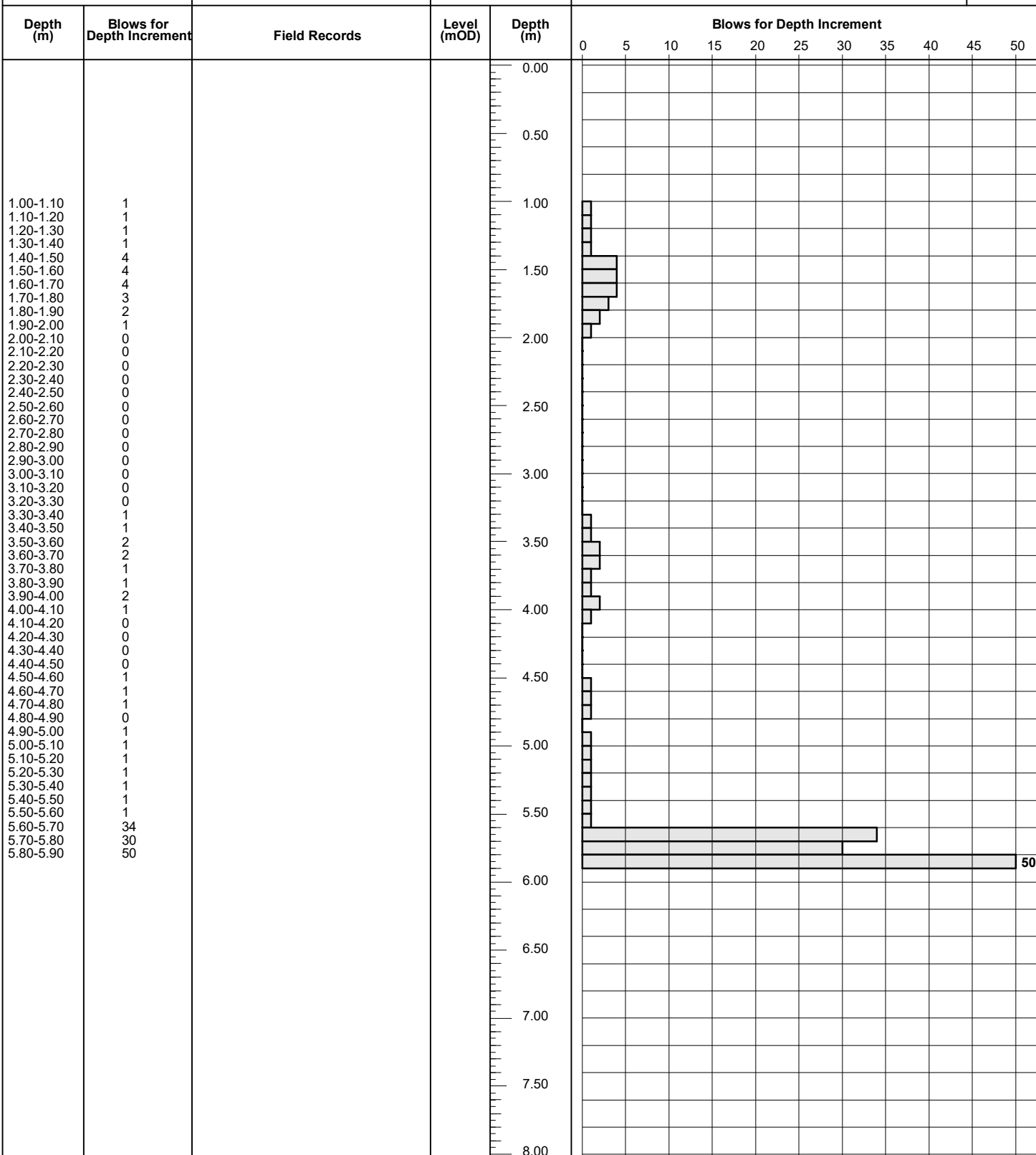
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Logged
By

Figure No.

LKC 20 1870.DP108

Method Dynamic Probing	Cone Dimensions	Ground Level (mOD)	Client Mr S. Postchi	Job Number LKC 20 1870
	Location	Dates 01/12/2020	Engineer LKC	Sheet 1/1


Remarks

Scale (approx)	Logged By
1:40	
Figure No.	
LKC 20 1870.DP109	

Appendix C

Certificate of Analysis – Soil



2183

Amended Report

Report No.:	20-35101-3		
Initial Date of Issue:	24-Dec-2020	Date of Re-Issue:	13-Jan-2021
Client	LK Consult		
Client Address:	Unit 29 Eton Business Park Eton Hill Road Radcliffe Manchester Lancashire M26 2ZS		
Contact(s):	Contaminated Land Paul Quimby		
Project	LKC 20 1870 22 Cockey Moor Road		
Quotation No.:		Date Received:	21-Dec-2020
Order No.:	738213	Date Instructed:	21-Dec-2020
No. of Samples:	2		
Turnaround (Wkdays):	5	Results Due:	29-Dec-2020
Date Approved:	24-Dec-2020		
Approved By:			
Details:	Glynn Harvey, Technical Manager		

Results - Soil

Project: LKC 20 1870 22 Cockey Moor Road

Client: LK Consult	Chemtest Job No.:				20-35101	20-35101
Quotation No.:	Chemtest Sample ID.:				1117466	1117467
	Sample Location:				WS103	WS105
	Sample Type:				SOIL	SOIL
	Top Depth (m):				0.2	2.5
	Bottom Depth (m):				1.0	
	Date Sampled:				18-Dec-2020	18-Dec-2020
Determinand	Accred.	SOP	Units	LOD		
Moisture	N	2030	%	0.020	19	14
pH	U	2010		4.0	7.1	6.2
Magnesium (Water Soluble)	N	2120	g/l	0.010	< 0.010	< 0.010
Sulphate (2:1 Water Soluble) as SO ₄	U	2120	g/l	0.010	0.19	< 0.010
Chloride (Water Soluble)	U	2220	g/l	0.010	0.020	< 0.010
Nitrate (Water Soluble)	N	2220	g/l	0.010	< 0.010	< 0.010

Test Methods

SOP	Title	Parameters included	Method summary
2010	pH Value of Soils	pH	pH Meter
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <37°C.
2040	Soil Description(Requirement of MCERTS)	Soil description	As received soil is described based upon BS5930
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES
2220	Water soluble Chloride in Soils	Chloride	Aqueous extraction and measurement by 'Aquakem 600' Discrete Analyser using ferric nitrate / mercuric thiocyanate.

Report Information

Key

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

Comments or interpretations are beyond the scope of UKAS accreditation

The results relate only to the items tested

Uncertainty of measurement for the determinands tested are available upon request

None of the results in this report have been recovery corrected

All results are expressed on a dry weight basis

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

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

All Asbestos testing is performed at the indicated laboratory

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

Sample Deviation Codes

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

Sample Retention and Disposal

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

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

Charges may apply to extended sample storage

If you require extended retention of samples, please email your requirements to:
customerservices@chemtest.com



Final Report

Report No.: 20-34785-1
Initial Date of Issue: 22-Dec-2020
Client LK Consult
Client Address: Unit 29 Eton Business Park
Eton Hill Road
Radcliffe
Manchester
Lancashire
M26 2ZS
Contact(s): Paul Quimby
Project LKC 20 1870 22 Cockey Moore Road

Quotation No.:		Date Received:	17-Dec-2020
Order No.:	738213	Date Instructed:	17-Dec-2020
No. of Samples:	5		
Turnaround (Wkdays):	5	Results Due:	23-Dec-2020
Date Approved:	22-Dec-2020		

Approved By:

Details: Glynn Harvey, Technical Manager

Results - Soil

Project: LKC 20 1870 22 Cockey Moore Road

Client: LK Consult	Chemtest Job No.:				20-34785	20-34785	20-34785	20-34785	20-34785
Quotation No.:	Chemtest Sample ID.:				1115748	1115749	1115752	1115756	1115758
Order No.: 738213	Client Sample Ref.:				ES1	ES2	ES1	ES2	ES1
	Sample Location:				WS102	WS102	HD101	HD102	HD103
	Sample Type:				SOIL	SOIL	SOIL	SOIL	SOIL
	Top Depth (m):				0.0	0.5	0.0	0.4	0.0
	Bottom Depth (m):				0.5	1.0	0.5	0.9	0.5
	Date Sampled:				16-Dec-2020	16-Dec-2020	16-Dec-2020	16-Dec-2020	16-Dec-2020
	Asbestos Lab:				COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY
Determinand	Accred.	SOP	Units	LOD					
ACM Type	U	2192		N/A	-	-	-	-	-
Asbestos Identification	U	2192		N/A	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected
ACM Detection Stage	U	2192		N/A	-	-	-	-	-
Moisture	N	2030	%	0.020	16	13	11	14	16
Soil Colour	N	2040		N/A	Brown	Brown	Brown	Brown	Brown
Other Material	N	2040		N/A	Stones and Roots	Stones	Stones	Stones	Stones
Soil Texture	N	2040		N/A	Sand	Sand	Sand	Clay	Sand
pH	M	2010		4.0	6.7	7.0	7.7	8.0	8.5
Sulphate (2:1 Water Soluble) as SO4	M	2120	g/l	0.010	< 0.010	< 0.010	0.21	< 0.010	0.014
Arsenic	M	2450	mg/kg	1.0	36	18	72	20	18
Cadmium	M	2450	mg/kg	0.10	0.45	0.16	0.48	0.25	0.40
Chromium	M	2450	mg/kg	1.0	22	15	60	23	15
Copper	M	2450	mg/kg	0.50	96	63	230	60	69
Mercury	M	2450	mg/kg	0.10	0.35	0.16	0.23	0.14	1.6
Nickel	M	2450	mg/kg	0.50	35	26	63	35	32
Lead	M	2450	mg/kg	0.50	190	120	430	110	100
Selenium	M	2450	mg/kg	0.20	0.71	0.20	0.28	0.38	0.36
Vanadium	U	2450	mg/kg	5.0	48	34	120	28	37
Zinc	M	2450	mg/kg	0.50	130	52	500	160	140
Chromium (Hexavalent)	N	2490	mg/kg	0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Organic Matter	M	2625	%	0.40	2.4	6.0	8.5	2.6	9.1
Naphthalene	M	2800	mg/kg	0.10	< 0.10	< 0.10	0.21	< 0.10	1.9
Acenaphthylene	N	2800	mg/kg	0.10	< 0.10	< 0.10	0.10	< 0.10	0.10
Acenaphthene	M	2800	mg/kg	0.10	< 0.10	< 0.10	0.33	< 0.10	5.5
Fluorene	M	2800	mg/kg	0.10	< 0.10	< 0.10	0.33	< 0.10	3.2
Phenanthrene	M	2800	mg/kg	0.10	< 0.10	1.4	3.5	0.44	32
Anthracene	M	2800	mg/kg	0.10	< 0.10	0.37	1.0	< 0.10	6.8
Fluoranthene	M	2800	mg/kg	0.10	< 0.10	3.6	5.7	0.56	40
Pyrene	M	2800	mg/kg	0.10	< 0.10	3.1	4.8	0.49	31
Benzo[a]anthracene	M	2800	mg/kg	0.10	< 0.10	1.9	2.6	0.27	15
Chrysene	M	2800	mg/kg	0.10	< 0.10	1.4	2.1	0.21	13
Benzo[b]fluoranthene	M	2800	mg/kg	0.10	< 0.10	2.3	3.1	0.39	17
Benzo[k]fluoranthene	M	2800	mg/kg	0.10	< 0.10	0.88	1.1	0.14	6.2
Benzo[a]pyrene	M	2800	mg/kg	0.10	< 0.10	1.9	2.4	0.28	13
Indeno(1,2,3-c,d)Pyrene	M	2800	mg/kg	0.10	< 0.10	1.2	1.4	< 0.10	8.6

