BROWNFIELD SOLUTIONS LTD

GEO-ENVIRONMENTAL ENGINEERING EXCELLENCE

# REAL ESTATE INVESTMENT PARTNERSHIPS LTD

Thomas Street, Manchester

Geo-Environmental Assessment Report

JW/C3742/9352

June 2020

| EXECUTIVE SUMMARY | |
|---|---|
| **Location and Brief Site Description** | The site is located off Thomas Street, Manchester, and covers an area of circa 500m2.<br>The site comprises a 3-storey vacant commercial building with basement, next to a derelict, unstable 2-storey building with basement.<br>Generally, the site is flat, and is bordered on all sides by mixed commercial and residential areas. |
| **Ground Conditions** | Made ground was encountered in all locations up to 0.86m bgl, comprising generally of either gravelly sandy clay or sandy gravel.<br>Natural strata comprised firm to stiff clay with minor constituents or silt, sand and gravel. |
| **Human Health Risk Assessment - Soil Contamination** | No contaminants were identified above the relevant screening criteria, confirmatory testing is recommended post demolition, although the overall risks are considered to be low at this stage. |
| **Ground Gas** | No ground gas monitoring was undertaken due to access constraints. It is recommended that supplementary investigation is undertaken to install gas monitoring wells. |
| **Controlled Waters** | Th overall risks to controlled waters are considered to be low at this stage, subject to confirmatory post demolition investigations. |
| **Outline Remedial Strategy** | There are no specific remedial requirements at this stage. |
| **Waste** | All five samples screened using the HazWasteOnline tool found the samples to be non-hazardous. The one WAC test undertaken exceeded the inert criteria for antimony. It is likely that soils will be accepted at a non-hazardous waste facility. |
| **Foundations and Floor Slabs** | Further investigation will be required in order to inform preliminary geotechnical design and to confirm the required foundation solution, alongside floor slab requirements. |
| **Highways** | CBR values of 3-6% are likely to be achieved in made ground and natural soils. |
| **Drainage** | Soakaways are not likely to be suitable on-site, given the relatively impermeable nature of the soils encountered on-site. |
| **Further Work** | The following are required to progress the site to the construction phase:<br>• Supplementary Intrusive site investigations and update the findings of this report.<br>• Demolition Asbestos survey.<br>• Detailed foundation design. |

This executive summary should be read in conjunction with the full report, reference JW/C3742/9352,and not as a standalone document.

## PROJECT QUALITY CONTROL DATA SHEET

| | | | |
|---|---|---|---|
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| C3742/02 | - | Exploratory Hole Location Plan |
| C3742/03 (01-03) | - | Foundation Profiles |

## APPENDICIES

| Appendix | Title |
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| Appendix A | BSL Methodology and Guidance |
| Appendix B | Exploratory Hole Logs |
| Appendix C | Chemical Testing Results |
| Appendix D | Waste Assessment Report |

# 1.0 INTRODUCTION

## 1.1 Context

This report describes a Geo-Environmental Assessment carried out by Brownfield Solutions Limited (BSL) for Real Estate Investment Partnerships Ltd as instructed by Renaissance Engineers Ltd on a site off Thomas Street, Manchester and has been completed in general accordance with the following guidance:

- Environment Agency guidance - Land Contamination: Risk Management (LCRM).
- CLR11 - Model Procedures for the Management of Land Contamination.
- BS 10175:2011+A2:2017 Investigation of Potentially Contaminated Sites.
- BS5930: 2015 Code of Practice for Ground Investigations.
- BS EN 1997-1:2004+A1:2013 Eurocode 7. Geotechnical design. General rules plus UK National Annex.
- BS EN 1997-2:2007 Eurocode 7 Geotechnical design. Ground investigation and testing plus UK National Annex.

A glossary of terms used within this report is presented in Section 10.0.

## 1.2 Objectives and Scope

The objectives of this Geo-Environmental Assessment were to determine the environmental setting and ground conditions of the site, highlighting potential risks and areas of concern that may govern the development under the current planning regime. This assessment is also intended to fulfil the requirements of a Ground Investigation Report (GIR) as detailed in BS EN 1997-2:2007.

An exploratory intrusive investigation was undertaken to confirm the findings of the preliminary CSM and risk assessment and meet any objectives that had not been satisfied. The exploratory investigation was undertaken using hand excavated trial pitting, rotary coring, cable percussive drilling, laboratory chemical and geotechnical testing, with reporting on the findings.

## 1.3 Proposed Development

No detailed plans have been provided; however, we understand the proposed development is for a residential lead development comprising up to 5 storeys of apartments over a ground floor retail area. A full footprint basement is also being considered at this stage.

## 1.4 Previous Reports

This report should be read in conjunction with Renaissance Phase 1 Desk-Top Study (1601-09) issued in June 2016.

## 1.5 Limitations

This assessment has been prepared in accordance with the relevant current legislative framework, guidance and risk assessment methodology as outlined in Appendix A. BSL is not liable for any subsequent changes in the guidance and legislation.

The findings and opinions conveyed via this report are based on information obtained from a number of sources as detailed within this report, BSL have assumed this information is correct and reliable. Nevertheless, BSL cannot and does not guarantee the authenticity or reliability of the information it has relied upon.

BSL have used reasonable skill, care and diligence for the investigation of the site and the production of this report. There may be other conditions prevailing on the site which are outside the scope of work and have not been highlighted by this assessment and therefore have not been considered by this report. Responsibility cannot be accepted for such site conditions not revealed by the assessment.

This report has been prepared for the sole use and reliance of the Client, Real Estate Investment Partnerships Ltd. No other third parties may rely upon or reproduce the contents of this report without the written permission of Brownfield Solutions Ltd (BSL). If any unauthorised third party comes into possession of this report, they rely on it at their own risk and BSL do not owe them any Duty of Care.

The investigation carried out on the site has been conducted to provide the best information on the ground conditions within site access and budgetary constraints. The inherent variation of ground conditions allows only for definition of the actual conditions at the locations and depths of exploratory locations at the time of the investigation. Different ground conditions may exist that have not been identified within this investigation.

The recommendations in this report assume that ground levels will remain as existing, unless stated otherwise within the report. If there is to be any re-profiling (e.g. to create development platforms or flood defences) then the recommendations may not apply.

The groundwater results described are only representative of the dates on which they were recorded, and levels may vary seasonally (e.g. due to changes in weather).

This assessment has been based on the proposed planning layouts provided. Any subsequent change to the planning layout may have an impact on the validity of recommendations made within this report. Furthermore, new information, changed practices or new legislation may necessitate revised interpretation of the report after the date of its submission.

Although every effort has been made to position exploratory holes in the least sensitive areas of the site, exploratory hole positions were located approximately as part of this investigation and no guarantee can be given as to their accuracy. Consideration should be given to the possibility that exploratory holes excavated as part of this investigation and indeed any previous ground investigation work by others may be encountered beneath or within the influence of individual foundations. BSL cannot be held responsible for structural failures caused by the location of foundations of any form of structure within the influence of exploratory holes.

Where it has not been possible to reasonably use an EC7 compliant investigation technique, a practical alternative has been adopted to obtain indicative soil parameters and any interpretation is based upon engineering experience, local precedent where applicable and relevant published information.

The chemical testing carried out for this report was not scoped to comply with the requirements of the water supply company and further work may be required, unless otherwise stated.

Notwithstanding site observations concerning the presence or otherwise of archaeological issues, asbestos-containing materials (ACM) or invasive weeds (e.g. Japanese knotweed), this report does not constitute a formal survey of these potential issues.

The site plans enclosed in this report should not be scaled off. Any site boundary line depicted on plans does not imply legal ownership of land.