Results - Soil

Project: LKC 20 1870 22 Cockey Moore Road

Client: LK Consult	Chemtest Job No.:				20-34785	20-34785	20-34785	20-34785	20-34785
Quotation No.:	Chemtest Sample ID.:				1115748	1115749	1115752	1115756	1115758
Order No.: 738213	Client Sample Ref.:				ES1	ES2	ES1	ES2	ES1
	Sample Location:				WS102	WS102	HD101	HD102	HD103
	Sample Type:				SOIL	SOIL	SOIL	SOIL	SOIL
	Top Depth (m):				0.0	0.5	0.0	0.4	0.0
	Bottom Depth (m):				0.5	1.0	0.5	0.9	0.5
	Date Sampled:				16-Dec-2020	16-Dec-2020	16-Dec-2020	16-Dec-2020	16-Dec-2020
	Asbestos Lab:				COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY
Determinand	Accred.	SOP	Units	LOD					
Dibenz(a,h)Anthracene	N	2800	mg/kg	0.10	< 0.10	0.23	0.20	< 0.10	1.3
Benzo[g,h,i]perylene	M	2800	mg/kg	0.10	< 0.10	1.2	1.2	< 0.10	7.4
Total Of 16 PAH's	N	2800	mg/kg	2.0	< 2.0	19	30	2.9	200

Test Methods

SOP	Title	Parameters included	Method summary
2010	pH Value of Soils	pH	pH Meter
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <37°C.
2040	Soil Description(Requirement of MCERTS)	Soil description	As received soil is described based upon BS5930
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES
2192	Asbestos	Asbestos	Polarised light microscopy / Gravimetry
2450	Acid Soluble Metals in Soils	Metals, including: Arsenic; Barium; Beryllium; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Vanadium; Zinc	Acid digestion followed by determination of metals in extract by ICP-MS.
2490	Hexavalent Chromium in Soils	Chromium [VI]	Soil extracts are prepared by extracting dried and ground soil samples into boiling water. Chromium [VI] is determined by 'Aquakem 600' Discrete Analyser using 1,5-diphenylcarbazide.
2625	Total Organic Carbon in Soils	Total organic Carbon (TOC)	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.
2800	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Soil by GC-MS	Acenaphthene*; Acenaphthylene; Anthracene*; Benzo[a]Anthracene*; Benzo[a]Pyrene*; Benzo[b]Fluoranthene*; Benzo[ghi]Perylene*; Benzo[k]Fluoranthene; Chrysene*; Dibenzo[ah]Anthracene; Fluoranthene*; Fluorene*; Indeno[123cd]Pyrene*; Naphthalene*; Phenanthrene*; Pyrene*	Dichloromethane extraction / GC-MS

Report Information

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SN	This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
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N/E	not evaluated
<	"less than"
>	"greater than"

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The results relate only to the items tested

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All results are expressed on a dry weight basis

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

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

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

Sample Deviation Codes

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

Sample Retention and Disposal

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

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

Charges may apply to extended sample storage

If you require extended retention of samples, please email your requirements to:
customerservices@chemtest.com

Appendix D

Certificate of Analysis - Geotechnical



TEST REPORT

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

Contract LKC 20 1870 -
22 Cockey Moor Road, Bury

Job Number MRN 4066/6
Date of Issue 07 January 2021
Page 1 of 4

Approved Signatories

S J Hutchings, O P Davies

Notes

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



Andrew House, Hadfield Street, Dukinfield, Cheshire SK16 4QX Tel: 0161 475 0870
Email: enquiries@murrayrix.com Website: www.murrayrix.com

Also at: London: 020 8523 1999

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MURRAY RIX

ANDREW HOUSE, HADFIELD STREET,
DUKINFIELD, CHESHIRE SK16 4QX
TEL 0161 475 0870



TEST CERTIFICATE

LIQUID AND PLASTIC LIMIT

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

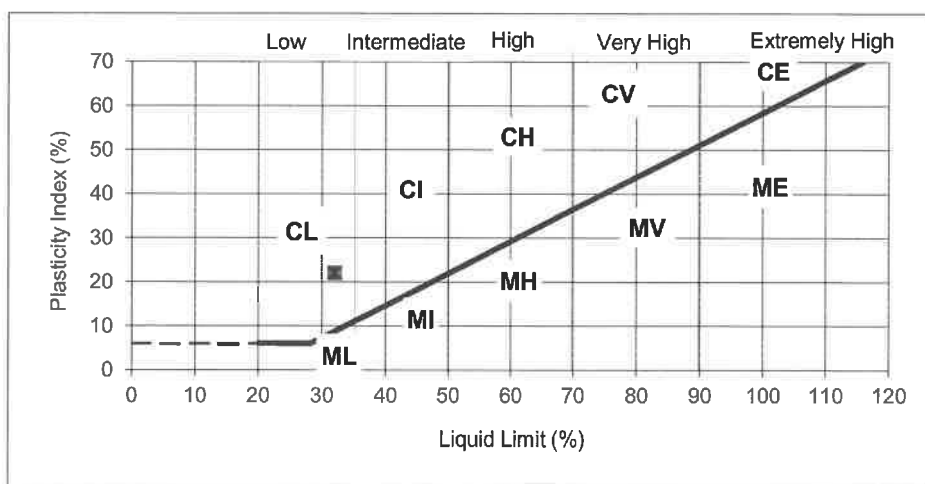
MOISTURE CONTENT METHOD BS 1377: PART 2: 1990 Clause 3.2

CLIENT	LK Consult Ltd
SITE	LKC 20 1870 - 22 Cockey Moor Road, Bury
JOB NUMBER	MRN 4066/6

SAMPLE LABEL	WS101 SPT 1.2m	DATE SAMPLED	Not advised
SAMPLE No.	94903	DATE RECEIVED	17-Dec-20
DATE TESTED	22-Dec-20	SAMPLED BY	Client

MATERIAL	Stiff brown silty sandy CLAY with occasional gravel
ADVISED SOURCE	Site Investigation Sample

Moisture Content (Natural) (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Passing 425 micron (%)
13	32	10	22	78



REMARKS

Sample tested after wet sieving

SIGNED

NAME

Page 2 of 4

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

DATE

07-Jan-21

MURRAY RIX

ANDREW HOUSE, HADFIELD STREET,
DUKINFIELD, CHESHIRE SK16 4QX
TEL 0161 475 0870



TEST CERTIFICATE

LIQUID AND PLASTIC LIMIT

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

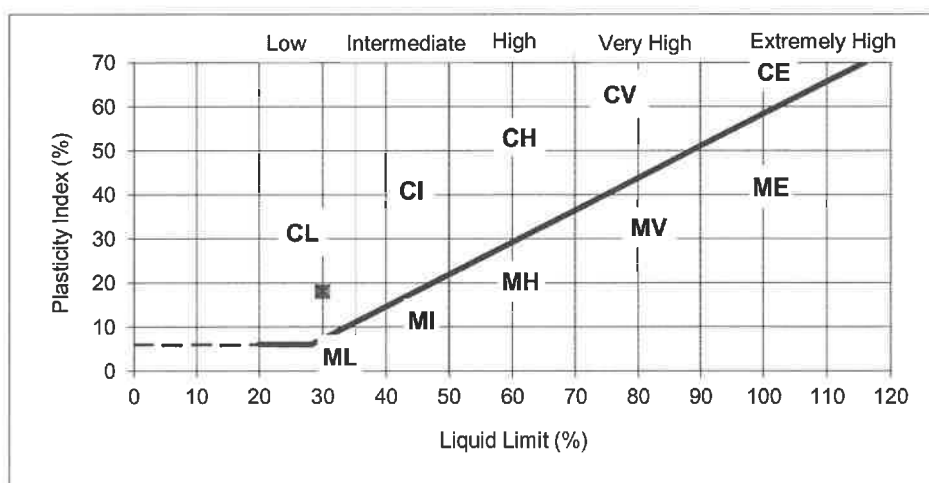
MOISTURE CONTENT METHOD BS 1377: PART 2: 1990 Clause 3.2

CLIENT	LK Consult Ltd
SITE	LKC 20 1870 - 22 Cockey Moor Road, Bury
JOB NUMBER	MRN 4066/6

SAMPLE LABEL	WS104 0.5-1.0m	DATE SAMPLED	Not advised
SAMPLE No.	94904	DATE RECEIVED	17-Dec-20
DATE TESTED	22-Dec-20	SAMPLED BY	Client

MATERIAL	Stiff brown silty sandy CLAY with occasional gravel
ADVISED SOURCE	Site Investigation Sample

Moisture Content (Natural) (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Passing 425 micron (%)
15	30	12	18	75



REMARKS

Sample tested after wet sieving

SIGNED

NAME
Page 3 of 4

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

DATE 07-Jan-21

MURRAY RIX

ANDREW HOUSE, HADFIELD STREET,
DUKINFIELD, CHESHIRE SK16 4QX
TEL 0161 475 0870



TEST CERTIFICATE

LIQUID AND PLASTIC LIMIT

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

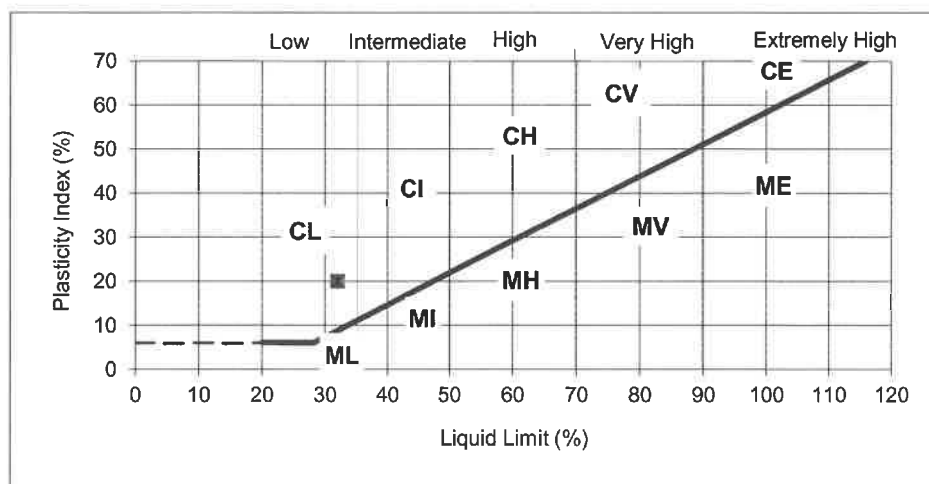
MOISTURE CONTENT METHOD BS 1377: PART 2: 1990 Clause 3.2

CLIENT	LK Consult Ltd
SITE	LKC 20 1870 - 22 Cockey Moor Road, Bury
JOB NUMBER	MRN 4066/6

SAMPLE LABEL	WS107 0.5-1.0m	DATE SAMPLED	Not advised
SAMPLE No.	94905	DATE RECEIVED	17-Dec-20
DATE TESTED	22-Dec-20	SAMPLED BY	Client

MATERIAL	Stiff brown silty sandy CLAY with occasional gravel
ADVISED SOURCE	Site Investigation Sample

Moisture Content (Natural) (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Passing 425 micron (%)
16	32	12	20	81



REMARKS

Sample tested after wet sieving

SIGNED

NAME O.P. Davies BA (Hons)
Page 4 of 4 (Laboratory Manager)

DATE 07-Jan-21

Appendix E

Gas Monitoring Results



Site	22 Cockey Moor Road, Radcliffe
Job Number	LKC 20 1870
Date	24.12.2020
Engineer	NJ
Visit	1 of 6

Atmospheric / Ground Conditions	
Atmospheric pressure trend onsite	Steady
Atmospheric pressure (prev 24hrs)	Rising then falling
Weather Conditions	Cold, slightly rainy, windy
Ground Conditions	Wet

ABBREVIATIONS	
ND	Not detected
NR	Not recorded
UR	Unable to record
OS	Off recordable scale
N/A	Not applicable
ppm	Parts per million
mb	Millibars
l/hr	Litres per hour
mbgl	Metres below ground level
LEL	Lower explosive limit in air

All monitoring is carried out in line with LK Consult Ltd procedures, with reference to CIRIA C665.