Any recommendations made in this report should be confirmed with the Regulatory Authorities prior to implementation to ensure compliance.

# 2.0 THE SITE

## 2.1 Location

The site is located off Thomas Street, Manchester, M4 1ER. It is situated in the Northern Quarter of Manchester City Centre, centred on National Grid Reference 384383, 398602 as shown on the Site Location Plan, Drawing No. C3742/01.

## 2.2 Site Description

A site walkover was undertaken on-site. The main site features and potential issues are detailed below and are shown on the Site Features Plan, Drawing No. C3742/02.

| Feature | Description |
|---|---|
| Site Area | The site covers approximately 500m$^2$. |
| Site Access | Access to the site is gained off Thomas Street to the north-east of the site. |
| Current Land Use and Site Features | The site comprises a three-storey vacant commercial building with basement between 42 and 46 Thomas Street. The units have, in recent years, been utilised as a clothing shop.<br>A derelict unstable two storey building with basement, adjoining 42 to 46 is present at 48 to 50 Thomas Street. This area of the site was inaccessible due to unsafe conditions. |
| Potential Sources of Gross Contamination | Evidence of a workshop is present in an area of the basement, with paint pots, spray paints and paint powder stored on a small workbench. |
| Vegetation | There does not appear to be any vegetation on site. |
| Topography | The site is generally flat. |
| Site Boundaries | The site is open to the roads bordering the site on all sides. |
| Surrounding Area | The site is set within a mixed commercial and residential area, bordered generally by restaurants, bars and pubs. |

# 3.0 PREVIOUS REPORTS

## 3.1 Summary of Renaissance Desk Study

A summary of the relevant points from the Desk Study completed by Renaissance (ref 1601-09 issued in June 2016) is presented below:

- The site has had previous development since 1851. The detailed OS map of the area shows the site broadly developed as it is in its current state. Notable exceptions include the internal courtyard areas appear to not be infilled with development & No. 7 Kelvin Street doesn't appear to be constructed or developed to its current state. It also appears that the constructions to Back Turner Street are not connected to those fronting Thomas Street.
- Geology comprises drift deposits of Till (clay, sands and gravels, Secondary Undifferentiated Aquifer) over Chester Pebble Beds Formation (sandstone, Principle Aquifer).
- A fault is indicated to the immediate south-west of the site and runs north-west to south-east. The feature is described as a normal fault.
- The Groundsure documentation suggests there is no evidence of past or present underground coal mining.
- There are no records of landfill sites within 250m of the site.
- The nearest surface water receptor is a small pond and stream located 450m north-west of the site and the nearest named watercourse is the Rochdale Canal is located approximately 520m south-east, whilst the River Irwell is located approximately 560m west of the site.
- The site is located in a Zone 1 floodplain and the risk of flooding is very low.
- The risk to human health is considered to be low to moderate.
- The development end use risk is low to moderate.
- The risk to controlled waters is low to moderate.
- The risk from gas is low to moderate.
- The site is not located in an area requiring radon precautions in foundations.
- The site is located in the UXO moderate risk zone.
- The report recommended that a detailed phase II ground investigation should be carried out.

# 4.0 METHOD OF INVESTIGATION

## 4.1 Objectives

To confirm the risks to the identified receptors and confirm the ground conditions in respect to the identified geotechnical and geo-environmental risks, an appropriate intrusive investigation was undertaken as per the recommendations of the Phase I Desk Study Assessment.

The aim of the fieldwork was to:

- Investigate ground conditions on the site and the potential need for detailed investigation.
- Install standpipes to allow future monitoring.
- Assess the potential contamination on the site and obtain samples for contamination screening.
- Assess the potential impact of any contamination on controlled waters.
- Obtain geotechnical information on the ground conditions at the site for preliminary foundation design and preliminary pavement design purposes.
- Give an assessment of the geo-environmental risks associated with redevelopment of the site.

## 4.2 Site Works

The following site works have been undertaken as part of the intrusive investigation between the dates of 14th and 15th February 2018.

| Method | No. | Range Depths (m bgl) | Purpose |
|---|---|---|---|
| Hand-excavated trial pits | 10 | 0.50 – 1.35 | Establish general ground conditions and gain good coverage. Assess foundation construction. |
| Rotary cores | 4 | NA | Assess basement wall construction. |

A cable percussive borehole was proposed to aid in the assessment of deeper ground conditions, for in-situ and laboratory geotechnical testing and for installation of a gas and groundwater monitoring borehole. However, when on-site, due to the abundance of services and constrained working area, it was not possible to drill this borehole to the required depths. Demolition of the remaining structures will therefore be required to facilitate access for further ground investigations to take place.

Because of these constraints, full geotechnical and gas monitoring data could not be obtained, limiting the scope of recommendations within this report.

The approximate locations of the exploratory holes are indicated on the Exploratory Hole Location Plan, Drawing No C3742/02. The exploratory hole logs are presented in Appendix B.

The exploratory holes were logged by an experienced geo-environmental engineer in general accordance with the following guidance:

- BS 5930:2015 Code of Practice for Site Investigations.
- BS EN 14688-1:2018 Geotechnical Investigation and Testing – Identification and classification of soil.

## 4.3 Sampling

During the drilling and excavation of the exploratory holes, representative samples were taken at regular intervals to assist in the identification of the soils and to allow subsequent laboratory testing. They were stored and transported in general accordance with BS 10175:2011+A2:2017.

The type of sample was dependent upon the stratum and the purpose of analysis in accordance with current environmental and geotechnical guidance.

The distribution of samples taken across the site is recorded on the exploratory logs and a summary of the samples taken is presented in the table below:

| Type | Number |
|---|---|
| Environmental (ES) | 17 |

## 4.4 Laboratory Testing

As part of the initial assessment for potential contamination of the site, selected samples were taken for the purpose of chemical contamination testing.

In the absence of particularly contaminative processes on site and the lack of visual evidence of potential hydrocarbon impaction representative soil samples were screened for the following general suite of determinands at a UKAS approved laboratory:

| Determinand | No of Samples |
|---|---|
| Arsenic, Cadmium, Chromium (III), Chromium (VI), Copper, Nickel, Mercury, Lead, Zinc, Selenium, speciated polycyclic hydrocarbons (PAH 16), free cyanide, phenols, soil organic matter and pH. | 5 |
| Waste Acceptance Criteria (WAC). | 1 |

The Chemical Laboratory Testing Results are presented in Appendix C.

No geotechnical sampling or testing was undertaken at the time of the site works, as cable percussive drilling works could not be completed to site constraints.

## 4.5 Monitoring

No ground gas and water monitoring standpipes were able to be installed and therefore no subsequent monitoring was undertaken.

# 5.0 GROUND CONDITIONS

A summary of the ground conditions encountered is presented in the table below:

| Stratum | Range Depths - Top (m bgl) | Range Depths - Base (m bgl) | Range Thickness' (m) | Brief Description |
|---|---|---|---|---|
| Made Ground | 0.00 | 0.18 – 0.86 | 0.18 – 0.86 | Concrete over gravelly sandy clay OR sandy gravel. |
| Natural Superficial | 0.18 – 0.86 | 0.50 – 1.35 | 0.14 – 0.80 | Slightly sandy clay OR organic clay |

Details are provided in the logs in Appendix B and the individual strata are described in the sections below.

## 5.1 Made Ground

Made ground was encountered in all of the hand excavated trial pit locations to depths of between 0.18m and 0.86m bgl. Hardstanding was encountered at each location and typically comprised concrete or paving slab to between 0.05m and 0.16mbgl.

Two types of made ground were encountered at the site; soft brown gravelly sandy clay with occasional ash, coal, and brick fragments to depths of up to 0.80m bgl and typically 0.40m in thickness and reddish brown sandy gravel with frequent brick cobbles and brick fragments to depths of up to 0.20m bgl and typically 0.15m in thickness.