¹Equipment is serviced and checked as recommended by the manufacturer. Refer to calibration records and service certificates.

²CH₄ is explosive between the range of 5-15%v/v. 100% lower explosive limit is equal to 5%v/v CH₄.

³Flow readings are based on a 1 minute average value where flow is detected (equipment range of +/- 12 ltr/hr).



Atmospheric / Ground Conditions	
Atmospheric pressure trend onsite	Falling
Atmospheric pressure (prev 24hrs)	Rising
Weather Conditions	Cloudy, cold, still
Ground Conditions	Damp

[illegible]

NOTES	
All monitoring is carried out in line with LK Consult Ltd procedures, with reference to CIRIA C665.	
¹ Equipment is serviced and checked as recommended by the manufacturer. Refer to calibration records and service certificates.	
² CH4 is explosive between the range of 5-15%v/v. 100% lower explosive limit is equal to 5%v/v CH4.	
³ Flow readings are based on a 1 minute average value where flow is detected (equipment range of +/- 12 ltr/hr).	



Atmospheric / Ground Conditions	
Atmospheric pressure trend onsite	Rising
Atmospheric pressure (prev 24hrs)	Falling then Rising
Weather Conditions	Cold, light breeze, partly cloudy with sun
Ground Conditions	Wet, partly frozen

[illegible]

NOTES	
All monitoring is carried out in line with LK Consult Ltd procedures, with reference to CIRIA C665.	
¹ Equipment is serviced and checked as recommended by the manufacturer. Refer to calibration records and service certificates.	
² CH4 is explosive between the range of 5-15%v/v. 100% lower explosive limit is equal to 5%v/v CH4.	
³ Flow readings are based on a 1 minute average value where flow is detected (equipment range of +/- 12 ltr/hr).	



Atmospheric / Ground Conditions	
Atmospheric pressure trend onsite	Steady
Atmospheric pressure (prev 24hrs)	Falling
Weather Conditions	Overcast, slightly windy
Ground Conditions	Dry

[illegible]

NOTES	
All monitoring is carried out in line with LK Consult Ltd procedures, with reference to CIRIA C665.	
¹ Equipment is serviced and checked as recommended by the manufacturer. Refer to calibration records and service certificates.	
² CH4 is explosive between the range of 5-15%v/v. 100% lower explosive limit is equal to 5%v/v CH4.	
³ Flow readings are based on a 1 minute average value where flow is detected (equipment range of +/- 12 ltr/hr).	



 LK CONSULT LTD
 GAS MONITORING RECORD

Site	22 Cockey Moor Road, Radcliffe
Job Number	LKC 20 1870
Date	22.03.2021
Engineer	NJ
Visit	6 of 6

Equipment ¹		
Instrument	Serial Number	Comments
Gas Analyser G500	G502417	Serviced, calibrated, gas checked.
Geotech Diometer	81070	Operating normally.

Atmospheric / Ground Conditions	
Atmospheric pressure trend onsite	Steady
Atmospheric pressure (prev 24hrs)	Steady
Weather Conditions	Overcast
Ground Conditions	Drv

[illegible]

ABBREVIATIONS	
ND	Not detected
NR	Not recorded
UR	Unable to record
OS	Off recordable scale
N/A	Not applicable
ppm	Parts per million
mb	Millibars
l/hr	Litres per hour
mbgl	Metres below ground level
LEL	Lower explosive limit in air

NOTES
All monitoring is carried out in line with LK Consult Ltd procedures, with reference to CIRIA C665.
¹ Equipment is serviced and checked as recommended by the manufacturer. Refer to calibration records and service certificates.
² CH4 is explosive between the range of 5-15%v/v. 100% lower explosive limit is equal to 5%v/v CH4.
³ Flow readings are based on a 1 minute average value where flow is detected (equipment range of +/- 12 ltr/hr).

Appendix F

Generic Assessment Criteria Values

Summary of Category 4 Screening Levels: 2015

Substance	Residential (with home- grown produce)	Residential (without home- grown produce)	Allotments	Commercial	Public Open Space 1	Public Open Space 2
Arsenic	37 mg/kg	40 mg/kg	49 mg/kg	640 mg/kg	79 mg/kg	170 mg/kg
Benzene	0.87 mg/kg	3.3 mg/kg	0.18 mg/kg	98 mg/kg	140 mg/kg	230 mg/kg
Benzo(a)pyrene	5.0 mg/kg	5.3 mg/kg	5.7 mg/kg	77 mg/kg	10 mg/kg	21 mg/kg
Cadmium	22 mg/kg	150 mg/kg	3.9 mg/kg	410 mg/kg	220 mg/kg	880 mg/kg
Chromium VI	21 mg/kg	21 mg/kg	170 mg/kg	49 mg/kg	21 mg/kg	250 mg/kg
Lead	200 mg/kg	310 mg/kg	80 mg/kg	2300 mg/kg	630 mg/kg	1300 mg/kg

Summary Table for the Generic Assessment Criteria for Human Health Risk Assessment Land Quality Management (LQM) S4ULs.

All GAC are based on sandy loam soils with a pH 7.

		LQM Generic Assessment Criteria (mg/kg) Dry weight soil						
Contaminant		SOM	Res +	Res -	Allot.	Comm.	POS _{resi}	POS _{park}
Metals	Inorganic Arsenic	6%	37	40	43	640	79	170
	Beryllium	6%	1.7	1.7	35	12	2.2	63
	Boron	6%	290	11,000	45	240,000	21,000	46,000
	Cadmium	6%	11	85	1.9	190	120	532
	Chromium (III)	6%	910	910	18,000	8,600	1,500	33,000
	Chromium (VI)	6%	6.0	6.0	1.8	33	7.7	220
	Copper	6%	2,400	7,100	520	68,000	12,000	44,000
	Elemental Mercury	6%	1.2	1.2	21	58 (25.8) ^{vap}	16	30 (25.8) ^{vap}
	Inorganic Mercury	6%	40	56	19	1,100	120	240
	Methylmercury	6%	11	15	6.0	320	40	68
	Nickel	6%	180	180	230	980	230	3,400
	Selenium	6%	250	430	88	12,000	1,100	1,800
	Vanadium	6%	410	1,200	91	9,000	2,000	5,000
	Zinc	6%	3,700	40,000	620	730,000	81,000	170,000
BTEX Compounds	Benzene	1%	0.087	0.38	0.017	27	72	90
		2.5%	0.17	0.70	0.034	47	72	100
		6%	0.37	1.4	0.075	90	73	110
	Toluene	1%	130	880 (869) ^{vap}	22	56,000 (869) ^{vap}	56,000	87,000 (869) ^{vap}
		2.5%	290	1,900	51	110,000 (1,920) ^{vap}	56,000	95,000 (1,920) ^{vap}
		6%	660	3,900	120	180,000 (4,360) ^{vap}	56,000	100,000 (4,360) ^{vap}
	Ethylbenzene	1%	47	83	16	5,700 (518) ^{vap}	24,000	17,000 (518) ^{vap}
		2.5%	110	190	39	13,000 (1,220) ^{vap}	24,000	22,000 (1,220) ^{vap}
		6%	260	440	91	27,000 (2,840) ^{vap}	25,000	27,000 (2,840) ^{vap}
	o-xylene	1%	60	88	28	6,600 (478) ^{sol}	41,000	17,000 (478) ^{sol}
		2.5%	140	210	67	15,000 (1,120) ^{sol}	42,000	24,000 (1,120) ^{sol}
		6%	330	480	160	33,000 (2,620) ^{sol}	43,000	33,000 (2,620) ^{sol}
	m-xylene	1%	59	82	31	6,200 (625) ^{vap}	41,000	17,000 (625) ^{vap}
		2.5%	140	190	74	14,000 (1,470) ^{vap}	42,000	24,000 (1,470) ^{vap}
		6%	320	450	170	31,000 (3,460) ^{vap}	43,000	32,000 (3,460) ^{vap}
	p-xylene	1%	56	79	29	5,900 (576) ^{sol}	41,000	17,000 (576) ^{sol}
		2.5%	130	180	69	14,000 (1,350) ^{sol}	42,000	23,000 (1,350) ^{sol}
		6%	310	430	160	30,000 (3,170) ^{sol}	43,000	31,000 (3,170) ^{sol}

NOTES

^{sol/vap} = solubility / vapour limit (potentially use if free product identified, although highly conservative).

f = oral, dermal and inhalation exposures compared to oral HCV.

All GAC are based on sandy loam soils with a pH 7.

All GAC are based on sandy loam soils with a pH 7.		LQM Generic Assessment Criteria (mg/kg) Dry weight soil						
Contaminant		SOM	Res +	Res -	Allot.	Comm.	POS _{resi}	POS _{park}
Polycyclic Aromatic Hydrocarbons (PAHs)	Acenaphthene	1%	210	3,000 (57.1) ^{sol}	34	84,000 (57.0) ^{sol}	15,000	29,000
		2.5%	510	4,700 (141) ^{sol}	85	97,000 (141) ^{sol}	15,000	30,000
		6%	1,100	6,000 (336) ^{sol}	200	100,000	15,000	30,000
	Acenaphthylene	1%	170	2,900 (86.1) ^{sol}	28	83,000 (86.1) ^{sol}	15,000	29,000
		2.5%	420	4,600 (212) ^{sol}	69	97,000 (212) ^{sol}	15,000	30,000
		6%	920	6,000 (506) ^{sol}	160	100,000	15,000	30,000
	Anthracene	1%	2,400	31,000 (1.17) ^{vap}	380	520,000	74,000	150,000
		2.5%	5,400	35,000	950	540,000	74,000	150,000
		6%	11,000	37,000	2,200	540,000	74,000	150,000
	Benz(a)anthracene	1%	7.2	11	2.9	170	29	49
		2.5%	11	14	6.5	170	29	56
		6%	13	15	13	180	29	62
	Benzo(a)pyrene (only)	1%	2.2	3.2	0.97	35	5.7	11
		2.5%	2.7	3.2	2.0	35	5.7	12
		6%	3.0	3.2	3.5	36	5.7	13
	Benzo(b)fluoranthene	1%	2.6	3.9	0.99	44	7.1	13
		2.5%	3.3	4.0	2.1	44	7.2	15
		6%	3.7	4.0	3.9	45	7.2	16
	Benzo(ghi)perylene	1%	320	360	290	3,900	640	1,400
		2.5%	340	360	470	4,000	640	1,500
		6%	350	360	640	4,000	640	1,600
	Benzo(k)fluoranthene	1%	77	110	37	1,200	190	370
		2.5%	93	110	75	1,200	190	410
		6%	100	110	130	1,200	190	440
	Chrysene	1%	15	30	4.1	350	57	93
		2.5%	22	31	9.4	350	57	110
		6%	27	32	19	350	57	120
	Dibenzo(ah)anthracene	1%	0.24	0.31	0.14	3.5	0.57	1.1
		2.5%	0.28	0.32	0.27	3.6	0.58	1.3
		6%	0.3	0.32	0.43	3.6	0.58	1.4
	Fluoranthene	1%	280	1,500	52	23,000	3,100	6,300
		2.5%	560	1,600	130	23,000	3,100	6,300
		6%	890	1,600	290	23,000	3,100	6,400
	Fluorene	1%	170	2,800 (36.0) ^{sol}	27	63,000 (30.9) ^{sol}	9,900	20,000
		2.5%	400	3,800 (76.5) ^{sol}	67	68,000	9,900	20,000
		6%	860	4,500 (183) ^{sol}	160	71,000	9,900	20,000
	Indeno(123-cd)pyrene	1%	27	45	9.5	500	82	150
		2.5%	36	46	21	510	82	170
		6%	41	46	39	510	82	180
	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}
		2.5%	5.6 ^f	5.6 ^f	10 ^f	460 ^f (183) ^{sol}	4,900 ^f	1,900 ^f (183) ^{sol}
		6%	13 ^f	13 ^f	24 ^f	1,100 ^f (432) ^{sol}	4,900 ^f	3,000
	Phenanthrene	1%	95	1,300 (36.0) ^{sol}	15	22,000	3,100	6,200
		2.5%	220	1,500	38	22,000	3,100	6,200
		6%	440	1,500	90	22,000	3,100	6,300
	Pyrene	1%	620	3,700	110	54,000	7,400	15,000
		2.5%	1,200	3,800	270	54,000	7,400	15,000
		6%	2,000	3,800	620	54,000	7,400	15,000
Coal Tar (B(a)P as surrogate marker)	1%	0.79	1.2	0.32	15	2.2	4.4	
	2.5%	0.98	1.2	0.67	15	2.2	4.7	
	6%	1.1	1.2	1.2	15	2.2	4.8	

NOTES

^{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.