A localised band of black gravelly sand with sandstone masonry and brick cobbles, as well as abundant ash was encountered in TP03 between 0.10m and 0.40m bgl.

*Existing Foundations*
Four core holes were bored into the existing basement walls on-site. Walls were recorded as between 0.24m and 0.35m in thickness and typically comprised of two to three courses of brickwork.

All existing foundations were founded on stiff brown slightly sandy clay. The founding depth and type of the existing building varied across the site and was approximately 1.00m in depth (0.94m-1.05m bgl), but shallower foundations were noted at approximately 0.35m bgl (0.34m-0.36m bgl). Foundations were typically brick to the base with no footing or stepping out noted, with exception to TP01 and TP04. TP01 encountered a brick step/footing at 0.86m to 0.94m bgl which extended 0.14m from the wall. A small step was recorded in TP04 at 0.27m which extended 0.08m from the wall, the foundation continued to 0.97m bgl.

The existing foundations for TP08 were different to those above. A new wall appears to have been constructed internally within the building structure which founded at 0.10mbgl. The external wall which was 0.37m further back was founded at a depth of 0.58mbgl. The base of the foundation for TP09 and TP10 were not encountered and are therefore assumed to be greater than 1.30mbgl.

Existing foundations are detailed on drawing ref C3742/03.

## 5.2 Natural Superficial Strata

The natural strata underlying the site was generally firm to stiff clay with varying amounts of silt, sand and gravel as minor constituents.

A soft dark grey organic clay was encountered within TP05 from 1.30m to 2.30m and TP13 at 0.30m to 0.80m.

Shear vane readings in the cohesive soils indicate the clays are generally high strength.

### 5.3 Solid Geology

The solid geology of the Chester Formation was not encountered in this investigation.

### 5.4 Groundwater

Groundwater was encountered in five exploratory holes. The depths and locations are shown in the table below:

| Location | Depth during site works (m) |
|---|---|
| TP01 | 0.86 |
| TP07 | 0.34 |
| TP08 | 0.40 |
| TP09 | 0.70 |
| TP10 | 0.55 |

### 5.5 Observations

*Contamination*
During the works undertaken by BSL, no evidence for visual or olfactory contamination was observed.

*Excavations*
The sides of the trial pits were generally stable during excavation.

# 6.0 TEST RESULTS

## 6.1 Chemical Test Results - Soils

The samples were tested for an assessment of the chemical contamination and results were examined with reference to a selection of guidance documents as detailed in Appendix A. For reference, the Chemical Laboratory Testing Results are presented in Appendix H.

In this case the LQM/CIEH S4ULs and DEFRA C4SLs for a residential end use without homegrown produce have been adopted as Tier 1 generic screening values, which is considered to reflect the most sensitive development type (residential apartments), even with the ground floor likley to be used as a retail premises, although this is not fully confirmed.

The apparent exceedance of the relevant screening value for a residential without homegrown produce end use is taken as indicating further detailed assessment or remedial action is required.

*Metals*
One sample tested contained the following elevated determinands:

| Location | Metal | Concentration (mg/kg) | S4UL (mg/kg) |
|---|---|---|---|
| TP01 0.10 – 0.80m bgl | Mercury | 1.90 | 1.20 |

Despite being marginally in exceedance of the assessment criteria, the mercury concentrations remain below the Normal Background Concentrations for mercury in English soils in an urban environment as outlined in the Defra Technical Guidance Sheet on normal levels of contaminants in English soils: Mercury (2012). Additionally, the generic assessment criteria are based on the S4ULs, which for mercury can be further subdivided into its elemental, inorganic, and methyl forms, however laboratory testing only identifies the total mercury concentration (without specifying which form).

It is considered unlikely that mercury present in the made ground exists as elemental mercury, which is liquid at room temperature and very volatile at low temperatures, any elemental mercury is likely to have dissipated as a vapour. It is therefore considered more likely that the elevated levels of mercury observed in the made ground exist in the inorganic (GAC - 40mg/kg) or methyl forms (GAC - 11mg/kg), for which the S4ULs have not been exceeded and therefore no further consideration is required.

*Poly Aromatic Hydrocarbons (PAHs)*
No elevated PAHs have been detected above residential end use (without homegrown produce) screening values.

## 6.2 Waste Acceptance Criteria (WAC) Results

Wastes need to be classified based on their total concentrations and classified as either hazardous or non-hazardous waste. This is discussed in detail in Section 10.7. WAC testing is only required if the end disposal route is a landfill and WAC analysis must not be used for waste classification.

The Landfill Directive (Directive 1999/31/EC on the landfilling of waste, Decision 2003/33/EC and Landfill Regulations 2005) led to the establishment of a methodology for classifying wastes. Wastes can only be accepted at a landfill if they meet the relevant Waste Acceptance Criteria (WAC) for that type of landfill. A waste must comply with the WAC limits for the relevant landfill, otherwise the soil will need to be pre-treated. There are three different WAC criteria, these are:

- Inert waste.
- Stable Non-Reactive Hazardous Waste (SNRHW).
- Hazardous waste.

There are no standard set of WAC limits for non-hazardous landfill sites and each non-hazardous landfill will have its own set of criteria under which it is licenced to accept non-hazardous waste. These will need to be determined through the selected waste receiver prior to disposal.

A non-hazardous waste should not be compared with WAC limits for hazardous or SNRHW waste sites and the WAC test should only be used to determine if the waste is suitable for disposal at an inert waste landfill site. Likewise, wastes classified as hazardous based on their total concentrations should not be compared with WAC limits for inert waste landfill sites, as these will not be accepted.

As part of the investigations to date, solid and eluate WAC analysis was undertaken on one sample, the result of which is presented in the table below.

The WAC analysis results are presented in Appendix C and assessed in detail Section 10.7 of this report.

# 7.0 GEOTECHNICAL ASSESSMENT

## 7.1 Ground Model Summary

The site currently comprises a three-storey vacant commercial building with a basement between 42 and 46 Thomas Street. The units were recently used as a clothing shop. At 48-50 Thomas Street, a derelict, unstable two-storey building with a basement is present.

Made ground generally less than 1m thick was encountered in all locations, comprised of concrete over gravelly sandy clay and sandy gravel.

All existing foundations appear to be strip footings with brickwork founded directly on stiff brown slightly sandy clay. The founding depth and type of the existing building varied across the site and was approximately 1.00m in depth (0.94m-1.05m bgl), but shallower foundations were noted at approximately 0.35m bgl (0.34m-0.36m bgl).

The natural strata encountered beneath the made ground was generally stiff slightly sandy clay with rare coal fragments. Soft brown organic clay was encountered locally in TP09 and TP10 in the south-west of the site.

Groundwater strikes recorded during site works ranged between 0.34m and 0.86m bgl.

## 7.2 Soil Parameters

Geotechnical in-situ / laboratory testing has not been undertaken, due to access constraints. Given this, soil parameters cannot be assessed in detail at this stage for the proposed development type and it is recommended that once the on-site structures have been demolished, additional intrusive investigation are undertaken to obtain geotechnical information for design.

## 7.3 Foundations and Floor Slabs

The development will comprise up to 5 storeys of apartments over a ground floor retail area and is considered to be classed as Geotechnical Category 2 in accordance with Eurocode 7. A full footprint basement is also being considered at this stage.

Preliminary design cannot be undertaken at this stage due to the lack of geotechnical information obtained during the investigation and appropriate investigations ill be required.