All GAC are based on sandy loam soils with a pH 7.

LQM Generic Assessment Criteria (mg/kg) Dry weight soil

Contaminant	SOM	Res +	Res -	Allot.	Comm.	POS _{resi}	POS _{park}
Aliphatic							
EC 5-6	1%	42	42	730	3,200 (304) ^{sol}	570,000(304) ^{sol}	95,000 (304) ^{sol}
EC>6-8	1%	100	100	2,300	7,800 (144) ^{sol}	600,000	150,000 (144) ^{sol}
EC>8-10	1%	27	27	320	2,000 (78) ^{sol}	13,000	14,000 (78) ^{vap}
EC>10-12	1%	130 (48) ^{vap}	130 (48) ^{vap}	2,200	9,700 (48) ^{sol}	13,000	21,000 (48) ^{vap}
EC>12-16	1%	1,100 (24) ^{sol}	1,100 (24) ^{sol}	11,000	59,000 (24) ^{sol}	13,000	25,000 (24) ^{sol}
EC>16-35	1%	65,000 (8.48) ^{f, sol}	65,000 (8.48) ^{f, sol}	260,000 ^f	160,000 ^f	250,000 ^f	450,000 ^f
EC>35-44	1%	65,000 (8.48) ^{f, sol}	65,000 (8.48) ^{f, sol}	260,000 ^f	160,000 ^f	250,000 ^f	450,000 ^f
Aliphatic							
EC 5-6	2.5%	78	78	1,700	5,900 (558) ^{sol}	590,000	130,000 (558) ^{sol}
EC>6-8	2.5%	230	230	5,600	17,000 (322) ^{sol}	610,000	220,000 (322) ^{sol}
EC>8-10	2.5%	65	65	770	4,800 (190) ^{vap}	13,000	18,000 (190) ^{vap}
EC>10-12	2.5%	330 (118) ^{vap}	330 (118) ^{vap}	4,400	23,000 (118) ^{vap}	13,000	23,000 (118) ^{vap}
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}
EC>16-35	2.5%	92,000 (21) ^{f, sol}	92,000 (21) ^{f, sol}	270,000 ^f	1,700,000 ^f	250,000 ^f	480,000 ^f
EC>35-44	2.5%	92,000 (21) ^{f, sol}	92,000 (21) ^{f, sol}	270,000 ^f	1,700,000 ^f	250,000 ^f	480,000 ^f
Aliphatic							
EC 5-6	6%	160	160	3,900	12,000 (1,150) ^{sol}	600,000	180,000 (1,150) ^{sol}
EC>6-8	6%	530	530	13,000	40,000 (736) ^{sol}	620,000	320,000 (736) ^{sol}
EC>8-10	6%	150	150	1,700	11,000 (451) ^{vap}	13,000	21,000 (451) ^{vap}
EC>10-12	6%	760 (283) ^{vap}	760 (283) ^{vap}	7,300	47,000 (283) ^{vap}	13,000	24,000 (283) ^{vap}
EC>12-16	6%	4,300 (142) ^{sol}	4,400 (142) ^{sol}	13,000	90,000 (142) ^{sol}	13,000	26,000 (142) ^{sol}
EC>16-35	6%	110,000 ^f	110,000 ^f	270,000 ^f	1,800,000 ^f	250,000 ^f	490,000 ^f
EC>35-44	6%	110,000 ^f	110,000 ^f	270,000 ^f	1,800,000 ^f	250,000 ^f	490,000 ^f
Aromatic							
EC5-7(benzene as non-threshold)	1%	70	370	13	26,000 (1,220) ^{sol}	56,000	76,000 (1,220) ^{sol}
EC>7-8(toluene)	1%	130	860	22	56,000 (869) ^{vap}	56,000	87,000 (869) ^{vap}
EC>8-10	1%	34	47	8.6	3,500 (613) ^{vap}	5,000	7,200 (613) ^{vap}
EC>10-12	1%	74	250	13	16,000 (364) ^{sol}	5,000	9,200 (364) ^{sol}
EC>12-16	1%	140	1,800	23	36,000 (169) ^{sol}	5,100	10,000
EC>16-21	1%	260 ^f	1,900 ^f	46 ^f	28,000 ^f	3,800 ^f	7,600 ^f
EC>21-35	1%	1,100 ^f	1,900 ^f	370 ^f	28,000 ^f	3,800 ^f	7,800 ^f
EC>35-44	1%	1,100 ^f	1,900 ^f	370 ^f	28,000 ^f	3,800 ^f	7,800 ^f
Aromatic							
EC5-7(benzene as non-threshold)	2.5%	140	690	27	46,000 (2,260) ^{sol}	56,000	84,000 (2,260) ^{sol}
EC>7-8(toluene)	2.5%	290	1,800	51	110,000 (1,920) ^{sol}	56,000	95,000 (1,920) ^{sol}
EC>8-10	2.5%	83	110	21	8,100 (1,500) ^{vap}	5,000	8,500 (1,500) ^{vap}
EC>10-12	2.5%	180	590	31	28,000 (899) ^{sol}	5,000	9,700 (899) ^{sol}
EC>12-16	2.5%	330	2,300 (419) ^{sol}	57	37,000	5,100	10,000
EC>16-21	2.5%	540 ^f	1,900 ^f	110 ^f	28,000 ^f	3,800 ^f	7,700 ^f
EC>21-35	2.5%	1,500 ^f	1,900 ^f	820 ^f	28,000 ^f	3,800 ^f	7,800 ^f
EC>35-44	2.5%	1,500 ^f	1,900 ^f	820 ^f	28,000 ^f	3,800 ^f	7,800 ^f
Aromatic							
EC5-7(benzene as non-threshold)	6%	300	1,400	57	86,000 (4,710) ^{sol}	56,000	92,000 (4,710) ^{sol}
EC>7-8(toluene)	6%	660	3,900	120	180,000 (4,360) ^{vap}	56,000	100,000 (4,360) ^{vap}
EC>8-10	6%	190	270	51	17,000 (3,580) ^{vap}	5,000	9,300 (3,580) ^{vap}
EC>10-12	6%	380	1,200	4	34,000 (2,150) ^{sol}	5,000	10,000
EC>12-16	6%	660	2,500	130	38,000	5,100	10,000
EC>16-21	6%	930 ^f	1,900 ^f	260 ^f	28,000 ^f	3,800 ^f	7,800 ^f
EC>21-35	6%	1,700 ^f	1,900 ^f	1,600 ^f	28,000 ^f	3,800 ^f	7,900 ^f
EC>35-44	6%	1,700 ^f	1,900 ^f	1,600 ^f	28,000 ^f	3,800 ^f	7,900 ^f
Aliphatic	1%	1,600 ^f	1,900 ^f	1,200 ^f	28,000 ^f	3,800 ^f	7,800 ^f
+Aromatic	2.5%	1,800 ^f	1,900 ^f	2,100 ^f	28,000 ^f	3,800 ^f	7,800 ^f
>EC44	6%	1,900 ^f	1,900 ^f	3,000 ^f	28,000 ^f	3,800 ^f	7,900 ^f

NOTES

^{sol}/^{vap} = solubility / vapour limit (potentially use if free product identified, although highly conservative).

^f = oral, dermal and inhalation exposures compared to oral HCV.

All GAC are based on sandy loam soils with a pH 7.

		LQM Generic Assessment Criteria (mg/kg) Dry weight soil						
Contaminant		SOM	Res +	Res -	Allot.	Comm.	POS _{resi}	POS _{park}
Chloalkanes and Alkenes & Explosives	1,2 Dichloroethane (DCA)	1%	7.1E-03	9.2E-03	4.6E-03	0.67	29	21
		2.5%	1.1E-02	1.3E-02	8.3E-03	0.97	29	24
		6%	1.9E-02	2.3E-02	1.6E-02	1.7	29	28
	1,1,1 Trichloroethane (TCA)	1%	8.8	9.0	48	660	140,000	57,000 (1,425) ^{vap}
		2.5%	18	18	110	1,300	140,000	76,000 (2,915) ^{vap}
		6%	39	40	240	3,000	140,000	100,000 (6,392) ^{vap}
	1,1,2,2-Tetrachloroethanes (PCA)	1%	1.6	3.9	0.41	270	1,400	1,800
		2.5%	3.4	8.0	0.89	550	1,400	2,100
		6%	7.5	17	2.0	1,100	1,400	2,300
	1,1,1,2-Tetrachloroethanes (PCA)	1%	1.2	1.5	0.79	110	1,400	1,500
		2.5%	2.8	3.5	1.9	250	1,400	1,800
		6%	6.4	8.2	4.4	560	1,400	2,100
	Tetrachloroethene (PCE)	1%	0.18	0.18	0.65	19	1,400	810 (424) ^{sol}
		2.5%	0.39	0.40	1.5	42	1,400	1,100 (951) ^{sol}
		6%	0.90	0.92	3.6	95	1,400	1,500
	Tetrachloromethane (carbon tetrachloride)	1%	2.6E-02	2.6E-02	0.45	2.9	890	190
		2.5%	5.6E-02	5.6E-02	1.0	6.3	920	270
		6%	0.13	0.13	2.4	14	950	400
	Trichloroethene (TCE)	1%	1.6E-02	1.7E-02	4.1E-02	1.2	120	70
		2.5%	3.4E-02	3.6E-02	9.1E-02	2.6	120	91
		6%	7.5E-02	8.0E-02	0.21	5.7	120	120
	Trichloromethane (chloroform)	1%	0.91	1.2	0.42	99	2,500	2,600
		2.5%	1.7	2.1	0.83	170	2,500	2,800
		6%	3.4	4.2	1.7	350	2,500	3,100
	Chloroethene (vinyl chloride)	1%	6.4E-04	7.7E-04	5.5E-04	5.9E-02	3.5	4.8
		2.5%	8.7E-04	1.0E-03	1.0E-03	7.7E-02	3.5	5.0
		6%	1.4E-03	1.5E-03	1.8E-03	0.12	3.5	5.4
	2,4,6-Trinitrotoluene (TNT)	1%	1.6	65	0.24	1,000	130	260
		2.5%	3.7	66	0.58	1,000	130	270
		6%	8.1	66	1.4	1,000	130	270
	RDX	1%	120	13,000	17	210,000	26,000	49,000 (18.7) ^{sol}
		2.5%	250	13,000	38	210,000	26,000	51,000
		6%	540	13,000	85	210,000	27,000	53,000
	HMX	1%	5.7	6,700	0.86	110,000	13,000	23,000 (0.35) ^{vap}
		2.5%	13	6,700	1.9	110,000	13,000	23,000 (0.39) ^{vap}
		6%	26	6,700	3.9	110,000	13,000	24,000 (0.48) ^{vap}
Pesticides	Aldrin	1%	5.7	7.3	3.2	170	18	30
		2.5%	6.6	7.4	6.1	170	18	31
		6%	7.1	7.5	9.8	170	18	31
	Dieldrin	1%	0.97	7.0	0.17	170	18	30
		2.5%	2.0	7.3	0.41	170	18	30
		6%	3.5	7.4	0.96	170	18	31
	Atrazine	1%	3.3	610	0.5	9,300	1,200	2,300
		2.5%	7.8	620	1.2	9,400	1,200	2,400
		6%	17.4	620	2.7	9,400	1,200	2,400
	Dichlorvos	1%	3.2E-02	6.4	4.9E-03	140	16	26
		2.5%	6.6E-02	6.5	1.0E-02	140	16	26
		6%	0.14	6.6	2.2E-02	140	16	27
	Endosulfans (2 isomers)	1%	7.4	160 (3.0E-03) ^{vap}	1.2	5,600 (3.0E-03) ^{vap}	1,200	2,300
		2.5%	18	280 (7.0E-03) ^{vap}	2.9	7,400 (7.0E-03) ^{vap}	1,200	2,400
		6%	41	410 (1.6E-02) ^{vap}	6.8	8,400 (1.6E-02) ^{vap}	1,200	2,500
	Hexachlorocyclohexane (3 isomers), inc Lindane	1%	8.5E-02	3.7	1.3E-02	65	8.1	15
		2.5%	0.2	3.8	3.2E-02	65	8.1	15
		6%	0.46	3.8	7.7E-02	65	8.1	16