The existing foundations as described in Section 5.1 comprise brick directly founding upon stiff brown slightly sandy clay. The founding depth and type of the existing building varied across the site and was approximately 1.00m in depth (0.94m-1.05m bgl). As detailed design proposals are not available, BSL cannot comment on the use of the existing foundations at this stage (e.g. if facades are to be retained, with existing foundations utilised as support). Detailed plans will be required as part of a full geotechnical assessment.

*UXO*
Based on the available information to date, specialist UXO advice and/or supervision will be required for all groundworks.

## 7.4 Site Preparation and Construction

There are a number of services crossing the site. To allow construction, all services will need to be disconnected and any suspected dead services are confirmed as dead by testing.

Instability of excavations through natural soils is not anticipated provided they are not exposed to adverse weather conditions for any substantial period of time. Instability of the made ground should be allowed for. All excavations should be carried out in accordance with CIRIA Report 97 'Trenching Practice'.

Excavation depths should generally be readily achieved using conventional plant (JCB or similar) although high specification plant (tracked 360° or similar) is recommended to maintain the build programme. Breaking equipment may also be required locally to penetrate old foundations associated with former construction / intact rock quality strata.

Dependant on requirements, it may be feasible to excavate the localised area of organic clay into the underlying superficial deposits to remove the organic clay deposits entirely. This material could then be replaced with suitable materials in an engineered manner, thus removing the development constraint.

### 7.5 Basement Construction

It is understood that a basement structure is proposed beneath the majority of the new structure. Depths to the base of the structure are not currently known to BSL. Due to the lack of geotechnical testing, we cannot provide detailed advice on basement construction at present, the following advice is general.

Provided the footprint of the existing basement is set to change, the following points will need to be considered in the design and construction of the basement:

- The method of excavation of materials within the basement.
- Temporary and permanent support of the excavation.
- Groundwater levels, control and water proofing of basement sidewalls/base.
- Active pressures from groundwater and the surrounding earth acting on the sidewalls/base.
- Potential settlement of adjacent structures or infrastructure due to ground deformation or dewatering.
- Differential settlement between the basement structure and other foundations or floor slab elements.
- Cut and fill requirements across the wider site.
- Floor heave/settlement.

### 7.6 Highways

Based on Table 5.1 from DMRB IAN 73/06 Rev 1 equilibrium CBR values of 3-6% are likely to be achieved in made ground and undisturbed natural clay soils for pavement design purposes, unless proven otherwise by in-situ testing at formation level by a specialist geotechnical engineer

Where the CBR is found to be less than 2%, the sub-grade is unlikely to be suitable for both the trafficking of site plant and as a permanent highway foundation without improvement of the soils.

Where soft organic clay is encountered beneath proposed pavements it is recommended that this is removed to mitigate against settlement.

Based on the fines content of the soils, they are considered to be frost susceptible, therefore highway construction should be a minimum thickness of 450mm to mitigate against the risk.

Care should be taken to ensure the stratum at formation level is protected against inclement weather, as this is likely to lead to surface deterioration and a decrease in soils strengths.

### 7.7 Soakaways

The use of soakaways within the natural ground is not feasible at the site due to the presence of relatively impermeable strata underlying the site.

# 8.0 ENVIRONMENTAL ASSESSMENT

## 8.1 Contamination

*Soils*
Based on the limited testing to date, no contaminants have been identified above the relevant screening criteria. It is recommended that following demolition of on-site structures, additional sampling and testing is undertaken during supplementary works for confirmatory purposes.

*Permanent Ground Gases*
As no ground gas monitoring wells were installed and no gas monitoring data is available, BSL cannot determine whether gas protection measures will be required at the development, and if they are, what level of protection would be required. It is recommended that following demolition of on-site structures, supplementary works are undertaken to install wells for monitoring purposes.

*Utilities*
The level of protection for the clean potable water supply pipes should be determined using the local water company risk assessment criteria in accordance with UKWIR.

As the site is brownfield, there is the assumption that barrier pipe would be utilised, although requirements should be confirmed by risk assessment and with the water supply company.

## 8.2 Qualitative Risk Assessment

The CSM has been revised based on the findings of the site investigation and laboratory testing results and these are presented overleaf. Unless stated otherwise, in respect to off-site sources, only risks that are assessed as moderate and above within the preliminary CSM have been carried forward to this section, or where a previously unidentified potential source, pathway and / or receptor has been identified from the recent site works.

| Human Health | | | | | | |
|---|---|---|---|---|---|---|
| Potential Source | Potential Pathway | Potential Receptor | Likelihood | Severity | Level of Risk | Justification |
| **(From previous Desk Study) On site Made Ground Underground Boilers / Tanks** Asbestos Heavy Metals PAHs Petroleum Hydrocarbons Sulphates | Ingestion, direct contact, inhalation of vapours | End-users | Unlikely | Medium | Low | No contaminants have been identified to date in respect to the proposed end use. Whilst no detailed proposals are available, much of the made ground is likley to be removed during the construction of a new basement across the site, thus also removing the potential source. No visual or olfactory evidence of petroleum hydrocarbon contamination was noted at the site. The presence of hardstanding at ground level and in the new full footprint basement will block any pathways for ingestion and direct contact. Risks are therefore considered to be low, subject to confirmatory testing in previously inaccessible areas. |
| **On site Made Ground Ground Gases** Carbon dioxide, methane, petroleum hydrocarbon vapours | Migration into confined spaces, inhalation and asphyxiation/ explosion | End-users / property / structures | Unlikely | Severe | Low to Moderate | Made ground is generally less than 1.00m thick across the site, with no significant putrescible matter, thus limiting the gas generation potential of this source, which is considered to be very low to negligible. Whilst the made ground on site will likley be removed, made ground is likely to extend off site in all directions, with this potential source remaining in situ. There are no records of any ground gas issues at the site known to BSL, where the structures have been in ongoing occupation through the last several decades and beyond. No visual or olfactory evidence of petroleum hydrocarbon contamination was noted at the site in relation to the potential for hydrocarbon vapour intrusion. However, confirmatory ground gas monitoring should be carried out as part of any post demolition investigations to confirm this assesses level of risk. |

| Controlled Waters | | | | | | |
|---|---|---|---|---|---|---|
| **Potential Source** | **Potential Pathway** | **Potential Receptor** | **Likelihood** | **Severity** | **Level of Risk** | **Justification** |
| **(From previous Desk Study) On site Made Ground Underground Boilers / Tanks** Heavy Metals PAHs Petroleum Hydrocarbons | Overland flow, / migration through saturated zone | Nearest surface water features >450m NW (Surface water) | Unlikely | Medium | Low | It is considered contaminants associated with the made ground and possible former tanks are unlikely to impact the nearest surface water features, which lie in excess of 450m away, which provides a considerable distance for attenuation and degradation to occur. In addition, the presence of low permeability glacial Till will inhibit lateral migration. Therefore, a low risk is posed to surface water features. |
| | Leaching through unsaturated zone / Migration through saturated zone | Secondary Un-differentiated Aquifer in Superficial Deposits (Ground-water) | Unlikely | Medium | Low | The site is currently surfaced in hardstanding/structures and will remain so after development, inhibiting infiltration and thus leachate generation.<br>No visual or olfactory evidence of petroleum hydrocarbons was noted during the intrusive investigation to date that could potentially impact the underlying aquifer.<br>Furthermore, it is likley that much of the made ground will be removed for construction of the basement, removing the potential source. Therefore, the risk is considered to be low at this stage, subject to the findings of post demolition investigations. |
| | Migration through saturated zone | Principal Aquifer in Bedrock (Ground-water) | Unlikely | Medium | Low | As stated above, no visual or olfactory evidence of petroleum hydrocarbons was noted during the intrusive investigation to date that could potentially impact the underlying aquifer.<br>There are no groundwater abstraction licences or Source Protection Zones near the site.<br>In addition, the presence of low permeability glacial Till will inhibit vertical migration of any contaminants.<br>The risk is considered to be low at this stage, subject to the findings of post demolition investigations. |

## 8.3 Summary of Identified Risks

*Human Health*
The overall risks to human health are considered to be low at this stage, however additional sampling and testing, alongside ground gas monitoring, is recommended as part of any post demolition investigations for confirmatory purposes.

*Controlled Waters*
No significant potential sources of contamination have been identified to date and the risks are perceived to be low, although as stated above, confirmatory investigation will be required post demolition.

## 8.4 Remedial Measures

To date, no specific remedial measures are required, however further investigation and testing is recommended post demolition in previously inaccessible areas. Once investigations are completed, the findings of this report will be updated to confirm the level of risk and any remedial measures, if any are required.

The level of protection for the clean potable water supply pipes should be determined using the local water company risk assessment criteria in accordance with UKWIR, although it is assumed barrier pipe will be adopted given the brownfield nature of the site.

*General*
It is recommended that the approval of the Regulators (Local Authority/Environment Agency) is obtained in regard to the above prior to any irrevocable action is taken at the site.

A watching brief is recommended during groundworks for any unidentified sources of contamination. If any gross contaminated material is encountered works should cease in that area and BSL consulted.

## 8.5 Health and Safety Issues

During the reclamation and construction phases of the site development it will be necessary to protect the health and safety of site personnel. The risk to construction and ground workers is assessed in the table below:

| Potential Source | Potential Pathway | Potential Receptor | Likelihood | Severity | Level of Risk |
|---|---|---|---|---|---|
| Made Ground (heavy metals, PAHs) | Ingestion, direct contact, inhalation of dusts. | Construction Workers | Low likelihood | Mild | Low |
| Asbestos | Ingestion, direct contact, inhalation of dusts. | Construction Workers | Low likelihood | Medium | Moderate/low |

The risk from made ground will be mitigated by standard PPE including gloves. Welfare facilities should be made available to wash before hand to mouth activities.

General guidance on these matters is given in the Health and Safety Executive (HSE) document “Protection of Workers and the General Public during the Redevelopment of Contaminated Land”. In summary, the following measures are suggested to provide a minimum level of protection:

- All ground workers should be issued with the relevant protective clothing, footwear and gloves. These protective items should not be removed from the site and personnel should be instructed as to why and how they are to be used.
- Hand-washing and boot-washing facilities should be provided.
- Care should be taken to minimise the potential for off-site migration of contamination by the provision of dust suppression control and wheel cleaning equipment during the construction works.
- Good practices relating to personal hygiene should be adopted on the site.
- The contractor shall satisfy the Health and Safety Executive with regard to any other matters concerning the health, safety and welfare of persons on the site.

## 8.6 Asbestos

The investigation of asbestos issues within structures was beyond the scope of this report. However, guidance from UK Government indicates that asbestos should be assumed to be present in buildings unless proven otherwise.

Any asbestos within structures will require removal prior to re-development. This will need to be done by a suitably qualified experienced and licensed contractor, who ensures that adequate PPE is provided to operatives, and that all the relevant legislation is adhered to.

In addition, the presence of asbestos within the ground will require, a safe system of work to be set up on site to deal with the asbestos risk from the made ground. This may include but be not limited to:

- The use of qualified personnel where required.
- Careful segregation of stockpiles on site.
- Defining transport routes.
- Cleaning down of machinery in designated areas.
- Decontamination unit for ground workers.
- Damping down of soils to prevent dust migration.

Excavations in soils containing asbestos should comply with the CL:AIRE publication 'Interpretation for Managing and working with Asbestos in Soil and Construction and Demolition Materials' (CARSOIL) and CAR 2012. All such works will need to be agreed with the regulatory bodies (HSE and/or LA).

Additional guidance is provided within the BSL methodology Guidance Note in Appendix A.

## 8.7 Waste

As described in the 'Waste Duty of Care Code of Practice (2016)' any substance or object that the holder discards, intends to discard or is required to discard is a waste. It is the responsibility of the waste producer to classify this waste. The classification process is described in the 'Guidance on the classification and assessment of waste' WM3 and aims to determine whether the waste is Hazardous or Non-Hazardous to human health and the environment.

Any material excavated on site may be classified as waste and it is a statutory responsibility of the holder of a material to form their own view on whether or not it constitutes waste. This includes determining when waste that has been treated in some way can cease to be classed as waste for a particular purpose.

The most sustainable and economic method of dealing with waste soil is usually the retention and re-use on site. If soils are required to be removed from site, then there are three main options for the disposal of soils:

1. Re-use on another site (subject to suitability of the soils and complying with relevant waste legislation).
2. Disposal to a permitted waste recycling facility.
3. Disposal to a landfill site.

Note that wastes should first be classified based on their total concentrations and given the classification of either hazardous or non-hazardous. WAC testing is then **only** required if the end disposal route is landfill.

Leaching test results obtained as part of landfill WAC analysis must **not** be used for waste classification and hazardous waste assessment purposes.

Details of how material should be classified for waste disposal are presented in the BSL Methodology and Guidance in Appendix A and are summarised in the table below:

| | PRIOR TO LEAVING SITE | | | |
|---|---|---|---|---|
| **Classification based on Total Concentrations[1]** | **Non-Hazardous Waste** | | **Hazardous Waste** | |
| | IF SOILS CANNOT BE RE-USED ELSEWHERE AND MUST GO TO LANDFILL | | | |
| **WAC testing** | Below inert WAC limit values | Above inert WAC limit values | Below hazardous WAC limit values[4] | > WAC limit values |
| **Landfill requirements** | INERT landfill | NON-HAZARDOUS landfill[2] | HAZARDOUS landfill | PRE-TREATMENT[3] |

1 Total concentrations are defined as tests results on solids as opposed to leachate (i.e. a liquid).
2 Individual sites may have certain limit values pre-determined in their licence.
3 After pre-treatment the material characteristics may have changed to an extent that allow the soil to be re-classified.
4 Possibility that wastes could be classified as stable Nonreactive HAZARDOUS waste in non-hazardous Landfill (e.g. soils containing low concentrations of asbestos, gypsum or sulphate bearing soils).

Waste classified as non-hazardous can be accepted into a non-hazardous landfill without having to pass any numerical WAC.

Soils above hazardous WAC limit values require pre-treatment prior to disposal. The effective pre-treatment, typically involving separation, sorting and screening, can offer cost savings through reducing the hazardous nature and volumes of soil. Costs for disposal of non-hazardous/hazardous soils are significant compared to the disposal of inert material.

*Waste Classification - Total Concentrations and WAC Analysis*
We have reviewed the testing results and assessed them through a waste classification database which allows users to code and classify waste as defined in the EWC (European Waste Catalogue) based on EC Regulation 1272/2008 on the Classification, Labelling and Packaging of Substances and Mixtures (CLP) and latest Environment Agency guidance (WM3 "Guidance on the classification and assessment of waste - Technical Guidance").

Five samples were tested to assess whether they contained any contaminants in the hazardous range when screened against assessment criteria within WM3.