NOTES

^{sol} / ^{vap} = solubility / vapour limit (potentially use if free product identified, although highly conservative).

All GAC are based on
sandy loam soils with a pH
7.

All GAC are based on sandy loam soils with a pH 7.			LQM Generic Assessment Criteria (mg/kg) Dry weight soil					
Contaminant		SOM	Res +	Res -	Allot.	Comm.	POS _{resi}	POS _{park}
Chlorobenzenes	Chlorobenzene	1%	0.46	0.46	5.9	56	11,000	1,300 (675) ^{sol}
		2.5%	1.0	1.0	14	130	13,000	2,000 (1,520) ^{sol}
		6%	2.4	2.4	32	290	14,000	2,900
	Dichlorobenzenes (3 isomers)	1%	23	24	94	2,000 (571) ^{sol}	90,000	24,000 (571) ^{sol}
		2.5%	55	57	230	4,800 (1,370) ^{sol}	95,000	36,000 (1,370) ^{sol}
		6%	130	130	540	11,000 (3,240) ^{sol}	98,000	51,000 (3,270) ^{sol}
	Trichlorobenzenes (3 isomers)	1%	2.6	2.6	55	220	15,000	1,700 (318) ^{vap}
		2.5%	6.4	6.4	140	530	17,000	2,600 (786) ^{vap}
		6%	15	15	320	1,300	19,000	4,000 (1,880) ^{vap}
	Tetrachlorobenzenes (3 isomers)	1%	0.66	0.75	0.38	49 (39.4) ^{vap}	78	110 (39) ^{vap}
		2.5%	1.6	1.9	0.90	120 (98.1) ^{vap}	79	120
		6%	3.7	4.3	2.2	240 (235) ^{vap}	79	130
	Pentachlorobenzene	1%	5.8	19	1.2	640 (43.0) ^{sol}	100	190
		2.5%	12	30	3.1	770 (107) ^{sol}	100	190
		6%	22	38	7.0	830	100	190
	Hexachlorobenzene	1%	1.8 (0.20) ^{vap}	4.1 (0.20) ^{vap}	0.47	110 (0.20) ^{vap}	16	30
		2.5%	3.3 (0.50) ^{vap}	5.7 (0.50) ^{vap}	1.1	120	16	30
		6%	4.9	6.7 (1.2) ^{vap}	2.5	120	16	30
Chlorophenol	Chlorophenols (4 congeners)	1%	0.87 ^g	94	0.13 ^g	3,500	620	1,100
		2.5%	2.0	150	0.30	4,000	620	1,100
		6%	4.5	210	0.70	4,300	620	1,100
	Pentachlorophenol	1%	0.22	27 (16.4) ^{vap}	3.0E-02	400	60	110
		2.5%	0.52	29	8.0E-02	400	60	120
		6%	1.2	31	0.19	400	60	120
Others	Carbon Disulphide	1%	0.14	0.14	4.8	11	11,000	1,300
		2.5%	0.29	0.29	10	22	11,000	1,900
		6%	0.62	0.62	23	47	11,000	2,700
	Hexachlorobutadiene	1%	0.29	0.32	0.25	31	25	48
		2.5%	0.7	0.78	0.61	66	25	50
		6%	1.6	1.8	1.4	120	25	51
	Phenol	1%	280	750	66	760 ^{dir} (31,000)	760 ^{dir} (11,000)	760 ^{dir} (8,600)
		2.5%	550	1,300	140	1,500 ^{dir} (35,000)	1,500 ^{dir} (11,000)	1,500 ^{dir} (9,700)
		6%	1,100	2,300	280	3,200 ^{dir} (37,000)	3,200 ^{dir} (11,000)	3,200 ^{dir} (11,000)

NOTES

^{sol / vap} = solubility / vapour limit (potentially use if free product identified, although highly conservative).

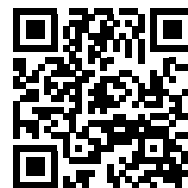
^{dir} = S4uls based on threshold protective of direct skin contact with phenol (brackets long term exposure for illustration purposes).

^g = derived based on 2,3,4,6-tetrachlorophenol.

Appendix G

HazWaste Online Output Sheets

Waste Classification Report



AJGJU-DXSGX-FZ82J

Job name

LKC 20 1870

Description/Comments

Project

LKC 20 1870

Site

Cockey Moor Road

Related Documents

#	Name	Description
1	HWOL_20-34785-20201222 115921.hwol	.hwol file used to create the Job

Waste Stream Template

Example waste stream template for contaminated soils

Classified by

Name: Peter Dunn	Company: LK Group	HazWasteOnline™ Training Record:	
Date: 13 Jan 2021 17:27 GMT	Unit 29, Eton Business Park	Course	Date
Telephone: 0161 763 7200	Eton Hill Rd, Radcliffe	Hazardous Waste Classification	17 Sep 2019
	Manchester	Advanced Hazardous Waste Classification	18 Sep 2019
	M26 2ZS		

Report

Created by: Peter Dunn
Created date: 13 Jan 2021 17:27 GMT

Job summary

#	Sample Name	Depth [m]	Classification Result	Hazard properties	Page
1	WS102-ES1-16/12/2020-0.0	0.0-0.5	Non Hazardous		2
2	WS102-ES2-16/12/2020-0.5	0.5-1.0	Non Hazardous		4
3	HD101-ES1-16/12/2020-0.0	0.0-0.5	Non Hazardous		6
4	HD102-ES2-16/12/2020-0.4	0.4-0.9	Non Hazardous		8
5	HD103-ES1-16/12/2020-0.0	0.0-0.5	Non Hazardous		10

Appendices	Page
Appendix A: Classifier defined and non CLP determinands	12
Appendix B: Rationale for selection of metal species	13
Appendix C: Version	13

Classification of sample: WS102-ES1-16/12/2020-0.0

 **Non Hazardous Waste**
Classified as **17 05 04**
in the List of Waste

Sample details

Sample Name:	LoW Code:
WS102-ES1-16/12/2020-0.0	Chapter:
Sample Depth:	17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
0.0-0.5 m	Entry:
Moisture content:	17 05 04 (Soil and stones other than those mentioned in 17 05 03)
16%	
(wet weight correction)	

Hazard properties

None identified

Determinands

Moisture content: 16% Wet Weight Moisture Correction applied (MC)

#	Determinand			CLP Note	User entered data	Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
	CLP index number	EC Number	CAS Number								
1	arsenic { arsenic trioxide }				36 mg/kg	1.32	39.927 mg/kg	0.00399 %		✓	
	033-003-00-0	215-481-4	1327-53-3								
2	cadmium { cadmium oxide }				0.45 mg/kg	1.142	0.432 mg/kg	0.0000432 %		✓	
	048-002-00-0	215-146-2	1306-19-0								
3	chromium in chromium(III) compounds { chromium(III) oxide (worst case) }				22 mg/kg	1.462	27.01 mg/kg	0.0027 %		✓	
		215-160-9	1308-38-9								
4	chromium in chromium(VI) compounds { chromium(VI) compounds, with the exception of barium chromate and of compounds specified elsewhere in this Annex }				<0.5 mg/kg	2.27	<1.135 mg/kg	<0.000113 %			<LOD
	024-017-00-8										
5	copper { dicopper oxide; copper (I) oxide }				96 mg/kg	1.126	90.792 mg/kg	0.00908 %		✓	
	029-002-00-X	215-270-7	1317-39-1								
6	lead { lead chromate }			1	190 mg/kg	1.56	248.946 mg/kg	0.016 %		✓	
	082-004-00-2	231-846-0	7758-97-6								
7	mercury { mercury dichloride }				0.35 mg/kg	1.353	0.398 mg/kg	0.0000398 %		✓	
	080-010-00-X	231-299-8	7487-94-7								
8	nickel { nickel chromate }				35 mg/kg	2.976	87.502 mg/kg	0.00875 %		✓	
	028-035-00-7	238-766-5	14721-18-7								
9	selenium { nickel selenate }				0.71 mg/kg	2.554	1.523 mg/kg	0.000152 %		✓	
	028-031-00-5	239-125-2	15060-62-5								
10	zinc { zinc oxide }				130 mg/kg	1.245	135.923 mg/kg	0.0136 %		✓	
	030-013-00-7	215-222-5	1314-13-2								
11	pH				6.7 pH		6.7 pH	6.7 pH			
			PH								
12	naphthalene				<0.1 mg/kg		<0.1 mg/kg	<0.00001 %			<LOD
	601-052-00-2	202-049-5	91-20-3								
13	acenaphthylene				<0.1 mg/kg		<0.1 mg/kg	<0.00001 %			<LOD
		205-917-1	208-96-8								
14	acenaphthene				<0.1 mg/kg		<0.1 mg/kg	<0.00001 %			<LOD
		201-469-6	83-32-9								

#	Determinand			CLP Note	User entered data	Conv. Factor	Compound conc.	Classification value	MC Applied	Conc. Not Used
	CLP index number	EC Number	CAS Number							
15	fluorene	201-695-5	86-73-7		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
16	phenanthrene	201-581-5	85-01-8		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
17	anthracene	204-371-1	120-12-7		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
18	fluoranthene	205-912-4	206-44-0		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
19	pyrene	204-927-3	129-00-0		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
20	benzo[a]anthracene	601-033-00-9	200-280-6		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
21	chrysene	601-048-00-0	205-923-4		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
22	benzo[b]fluoranthene	601-034-00-4	205-911-9		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
23	benzo[k]fluoranthene	601-036-00-5	205-916-6		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
24	benzo[a]pyrene; benzo[def]chrysene	601-032-00-3	200-028-5		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
25	indeno[123-cd]pyrene	205-893-2	193-39-5		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
26	dibenz[a,h]anthracene	601-041-00-2	200-181-8		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
27	benzo[ghi]perylene	205-883-8	191-24-2		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
28	vanadium { divanadium pentaoxide; vanadium pentoxide }	023-001-00-8	215-239-8		48 mg/kg	1.785	71.979 mg/kg	0.0072 %	✓	
Total:								0.0618 %		