The results are presented in the table below, alongside the Waste Assessment Criteria (WAC) test results:

| Location | Depth (m) | Strata Type | Waste Classification | WAC Analysis | Comments |
|---|---|---|---|---|---|
| TP01 | 0.10 – 0.80 | MG: Slightly gravelly slightly sandy clay. | Non-Hazardous | NA | NA |

| Location | Depth (m) | Strata Type | Waste Classification | WAC Analysis | Comments |
|---|---|---|---|---|---|
| TP03 | 0.10 – 0.40 | MG: Gravelly sand with ash and cobbles. | NA | Stable Nonreactive HAZARDOUS waste in non-hazardous Landfill | Exceeds limits for antimony |
| TP04 | 0.20 – 0.30 | MG: Slightly gravelly slightly sandy clay. | Non-Hazardous | NA | NA |
| TP04 | 0.30 – 0.40 | Slightly sandy CLAY. | Non-Hazardous | NA | NA |
| TP08 | 0.30 | MG: Slightly gravelly slightly sandy clay. | Non-Hazardous | NA | NA |
| TP10 | 0.30 | MG: Slightly gravelly slightly sandy clay. | Non-Hazardous | NA | NA |

*Asbestos*

Asbestos testing was outside of the scope of this investigation. However, given the age of the on-site structures, it is likely that asbestos was utilised in construction at some point. Confirmatory testing is recommended post demolition.

During future groundworks, a watching brief should be maintained for evidence of Asbestos Containing Materials (ACMs), any ACMs observed should be handpicked and disposed of in accordance with current asbestos disposal regulations.

The possibility of automatic inert classification of the naturally occurring "clean" soils should be explored in accordance with Section 4.3 of the EA guidance document. The Council Decision includes a list of wastes in Section 2.1.1 of the document that are assumed to be inert and therefore acceptable at a landfill for inert waste without testing. This is the case if:

- They are single stream waste of a single waste type (although different waste types from the list may be accepted together if they are from a single source); and
- There is no suspicion of material or substances such as metals, asbestos, plastics, chemicals, etc to an extent which increases the risk associated with the waste sufficiently to justify contamination and they do not contain other classes of landfill.

*General*

If any gross hydrocarbon contaminated material is encountered during the construction phase, it is possible that this may be classified as hazardous and testing should be undertaken at that time.

Where it is necessary to dispose material off site it is recommended that materials are segregated and sufficient time is allowed to further classify the actual soil arisings that constitute the waste, including discussion with landfill sites and waste transfer stations to find the best disposal route. It is illegal to dilute and mix soils without a suitable permit.

*Re-use of Soils*

By definition in law, any material excavated from the ground becomes waste at the moment of excavation. If that soil (now a "waste") is then placed on another part of the development site (or used on another development site) without an appropriate materials management plan, permit or exemption being in place, by law this material is defined as "illegally deposited waste".

Landfill tax rules were updated on 1 April 2018 and as a result of the change, HM Revenue & Customs (HMRC) can now recover landfill tax on illegally deposited waste on construction sites. This could lead to excessive costs without the correct documentation in place. In addition, a person who makes, knowingly causes or knowingly facilitates a disposal to be made at an unauthorised site, is now also liable to pay Landfill Tax.

In order to comply with UK legislation and avoid excessive costs, if the re-use of soils is proposed on site, this should be done in accordance with the CL:AIRE "Development Industry Code of Practice for the Definition of Waste" (CL:AIRE DoWCoP) also known as a Materials Management Plan (MMP). Regardless of implementing the DoWCoP or not, all sites should have some form of materials tracking in place in compliance with current legislation. Any re-use scheme should also be designed to minimise disposal costs. Further guidance is provided in the BSL Methodology and Guidance in Appendix A.

# 9.0 CONCLUSIONS

## 9.1 Summary

*Environmental*
The overall risks to human health are considered to be low to low/moderate at this stage, and the overall risk to controlled waters are considered to be low. However, much of the site remained inaccessible at the time of the site works, therefore further confirmatory works are recommended post demolition.

Based on the testing undertaken to date, the waste classification assessment reveals the majority of the soils on site are likley to be classed as non-hazardous.

*Geotechnical*
As the cable percussive borehole could not be completed s part of initial site works, and the remainder of the site remains inaccessible, there is no in-situ or laboratory geotechnical testing available to provide preliminary geotechnical recommendations, including foundation solutions and floor slabs.

It is recommended that investigation is undertaken to obtain information on ground conditions to facilitate geotechnical design, once all on-site structures have been demolished.

Soakaways are unlikely to be feasible at the site, given the presence of relatively impermeable ground conditions underlying the site and the nature of the development.

## 9.2 Further Work

The following further work is considered necessary to progress the site to construction phase:

- Supplementary intrusive site investigations comprising cable percussive drilling, chemical and geotechnical laboratory testing and updates to the assessments within this report.
- Demolition Asbestos survey.
- Detailed foundation design.

## 10.0 GLOSSARY

| GLOSSARY | |
|---|---|
| **Term / Acronym** | **Definition** |
| **AST** | Above Ground Storage Tank. |
| **BaP** | Benzo (a) Pyrene. |
| **BGS** | British Geological Survey. |
| **BRE** | Building Research Establishment. |
| **BS** | British Standard. |
| **BSL** | Brownfield Solutions Ltd. |
| **BTEX** | Benzene, Toluene, Ethylbenzene, Xylenes. |
| **CAR 2012** | Control of Asbestos Regulations (2012). |
| **CBCB** | Cheshire Brine Compensation Board. |
| **CBCD** | Cheshire Brine Compensation District. |
| **CBR** | California Bearing Ratio. |
| **CIEH** | Chartered Institute of Environmental Health. |
| **CIRIA** | Construction Industry Research Association. |
| **CL:AIRE** | Contaminated Land: Applications in Real Environments. |
| **CLEA** | Contaminated Land Exposure Assessment. |
| **CLO** | Contaminated Land Officer. |
| **COMAH** | Control of Major Accident Hazards. |
| **Contamination** | Presence of a substance which is in, on or under land, and which has the potential to cause significant harm or to cause significant pollution of controlled water.<br>There is no assumption in this definition that harm results from the presence of the contamination.<br>Naturally enhanced concentrations of harmful substances can fall within this definition of contamination.<br>Contamination may relate to soils, surface water, groundwater or ground gas. |
| **Controlled Waters** | Inland freshwater (any lake, pond or watercourse above the freshwater limit), water contained in underground strata and any coastal water between the limit of highest tide or the freshwater line to the three-mile limit of territorial waters. |
| **CPT** | Cone Penetration Test. |
| **CSM** | Conceptual Site Model. A schematic hypothesis of the nature and sources of contamination, potential migration pathways (including description of the ground and groundwater) and potential receptors, developed on the basis of the information from the preliminary investigation and refined during subsequent phases of investigation and which is an essential part of the risk assessment process. The conceptual site model is initially derived from the information obtained by the preliminary investigation (i.e. the Phase I Desk Study). This conceptual model is used to focus subsequent investigations, where these are considered to be necessary, in order to meet the objectives of the investigations and the risk assessment. The results of intrusive investigations can provide additional data that can be used to further refine the conceptual site model. |
| **DCP** | Dynamic Cone Penetrometer. |
| **DNAPL** | Dense Non-Aqueous Phase Liquid. |
| **DoWCoP** | Definition of Waste Code of Practice. |
| **DWS** | Drinking Water Standard. |
| **EA** | Environment Agency. |
| **EHO** | Environmental health Officer. |
| **EQS** | Environmental Quality Standard. |
| **GAC** | Generic Assessment Criteria. |
| **GDR** | Geotechnical Design Report. |