Key

	User supplied data
	Determinand values ignored for classification, see column 'Conc. Not Used' for reason
•	Determinand defined or amended by HazWasteOnline (see Appendix A)
•	Speciated Determinand - Unless the Determinand is Note 1, the Conversion Factor is used to calculate the compound concentration
<LOD	Below limit of detection
ND	Not detected
CLP: Note 1	Only the metal concentration has been used for classification

Classification of sample: WS102-ES2-16/12/2020-0.5



Non Hazardous Waste
Classified as **17 05 04**
in the List of Waste

Sample details

Sample Name:	LoW Code:
WS102-ES2-16/12/2020-0.5	Chapter:
Sample Depth:	17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
0.5-1.0 m	Entry:
Moisture content:	17 05 04 (Soil and stones other than those mentioned in 17 05 03)
13%	
(wet weight correction)	

Hazard properties

None identified

Determinands

Moisture content: 13% Wet Weight Moisture Correction applied (MC)

#	Determinand			CLP Note	User entered data	Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
	CLP index number	EC Number	CAS Number								
1	arsenic { arsenic trioxide }				18 mg/kg	1.32	20.676 mg/kg	0.00207 %		✓	
	033-003-00-0	215-481-4	1327-53-3								
2	cadmium { cadmium oxide }				0.16 mg/kg	1.142	0.159 mg/kg	0.0000159 %		✓	
	048-002-00-0	215-146-2	1306-19-0								
3	chromium in chromium(III) compounds { chromium(III) oxide (worst case) }				15 mg/kg	1.462	19.073 mg/kg	0.00191 %		✓	
		215-160-9	1308-38-9								
4	chromium in chromium(VI) compounds { chromium(VI) compounds, with the exception of barium chromate and of compounds specified elsewhere in this Annex }				<0.5 mg/kg	2.27	<1.135 mg/kg	<0.000113 %			<LOD
	024-017-00-8										
5	copper { dicopper oxide; copper (I) oxide }				63 mg/kg	1.126	61.71 mg/kg	0.00617 %		✓	
	029-002-00-X	215-270-7	1317-39-1								
6	lead { lead chromate }			1	120 mg/kg	1.56	162.845 mg/kg	0.0104 %		✓	
	082-004-00-2	231-846-0	7758-97-6								
7	mercury { mercury dichloride }				0.16 mg/kg	1.353	0.188 mg/kg	0.0000188 %		✓	
	080-010-00-X	231-299-8	7487-94-7								
8	nickel { nickel chromate }				26 mg/kg	2.976	67.323 mg/kg	0.00673 %		✓	
	028-035-00-7	238-766-5	14721-18-7								
9	selenium { nickel selenate }				0.2 mg/kg	2.554	0.444 mg/kg	0.0000444 %		✓	
	028-031-00-5	239-125-2	15060-62-5								
10	zinc { zinc oxide }				52 mg/kg	1.245	56.311 mg/kg	0.00563 %		✓	
	030-013-00-7	215-222-5	1314-13-2								
11	pH				7 pH		7 pH	7pH			
			PH								
12	naphthalene				<0.1 mg/kg		<0.1 mg/kg	<0.00001 %			<LOD
	601-052-00-2	202-049-5	91-20-3								
13	acenaphthylene				<0.1 mg/kg		<0.1 mg/kg	<0.00001 %			<LOD
		205-917-1	208-96-8								
14	acenaphthene				<0.1 mg/kg		<0.1 mg/kg	<0.00001 %			<LOD
		201-469-6	83-32-9								

#	Determinand			CLP Note	User entered data	Conv. Factor	Compound conc.	Classification value	MC Applied	Conc. Not Used
	CLP index number	EC Number	CAS Number							
15	fluorene	201-695-5	86-73-7		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
16	phenanthrene	201-581-5	85-01-8		1.4 mg/kg		1.218 mg/kg	0.000122 %	✓	
17	anthracene	204-371-1	120-12-7		0.37 mg/kg		0.322 mg/kg	0.0000322 %	✓	
18	fluoranthene	205-912-4	206-44-0		3.6 mg/kg		3.132 mg/kg	0.000313 %	✓	
19	pyrene	204-927-3	129-00-0		3.1 mg/kg		2.697 mg/kg	0.00027 %	✓	
20	benzo[a]anthracene	601-033-00-9	200-280-6		1.9 mg/kg		1.653 mg/kg	0.000165 %	✓	
21	chrysene	601-048-00-0	205-923-4		1.4 mg/kg		1.218 mg/kg	0.000122 %	✓	
22	benzo[b]fluoranthene	601-034-00-4	205-911-9		2.3 mg/kg		2.001 mg/kg	0.0002 %	✓	
23	benzo[k]fluoranthene	601-036-00-5	205-916-6		0.88 mg/kg		0.766 mg/kg	0.0000766 %	✓	
24	benzo[a]pyrene; benzo[def]chrysene	601-032-00-3	200-028-5		1.9 mg/kg		1.653 mg/kg	0.000165 %	✓	
25	indeno[123-cd]pyrene	205-893-2	193-39-5		1.2 mg/kg		1.044 mg/kg	0.000104 %	✓	
26	dibenz[a,h]anthracene	601-041-00-2	200-181-8		0.23 mg/kg		0.2 mg/kg	0.00002 %	✓	
27	benzo[ghi]perylene	205-883-8	191-24-2		1.2 mg/kg		1.044 mg/kg	0.000104 %	✓	
28	vanadium { divanadium pentaoxide; vanadium pentoxide }	023-001-00-8	215-239-8		34 mg/kg	1.785	52.806 mg/kg	0.00528 %	✓	
Total:								0.0402 %		

Key

	User supplied data
	Determinand values ignored for classification, see column 'Conc. Not Used' for reason
•	Determinand defined or amended by HazWasteOnline (see Appendix A)
	Speciated Determinand - Unless the Determinand is Note 1, the Conversion Factor is used to calculate the compound concentration
<LOD	Below limit of detection
ND	Not detected
CLP: Note 1	Only the metal concentration has been used for classification

Classification of sample: HD101-ES1-16/12/2020-0.0

 **Non Hazardous Waste**
Classified as **17 05 04**
in the List of Waste

Sample details

Sample Name:	LoW Code:
HD101-ES1-16/12/2020-0.0	Chapter:
Sample Depth:	17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
0.0-0.5 m	Entry:
Moisture content:	17 05 04 (Soil and stones other than those mentioned in 17 05 03)
11%	
(wet weight correction)	

Hazard properties

None identified

Determinands

Moisture content: 11% Wet Weight Moisture Correction applied (MC)

#	Determinand			CLP Note	User entered data		Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
	CLP index number	EC Number	CAS Number									
1	arsenic { arsenic trioxide }				72	mg/kg	1.32	84.606	mg/kg	0.00846 %	✓	
	033-003-00-0	215-481-4	1327-53-3									
2	cadmium { cadmium oxide }				0.48	mg/kg	1.142	0.488	mg/kg	0.0000488 %	✓	
	048-002-00-0	215-146-2	1306-19-0									
3	chromium in chromium(III) compounds { chromium(III) oxide (worst case) }				60	mg/kg	1.462	78.047	mg/kg	0.0078 %	✓	
		215-160-9	1308-38-9									
4	chromium in chromium(VI) compounds { chromium(VI) compounds, with the exception of barium chromate and of compounds specified elsewhere in this Annex }				<0.5	mg/kg	2.27	<1.135	mg/kg	<0.000113 %		<LOD
	024-017-00-8											
5	copper { dicopper oxide; copper (I) oxide }				230	mg/kg	1.126	230.469	mg/kg	0.023 %	✓	
	029-002-00-X	215-270-7	1317-39-1									
6	lead { lead chromate }			1	430	mg/kg	1.56	596.941	mg/kg	0.0383 %	✓	
	082-004-00-2	231-846-0	7758-97-6									
7	mercury { mercury dichloride }				0.23	mg/kg	1.353	0.277	mg/kg	0.0000277 %	✓	
	080-010-00-X	231-299-8	7487-94-7									
8	nickel { nickel chromate }				63	mg/kg	2.976	166.879	mg/kg	0.0167 %	✓	
	028-035-00-7	238-766-5	14721-18-7									
9	selenium { nickel selenate }				0.28	mg/kg	2.554	0.636	mg/kg	0.0000636 %	✓	
	028-031-00-5	239-125-2	15060-62-5									
10	zinc { zinc oxide }				500	mg/kg	1.245	553.898	mg/kg	0.0554 %	✓	
	030-013-00-7	215-222-5	1314-13-2									
11	pH				7.7	pH		7.7	pH	7.7 pH		
			PH									
12	naphthalene				0.21	mg/kg		0.187	mg/kg	0.0000187 %	✓	
	601-052-00-2	202-049-5	91-20-3									
13	acenaphthylene				0.1	mg/kg		0.089	mg/kg	0.0000089 %	✓	
		205-917-1	208-96-8									
14	acenaphthene				0.33	mg/kg		0.294	mg/kg	0.0000294 %	✓	
		201-469-6	83-32-9									

#	Determinand			CLP Note	User entered data	Conv. Factor	Compound conc.	Classification value	MC Applied	Conc. Not Used
	CLP index number	EC Number	CAS Number							
15	fluorene	201-695-5	86-73-7		0.33 mg/kg		0.294 mg/kg	0.0000294 %	✓	
16	phenanthrene	201-581-5	85-01-8		3.5 mg/kg		3.115 mg/kg	0.000312 %	✓	
17	anthracene	204-371-1	120-12-7		1 mg/kg		0.89 mg/kg	0.000089 %	✓	
18	fluoranthene	205-912-4	206-44-0		5.7 mg/kg		5.073 mg/kg	0.000507 %	✓	
19	pyrene	204-927-3	129-00-0		4.8 mg/kg		4.272 mg/kg	0.000427 %	✓	
20	benzo[a]anthracene	601-033-00-9	200-280-6		2.6 mg/kg		2.314 mg/kg	0.000231 %	✓	
21	chrysene	601-048-00-0	205-923-4		2.1 mg/kg		1.869 mg/kg	0.000187 %	✓	
22	benzo[b]fluoranthene	601-034-00-4	205-911-9		3.1 mg/kg		2.759 mg/kg	0.000276 %	✓	
23	benzo[k]fluoranthene	601-036-00-5	205-916-6		1.1 mg/kg		0.979 mg/kg	0.0000979 %	✓	
24	benzo[a]pyrene; benzo[def]chrysene	601-032-00-3	200-028-5		2.4 mg/kg		2.136 mg/kg	0.000214 %	✓	
25	indeno[123-cd]pyrene	205-893-2	193-39-5		1.4 mg/kg		1.246 mg/kg	0.000125 %	✓	
26	dibenz[a,h]anthracene	601-041-00-2	200-181-8		0.2 mg/kg		0.178 mg/kg	0.0000178 %	✓	
27	benzo[ghi]perylene	205-883-8	191-24-2		1.2 mg/kg		1.068 mg/kg	0.000107 %	✓	
28	vanadium { divanadium pentaoxide; vanadium pentoxide }	023-001-00-8	215-239-8		120 mg/kg	1.785	190.658 mg/kg	0.0191 %	✓	
Total:								0.172 %		

Key

	User supplied data
	Determinand values ignored for classification, see column 'Conc. Not Used' for reason
•	Determinand defined or amended by HazWasteOnline (see Appendix A)
•	Speciated Determinand - Unless the Determinand is Note 1, the Conversion Factor is used to calculate the compound concentration
<LOD	Below limit of detection
ND	Not detected
CLP: Note 1	Only the metal concentration has been used for classification

Classification of sample: HD102-ES2-16/12/2020-0.4

 **Non Hazardous Waste**
Classified as **17 05 04**
in the List of Waste

Sample details

Sample Name:	HD102-ES2-16/12/2020-0.4	LoW Code:	
Sample Depth:	0.4-0.9 m	Chapter:	17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
Moisture content:	14%	Entry:	17 05 04 (Soil and stones other than those mentioned in 17 05 03)
	(wet weight correction)		

Hazard properties

None identified

Determinands

Moisture content: 14% Wet Weight Moisture Correction applied (MC)

#	Determinand			CLP Note	User entered data		Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
	CLP index number	EC Number	CAS Number									
1	arsenic { arsenic trioxide }				20	mg/kg	1.32	22.71	mg/kg	0.00227 %	✓	
	033-003-00-0	215-481-4	1327-53-3									
2	cadmium { cadmium oxide }				0.25	mg/kg	1.142	0.246	mg/kg	0.0000246 %	✓	
	048-002-00-0	215-146-2	1306-19-0									
3	chromium in chromium(III) compounds { chromium(III) oxide (worst case) }				23	mg/kg	1.462	28.91	mg/kg	0.00289 %	✓	
		215-160-9	1308-38-9									
4	chromium in chromium(VI) compounds { chromium(VI) compounds, with the exception of barium chromate and of compounds specified elsewhere in this Annex }				<0.5	mg/kg	2.27	<1.135	mg/kg	<0.000113 %		<LOD
	024-017-00-8											
5	copper { dicopper oxide; copper (I) oxide }				60	mg/kg	1.126	58.096	mg/kg	0.00581 %	✓	
	029-002-00-X	215-270-7	1317-39-1									
6	lead { lead chromate }			1	110	mg/kg	1.56	147.559	mg/kg	0.00946 %	✓	
	082-004-00-2	231-846-0	7758-97-6									
7	mercury { mercury dichloride }				0.14	mg/kg	1.353	0.163	mg/kg	0.0000163 %	✓	
	080-010-00-X	231-299-8	7487-94-7									
8	nickel { nickel chromate }				35	mg/kg	2.976	89.586	mg/kg	0.00896 %	✓	
	028-035-00-7	238-766-5	14721-18-7									
9	selenium { nickel selenate }				0.38	mg/kg	2.554	0.835	mg/kg	0.0000835 %	✓	
	028-031-00-5	239-125-2	15060-62-5									
10	zinc { zinc oxide }				160	mg/kg	1.245	171.273	mg/kg	0.0171 %	✓	
	030-013-00-7	215-222-5	1314-13-2									
11	pH				8	pH		8	pH	8pH		
			PH									
12	naphthalene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
	601-052-00-2	202-049-5	91-20-3									
13	acenaphthylene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
		205-917-1	208-96-8									
14	acenaphthene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<LOD
		201-469-6	83-32-9									

#	Determinand			CLP Note	User entered data	Conv. Factor	Compound conc.	Classification value	MC Applied	Conc. Not Used
	CLP index number	EC Number	CAS Number							
15	fluorene	201-695-5	86-73-7		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
16	phenanthrene	201-581-5	85-01-8		0.44 mg/kg		0.378 mg/kg	0.0000378 %	✓	
17	anthracene	204-371-1	120-12-7		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
18	fluoranthene	205-912-4	206-44-0		0.56 mg/kg		0.482 mg/kg	0.0000482 %	✓	
19	pyrene	204-927-3	129-00-0		0.49 mg/kg		0.421 mg/kg	0.0000421 %	✓	
20	benzo[a]anthracene	601-033-00-9	200-280-6		0.27 mg/kg		0.232 mg/kg	0.0000232 %	✓	
21	chrysene	601-048-00-0	205-923-4		0.21 mg/kg		0.181 mg/kg	0.0000181 %	✓	
22	benzo[b]fluoranthene	601-034-00-4	205-911-9		0.39 mg/kg		0.335 mg/kg	0.0000335 %	✓	
23	benzo[k]fluoranthene	601-036-00-5	205-916-6		0.14 mg/kg		0.12 mg/kg	0.000012 %	✓	
24	benzo[a]pyrene; benzo[def]chrysene	601-032-00-3	200-028-5		0.28 mg/kg		0.241 mg/kg	0.0000241 %	✓	
25	indeno[123-cd]pyrene	205-893-2	193-39-5		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
26	dibenz[a,h]anthracene	601-041-00-2	200-181-8		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
27	benzo[ghi]perylene	205-883-8	191-24-2		<0.1 mg/kg		<0.1 mg/kg	<0.00001 %		<LOD
28	vanadium { divanadium pentaoxide; vanadium pentoxide }	023-001-00-8	215-239-8		28 mg/kg	1.785	42.987 mg/kg	0.0043 %	✓	
Total:								0.0514 %		

Key

	User supplied data
	Determinand values ignored for classification, see column 'Conc. Not Used' for reason
•	Determinand defined or amended by HazWasteOnline (see Appendix A)
•	Speciated Determinand - Unless the Determinand is Note 1, the Conversion Factor is used to calculate the compound concentration
<LOD	Below limit of detection
ND	Not detected
CLP: Note 1	Only the metal concentration has been used for classification

Classification of sample: HD103-ES1-16/12/2020-0.0

 **Non Hazardous Waste**
Classified as **17 05 04**
in the List of Waste

Sample details

Sample Name:	LoW Code:
HD103-ES1-16/12/2020-0.0	Chapter:
Sample Depth:	17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
0.0-0.5 m	Entry:
Moisture content:	17 05 04 (Soil and stones other than those mentioned in 17 05 03)
16%	
(wet weight correction)	

Hazard properties

None identified

Determinands

Moisture content: 16% Wet Weight Moisture Correction applied (MC)

#	Determinand			CLP Note	User entered data	Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
	CLP index number	EC Number	CAS Number								
1	arsenic { arsenic trioxide }				18 mg/kg	1.32	19.963 mg/kg	0.002 %		✓	
	033-003-00-0	215-481-4	1327-53-3								
2	cadmium { cadmium oxide }				0.4 mg/kg	1.142	0.384 mg/kg	0.0000384 %		✓	
	048-002-00-0	215-146-2	1306-19-0								
3	chromium in chromium(III) compounds { chromium(III) oxide (worst case) }				15 mg/kg	1.462	18.416 mg/kg	0.00184 %		✓	
		215-160-9	1308-38-9								
4	chromium in chromium(VI) compounds { chromium(VI) compounds, with the exception of barium chromate and of compounds specified elsewhere in this Annex }				<0.5 mg/kg	2.27	<1.135 mg/kg	<0.000113 %			<LOD
	024-017-00-8										
5	copper { dicopper oxide; copper (I) oxide }				69 mg/kg	1.126	65.256 mg/kg	0.00653 %		✓	
	029-002-00-X	215-270-7	1317-39-1								
6	lead { lead chromate }			1	100 mg/kg	1.56	131.024 mg/kg	0.0084 %		✓	
	082-004-00-2	231-846-0	7758-97-6								
7	mercury { mercury dichloride }				1.6 mg/kg	1.353	1.819 mg/kg	0.000182 %		✓	
	080-010-00-X	231-299-8	7487-94-7								
8	nickel { nickel chromate }				32 mg/kg	2.976	80.002 mg/kg	0.008 %		✓	
	028-035-00-7	238-766-5	14721-18-7								
9	selenium { nickel selenate }				0.36 mg/kg	2.554	0.772 mg/kg	0.0000772 %		✓	
	028-031-00-5	239-125-2	15060-62-5								
10	zinc { zinc oxide }				140 mg/kg	1.245	146.378 mg/kg	0.0146 %		✓	
	030-013-00-7	215-222-5	1314-13-2								
11	pH				8.5 pH		8.5 pH	8.5 pH			
			PH								
12	naphthalene				1.9 mg/kg		1.596 mg/kg	0.00016 %		✓	
	601-052-00-2	202-049-5	91-20-3								
13	acenaphthylene				0.1 mg/kg		0.084 mg/kg	0.0000084 %		✓	
		205-917-1	208-96-8								
14	acenaphthene				5.5 mg/kg		4.62 mg/kg	0.000462 %		✓	
		201-469-6	83-32-9								

#	Determinand			CLP Note	User entered data	Conv. Factor	Compound conc.	Classification value	MC Applied	Conc. Not Used
	CLP index number	EC Number	CAS Number							
15	fluorene				3.2 mg/kg		2.688 mg/kg	0.000269 %	✓	
		201-695-5	86-73-7							
16	phenanthrene				32 mg/kg		26.88 mg/kg	0.00269 %	✓	
		201-581-5	85-01-8							
17	anthracene				6.8 mg/kg		5.712 mg/kg	0.000571 %	✓	
		204-371-1	120-12-7							
18	fluoranthene				40 mg/kg		33.6 mg/kg	0.00336 %	✓	
		205-912-4	206-44-0							
19	pyrene				31 mg/kg		26.04 mg/kg	0.0026 %	✓	
		204-927-3	129-00-0							
20	benzo[a]anthracene				15 mg/kg		12.6 mg/kg	0.00126 %	✓	
		601-033-00-9	200-280-6							
21	chrysene				13 mg/kg		10.92 mg/kg	0.00109 %	✓	
		601-048-00-0	205-923-4							
22	benzo[b]fluoranthene				17 mg/kg		14.28 mg/kg	0.00143 %	✓	
		601-034-00-4	205-911-9							
23	benzo[k]fluoranthene				6.2 mg/kg		5.208 mg/kg	0.000521 %	✓	
		601-036-00-5	205-916-6							
24	benzo[a]pyrene; benzo[def]chrysene				13 mg/kg		10.92 mg/kg	0.00109 %	✓	
		601-032-00-3	200-028-5							
25	indeno[123-cd]pyrene				8.6 mg/kg		7.224 mg/kg	0.000722 %	✓	
		205-893-2	193-39-5							
26	dibenz[a,h]anthracene				1.3 mg/kg		1.092 mg/kg	0.000109 %	✓	
		601-041-00-2	200-181-8							
27	benzo[ghi]perylene				7.4 mg/kg		6.216 mg/kg	0.000622 %	✓	
		205-883-8	191-24-2							
28	vanadium { divanadium pentaoxide; vanadium pentoxide }				37 mg/kg	1.785	55.484 mg/kg	0.00555 %	✓	
		023-001-00-8	215-239-8							
			1314-62-1							
Total:								0.0643 %		

Key

	User supplied data
	Determinand values ignored for classification, see column 'Conc. Not Used' for reason
•	Determinand defined or amended by HazWasteOnline (see Appendix A)
•	Speciated Determinand - Unless the Determinand is Note 1, the Conversion Factor is used to calculate the compound concentration
<LOD	Below limit of detection
ND	Not detected
CLP: Note 1	Only the metal concentration has been used for classification

Appendix A: Classifier defined and non CLP determinands

■ **chromium(III) oxide (worst case)** (EC Number: 215-160-9, CAS Number: 1308-38-9)

Description/Comments: Data from C&L Inventory Database

Data source: <https://echa.europa.eu/information-on-chemicals/cl-inventory-database/-/discli/details/33806>

Data source date: 17 Jul 2015

Hazard Statements: Acute Tox. 4 H332 , Acute Tox. 4 H302 , Eye Irrit. 2 H319 , STOT SE 3 H335 , Skin Irrit. 2 H315 , Resp. Sens. 1 H334 , Skin Sens. 1 H317 , Repr. 1B H360FD , Aquatic Acute 1 H400 , Aquatic Chronic 1 H410

■ **pH** (CAS Number: PH)

Description/Comments: Appendix C4

Data source: WM3 1st Edition 2015

Data source date: 25 May 2015

Hazard Statements: None.