| GLOSSARY | |
|---|---|
| **Term / Acronym** | **Definition** |
| **GFR** | Geotechnical Feedback Report. |
| **GIR** | Ground Investigation Report. |
| **GSV** | Gas Screening Value. |
| **Harm** | Adverse effect on the health of living organisms, or other interference with ecological systems of which they form part, and, in the case of human health, including property/structures and water supply pipelines. |
| **Hazard** | Inherently dangerous quality of a substance, procedure or event. |
| **HDPE** | High Density Polyethylene. |
| **HSV** | Hand Shear Vane. |
| **K** | Modulus of Subgrade Reaction. |
| **LCRM** | Land Contamination: Risk Management (EA guidance). |
| **LNAPL** | Light Non-Aqueous Phase Liquid (petrol, diesel, kerosene). |
| **LOD** | Limit of Detection (for particular method adopted). |
| **MMP** | Materials Management Plan. |
| **Mv** | Modulus of Volume of Compressibility. |
| **ND** | Not Detected. |
| **NHBC** | National House Building Council. |
| **NR** | Not Recorded. |
| **OS** | Ordnance Survey. |
| **PAH** | Polycyclic Aromatic Hydrocarbon. |
| **Pathway** | Mechanism or route by which a contaminant comes into contact with, or otherwise affects, a receptor. |
| **PCB** | Poly-Chlorinated Biphenyl. |
| **PCSM** | Preliminary Conceptual Site Model. |
| **pH** | Scale used to specify how acidic or basic a water-based solution is. |
| **PH** | Petroleum Hydrocarbons (not to be confused with pH scale). |
| **PID** | Photo Ionisation Detector. |
| **PNEC** | Predicted No-Effect Concentration. |
| **Precision** | Level of agreement within a series of measurements of a parameter. |
| **PSD** | Particle Size Distribution. |
| **PVC** | Polyvinyl Chloride. |
| **Receptor** | Human health, living organisms, ecological systems, controlled waters (surface waters and groundwater within aquifers), atmosphere, structures and utilities that could potentially be adversely affected by contaminant(s). |
| **Risk** | Probability of the occurrence, magnitude and consequences of an unwanted adverse effect on a receptor. |
| **Risk Assessment** | Process of establishing, to the extent possible, the existence, nature and significance of risk. |
| **Sampling** | Methods and techniques used to obtain a representative sample of the material under investigation. |
| **SOM** | Soil Organic Matter. |
| **Source** | Location from which contamination is, or was, derived. This could possibly be the location of the highest soil, groundwater or gas concentration of the contaminant(s). |
| **SPT** | Standard Penetration Test. |
| **SVOCs** | Semi Volatile Organic Compounds. |
| **TOC** | Total Organic Carbon. |
| **TPH CWG** | Total Petroleum Hydrocarbon (Criteria Working Group). |
| **TVOCs** | Total volatile organic compounds. |

| GLOSSARY | |
|---|---|
| **Term / Acronym** | **Definition** |
| **UCS** | Unconfined Compressive Strength. |
| **Uncertainty** | Parameter, associated with the result of a measurement that characterises the dispersion of the values that could reasonably be attributed to the measurement. |
| **UST** | Underground Storage Tank. |
| **UXO** | Unexploded Ordnance. |
| **VCCs** | Vibro Concrete Columns. |
| **VOCs** | Volatile Organic Compounds. |
| **WAC** | Waste Assessment Criteria. |
| **WFD (in waste context)** | Waste Framework Directive. |
| **WFD (in water context)** | Water Framework Directive. |
| **Units** | **Definition** |
| **°** | Degrees |
| **Φ** | Phi angle (in degrees) |
| **g/l** | Grams per Litre |
| **km** | Kilometres |
| **kPa** | Kilo Pascal (Equivalent to $kN/m^2$) |
| **$KN/m^2/mm$** | Kilo Newton per metered squared per millimeter |
| **$kN/m^2$** | Kilo Newtons per metre squared |
| **kPa** | Kilo Pascal (Equivalent to $kN/m^2$) |
| **l/hr** | Litres per hour |
| **MJ/kg** | Mega joule per kilogram |
| **MN** | Mega Newton |
| **$M^2/MN$** | Mega Newton per metre squared |
| **m** | Metres |
| **m bgl** | Metres Below Ground Level |
| **m OD** | Metres Ordnance Datum (sea level) |
| **µg/l** | Micrograms per Litre (parts per billion) |
| **µm** | Micrometre |
| **mb** | Millibars (atmospheric pressure) |
| **mg/kg** | Milligrams per kilogram (parts per million) |
| **$mg/m^3$** | Milligram per metre cubed |
| **mm** | Millimetre |
| **ppb** | Parts Per Billion |
| **Ppm** | Parts Per Million |

## 11.0 REFERENCES

Association of Ground Investigation Specialists. 'Guidelines for Good Practice in Site Investigation'. Issue 2, March 2006.

British Geological Survey Technical Report WD/97/34. 312pp. Environment Agency R&D Publication 8. 'The physical properties of major aquifers in England and Wales'. 1997.

British Geological Survey Technical Report WD/00/04. 234pp. Environment Agency R&D Publication 68 'The physical properties of minor aquifers in England and Wales'.

British Geological Survey 'The advanced soil geochemical atlas of England and Wales'. 2012.

BS 1377 'Method of Test for Soils for Civil Engineering Purposes'. 1990.

BS EN 1997-1. 'Eurocode 7 – Geotechnical design - Part 1: General rules'. Plus associated UK National Annex. 2004.

BS EN 1997-2. 'Eurocode 7 – Geotechnical design - Part 2: 'Geotechnical investigation and testing'. Plus associated UK National Annex. 2007.

BS 3882: 'Specification for topsoil'. 2015.

BS 5837: 'Trees in relation to design, demolition and construction Recommendations'. 2012.

BS 5930: 'Code of Practice for Site Investigations'. 2015.

BS 6031: 'Code of practice for earthworks'. 2009.

BS 8004: 'Code of practice for foundations'. 2015.

BS 8485+A1: 'Code of practise for the design of protective measures for methane and carbon dioxide ground gases for new buildings'. 2019.

BS 8500-1 AMD 2. Concrete. Complementary BS to BS EN 206. Part 1. 'Method of specifying and guidance for the specifier'. 2018.

BS 8576 'Guidance on investigations for ground gas – Permanent gases and Volatile Organic Compounds (VOCs)'. 2013.

BS 10175:2011+A2 'Investigation of Potentially Contaminated sites - code of practice'. 2017.

BS EN ISO 14688 'Geotechnical investigation and testing – Identification and classification of soil'. 2018.

BS EN ISO 14689 'Geotechnical investigation and testing – Identification and classification of rock'. 2018.

BS EN ISO 17892 'Geotechnical investigation and testing. Laboratory testing of soil.' Parts 1-12 :2018.

BRE Special Digest 1: 'Concrete in Aggressive Ground' 3rd Ed 2005.

BRE Report BR211, Scivyer, C. 'Radon – Guidance on protective measures for new buildings' 2015 Edition.

BRE Digest, vols. 240 and 241 'Low-rise buildings on shrinkable clay soils'. 1993.

BRE Digest 298 'The influence of trees on house foundations in clay soils'. 1999.

BRE Digest 365 'Soakaway Design'. 2016.

BRE Report 414. 'Protective measures for housing on gas contaminated land. Building Research Establishment Report'. 2011.

BRE Report 465 'Cover Systems for Land Regeneration'. 2004.

BRE Report 470 'Working platforms for tracked plant: good practice guide to the design, installation, maintenance and repair of ground-supported working platforms'. 2004.

CIRIA Special Publication SP32, PSA Civil Engineering Technical Guide 34, 'Construction over abandoned mine workings'. 1984.

CIRIA Special Publications 101-112, 'Remedial Treatment for Contaminated Land'. 1998.

CIRIA Special Publication 124, 'Barriers, liners and cover systems for containment and control of land contamination'. 1996.

CIRIA R143, 'The Standard Penetration Test (SPT): methods and use'. 1995.

CIRIA 149 'Protecting Development from Methane'. 1995.

CIRIA 150 'Methane Investigation Strategies'. 1995.

CIRIA 151 'Interpreting Measurements of Gas in the Ground'. 1995.