■ **acenaphthylene** (EC Number: 205-917-1, CAS Number: 208-96-8)

Description/Comments: Data from C&L Inventory Database

Data source: <http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database>

Data source date: 17 Jul 2015

Hazard Statements: Acute Tox. 4 H302 , Acute Tox. 1 H330 , Acute Tox. 1 H310 , Eye Irrit. 2 H319 , STOT SE 3 H335 , Skin Irrit. 2 H315

■ **acenaphthene** (EC Number: 201-469-6, CAS Number: 83-32-9)

Description/Comments: Data from C&L Inventory Database

Data source: <http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database>

Data source date: 17 Jul 2015

Hazard Statements: Eye Irrit. 2 H319 , STOT SE 3 H335 , Skin Irrit. 2 H315 , Aquatic Acute 1 H400 , Aquatic Chronic 1 H410 , Aquatic Chronic 2 H411

■ **fluorene** (EC Number: 201-695-5, CAS Number: 86-73-7)

Description/Comments: Data from C&L Inventory Database

Data source: <http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database>

Data source date: 06 Aug 2015

Hazard Statements: Aquatic Acute 1 H400 , Aquatic Chronic 1 H410

■ **phenanthrene** (EC Number: 201-581-5, CAS Number: 85-01-8)

Description/Comments: Data from C&L Inventory Database

Data source: <http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database>

Data source date: 06 Aug 2015

Hazard Statements: Acute Tox. 4 H302 , Eye Irrit. 2 H319 , STOT SE 3 H335 , Carc. 2 H351 , Skin Sens. 1 H317 , Aquatic Acute 1 H400 , Aquatic Chronic 1 H410 , Skin Irrit. 2 H315

■ **anthracene** (EC Number: 204-371-1, CAS Number: 120-12-7)

Description/Comments: Data from C&L Inventory Database

Data source: <http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database>

Data source date: 17 Jul 2015

Hazard Statements: Eye Irrit. 2 H319 , STOT SE 3 H335 , Skin Irrit. 2 H315 , Skin Sens. 1 H317 , Aquatic Acute 1 H400 , Aquatic Chronic 1 H410

■ **fluoranthene** (EC Number: 205-912-4, CAS Number: 206-44-0)

Description/Comments: Data from C&L Inventory Database

Data source: <http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database>

Data source date: 21 Aug 2015

Hazard Statements: Acute Tox. 4 H302 , Aquatic Acute 1 H400 , Aquatic Chronic 1 H410

■ **pyrene** (EC Number: 204-927-3, CAS Number: 129-00-0)

Description/Comments: Data from C&L Inventory Database; SDS Sigma Aldrich 2014

Data source: <http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database>

Data source date: 21 Aug 2015

Hazard Statements: Skin Irrit. 2 H315 , Eye Irrit. 2 H319 , STOT SE 3 H335 , Aquatic Acute 1 H400 , Aquatic Chronic 1 H410

■ **indeno[123-cd]pyrene** (EC Number: 205-893-2, CAS Number: 193-39-5)

Description/Comments: Data from C&L Inventory Database

Data source: <http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database>

Data source date: 06 Aug 2015

Hazard Statements: Carc. 2 H351

▪ **benzo[ghi]perylene** (EC Number: 205-883-8, CAS Number: 191-24-2)

Description/Comments: Data from C&L Inventory Database; SDS Sigma Aldrich 28/02/2015
Data source: <http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database>
Data source date: 23 Jul 2015
Hazard Statements: Aquatic Acute 1 H400 , Aquatic Chronic 1 H410

Appendix B: Rationale for selection of metal species

arsenic {arsenic trioxide}

Reasonable case CLP species based on hazard statements/molecular weight and most common (stable) oxide of arsenic. Industrial sources include: smelting; main precursor to other arsenic compounds (edit as required)

cadmium {cadmium oxide}

Reasonable case CLP species based on hazard statements/molecular weight, very low solubility in water. Industrial sources include: electroplating baths, electrodes for storage batteries, catalysts, ceramic glazes, phosphors, pigments and nematocides. (edit as required) Worst case compounds in CLP: cadmium sulphate, chloride, fluoride & iodide not expected as either very soluble and/or compound's industrial usage not related to site history (edit as required)

chromium in chromium(III) compounds {chromium(III) oxide (worst case)}

Reasonable case species based on hazard statements/molecular weight. Industrial sources include: tanning, pigment in paint, inks and glass (edit as required)

chromium in chromium(VI) compounds {chromium (VI) compounds, with the exception of barium chromate and of compounds specified elsewhere in this Annex}

Worst case species based on hazard statements/molecular weight (edit as required)

copper {dicopper oxide; copper (I) oxide}

Reasonable case CLP species based on hazard statements/molecular weight and insolubility in water. Industrial sources include: oxidised copper metal, brake pads, pigments, antifouling paints, fungicide. (edit as required) Worst case copper sulphate is very soluble and likely to have been leached away if ever present and/or not enough soluble sulphate detected. (edit as required)

lead {lead chromate}

Worst case CLP species based on hazard statements/molecular weight (edit as required)

mercury {mercury dichloride}

Worst case CLP species based on hazard statements/molecular weight (edit as required)

nickel {nickel chromate}

Worst case CLP species based on hazard statements/molecular weight (edit as required)

selenium {nickel selenate}

Worst case CLP species based on hazard statements/molecular weight (edit as required)

zinc {zinc oxide}

Worst case compound based on absence of CrVI and assumed metal oxides from a combustion, ash based source.

vanadium {divanadium pentaoxide; vanadium pentoxide}

worst case/most likely scenario

Appendix C: Version

HazWasteOnline Classification Engine: WM3 1st Edition v1.1, May 2018
HazWasteOnline Classification Engine Version: 2020.346.4563.8832 (11 Dec 2020)
HazWasteOnline Database: 2020.346.4563.8832 (11 Dec 2020)

This classification utilises the following guidance and legislation:

WM3 v1.1 - Waste Classification - 1st Edition v1.1 - May 2018

CLP Regulation - Regulation 1272/2008/EC of 16 December 2008

1st ATP - Regulation 790/2009/EC of 10 August 2009

2nd ATP - Regulation 286/2011/EC of 10 March 2011

3rd ATP - Regulation 618/2012/EU of 10 July 2012

4th ATP - Regulation 487/2013/EU of 8 May 2013

Correction to 1st ATP - Regulation 758/2013/EU of 7 August 2013

5th ATP - Regulation 944/2013/EU of 2 October 2013

6th ATP - Regulation 605/2014/EU of 5 June 2014

WFD Annex III replacement - Regulation 1357/2014/EU of 18 December 2014

Revised List of Waste 2014 - Decision 2014/955/EU of 18 December 2014

7th ATP - Regulation 2015/1221/EU of 24 July 2015

8th ATP - Regulation (EU) 2016/918 of 19 May 2016

9th ATP - Regulation (EU) 2016/1179 of 19 July 2016

10th ATP - Regulation (EU) 2017/776 of 4 May 2017

HP14 amendment - Regulation (EU) 2017/997 of 8 June 2017

13th ATP - Regulation (EU) 2018/1480 of 4 October 2018

14th ATP - Regulation (EU) 2020/217 of 4 October 2019

15th ATP - Regulation (EU) 2020/1182 of 19 May 2020

POPs Regulation 2019 - Regulation (EU) 2019/1021 of 20 June 2019

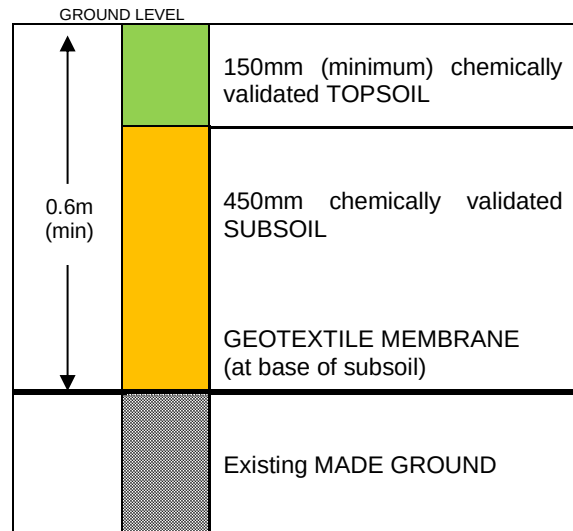
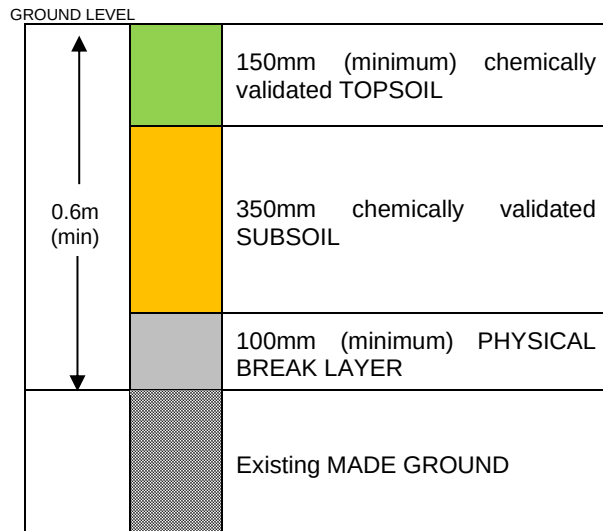
Appendix H

Environmental Cover System Construction

Private Gardens
Shared Landscaping

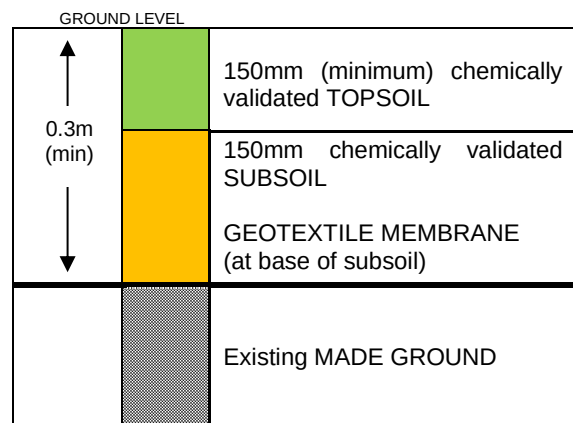
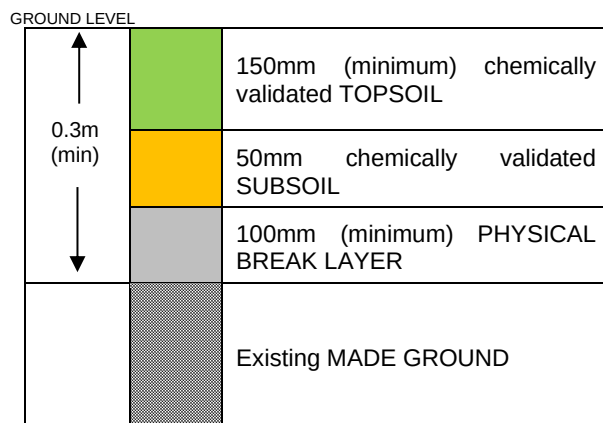
PRIVATE BACK GARDENS:

Either (physical break layer)
Or (geotextile membrane)



PRIVATE FRONT GARDENS / SHARED LANDSCAPING:

Either (physical break layer)
Or (geotextile membrane)



Hardstood Areas – No Remediation Required

Based across the UK with
offices in Manchester,
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- » Geotechnical
- » Contaminated Land
- » Flood Risk and Drainage
- » Asbestos
- » Invasive Species
- » Land Remediation
- » Project Management
- » Land Drilling