CIRIA 152 'Risk assessment for Methane and Other Gases from the Ground'. 1995.

CIRIA 552 'Contaminated Land Risk Assessment – A guide to good practice'. 2001.

CIRIA C659 'Assessing risks posed by hazardous ground gases to buildings.' 2006.

CIRIA C665 'Assessing Risks Posed by Hazardous Ground Gases to Buildings'. 2007.

CIRIA C681 'Unexploded Ordnance (UXO) A guide for the construction industry'. 2009.

CIRIA C716 'Remediating and mitigating risks from volatile organic compound (VOC) vapours from land affected by contamination'. 2012.

CIRIA C733 'Asbestos in Soil And Made Ground: A Guide To Understanding And Managing Risks'. 2014.

CIRIA C735 'Good Practice on The Testing and Verification of Protection Systems for Buildings Against Hazardous Ground Gases'. 2014.

CIRIA C748 'Guidance on the Use of Plastic Membranes as VOC Vapour Barriers'. 2014.

CIRIA C750 'Groundwater control: design and practice, second edition". 2016.

CIRIA C758 'Abandoned Mine Workings Manual'. 2019.

CL:AIRE and CIEH. 'Guidance on Comparing Soil Contamination Data with a Critical Concentration'. May 2008.

CL:AIRE 'The Definition of Waste: Development Industry Code of Practice'. Version 2. March 2011.

CL:AIRE RB17 'A Pragmatic Approach to Ground Gas Risk Assessment'. 2012.

CL:AIRE SP1010 'Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination'. Rev 2 2014.

CL:AIRE 'Interpretation for Managing and Working with Asbestos in Soil and Construction and Demolition Materials – CAR-SOILTM'. 2016.

CL:AIRE 'Petroleum Hydrocarbons in Groundwater: Guidance on assessing petroleum hydrocarbons using existing hydrogeological risk assessment methodologies' Version 1. March 2017.

DEFRA and the Environment Agency, CLR10 'Soil Guideline Value Reports for Individual Soil Contaminants'. 2002-2004.

DEFRA and the Environment Agency, CLR Report No 11 'Model Procedures for the Management of Contaminated Land'. 2004. [Withdrawn 2019.]

Department of the Environment, CLR Report No 1 'A framework for assessing the impact of contaminated land on groundwater and surface water'. 1994.

Department of the Environment, CLR Report No 2 'Guidance on Preliminary Site Inspection of Contaminated Land'. 1994.

Department of the Environment, CLR Report No 3 'Documentary research on Industrial Sites'. 1994.

Department of the Environment, CLR Report No 4 'Sampling Strategies for Contaminated Land'. 1994.

Department of the Environment Waste Management Paper No. 27. 'Landfill Gas: A Technical Memorandum Providing Guidance on the Monitoring and Control of Landfill Gas'. 1992.

Department of the Environment. 'Industry Profiles' - 48 separate publications available from The Stationery Office, London. 1995.

DETR. Circular: Contaminated Land. 2006.

EC Regulation 1272/2008 'The Classification, labelling and packaging of substances and mixtures (CLP)' 2008.

Environment Agency guidance - Land Contamination: Risk Management (LCRM). 2019.

Environment Agency 'Using Soil Guideline Values'. 2009.

Environment Agency, 'Updated Technical Background to the CLEA model'. 2009.

Environment Agency, 'Human health toxicological assessment of contaminants in soil'. 2009.

Environment Agency Hazardous Waste: 'Guidance on the classification and assessment of waste' WM3 ver 1.1 May 2018.

Environment Agency. 'Remedial Targets Methodology. Hydrogeological Risk Assessment for Land Contamination'. 2006.

Environment Agency & NHBC. R&D Publication 66. 'Guidance for the Safe Development of Housing on Land Affected by Contamination'. 2008.

Environment Agency. R&D Publication 20. 'Methodology for the Derivation of Remedial Targets for Soil and Groundwater to Protect Water Resources'. 1999.

Environment Agency Technical Guidance Note 01. Hydrogeological Risk Assessment for Landfills. [Withdrawn Feb 2016. Replaced with below].

Environment Agency and DEFRA 'Landfill developments: groundwater risk assessment for leachate'. 2016.

Environment Agency Petroleum Hydrocarbons in Groundwater 'Supplementary Guidance for Hydrogeological Risk Assessment'. 2009.

Environment Agency 'Groundwater protection: Principles and practice (GP3)'. 2013. [Superseded 2017 by www.gov.uk online guidance].

Environmental Permitting Guidance: version 3.1 'The Landfill Directive for the Environmental Permitting (England and Wales) Regulations'. 2010.

Environmental Quality Standards. 2008.

European Parliament Directive 2008/98/EC of the Council of 19 November 2008 on waste and repealing certain Directives. 2008.

European Parliament. Directive 2014/955/EU: Commission Decision of 18 December 2014 amending Decision 2000/532/EC on the list of waste pursuant to Directive 2008/98/EC.

Ground Engineering. Wilson & Card 'Proposed method classifying gassing sites' /1999.

Hazardous Waste (England and Wales) Regulations. 2005.

Health & Safety Executive (HSE). 'Protection of Workers & the General Public during the Development of Contaminated Land'. 1991.

Health and Safety Executive (HSE). Control of Asbestos Regulations (CAR). 2012.

Highways Agency. Design Guidance for Road Pavement Foundations (Draft HD25). Interim Advice Note 73/06. Rev 1. Highway Agency, London. 2009. [Withdrawn 30th May 2017].

ICE Thomas Telford 'Applications of Dynamic Cone Penetrometer testing in East Anglia'. 1989.

Land Quality Press, Nathanail, C. P., McCaffrey, C., Gillett, A., Ogden, R. C. and Nathanail, J.F. 'The LQM/CIEH S4ULs for Human Health Risk Assessment.' 2015.

Landfill Directive 'Directive 1999/31/EC on the landfilling of waste'. 1999.

Japanese Geotechnical Society. Hatanaka and Uchida 'Empirical correlation between penetration resistance and effective friction of sandy soil'. Soils & Foundations, 36 (4), 1-9. 1996.

Manual of Contract Documents for Highway Works, Specification for Highway Works: Volume 1, Amendment August 2014. [Withdrawn 30th May 2017].

Manual of Contract Documents for Highway Works, Specification for Highways Works – Series 600 Earthworks November 2006. [Withdrawn 30th May 2017, Replacement unknown].

National Planning Policy Framework (NPPF). July 2018.

National Planning Policy Framework - Technical Guidance. March 2012.

Total Petroleum Hydrocarbon Criteria Working Group Volume 1 'Analysis of Petroleum Hydrocarbons in Environmental Media'. 1999.

Total Petroleum Hydrocarbon Criteria Working Group Volume 2 Composition of Petroleum Mixtures. May 1998.

Total Petroleum Hydrocarbon Criteria Working Group Volume 3 'Selection of Representative TPH Fractions Based on Fate and Transport Considerations'. July 1997.

Total Petroleum Hydrocarbon Criteria Working Group Volume 4 'Development of Fraction Specific Reference Doses (RfDs) and Reference Concentrations (RfCs) for Total Petroleum Hydrocarbons (TPH)'. 1997

Total Petroleum Hydrocarbon Criteria Working Group Volume 5 'Human Health Risk-Based Evaluation of Petroleum Release Sites: Implementing the Working Group Approach' June 1999.

UK Drinking Water Standards: Water Supply (Water Quality) Regulations 1989 (SI 1989/1147) and Water Supply (Water Quality) Regulations 2000 (SI 2000/3184).

UKTAG. Updated recommendations on environmental standards. River Basin Management (2015-21). UK Technical Advisory Group on the Water Framework Directive. November 2013 (updated January 2018).

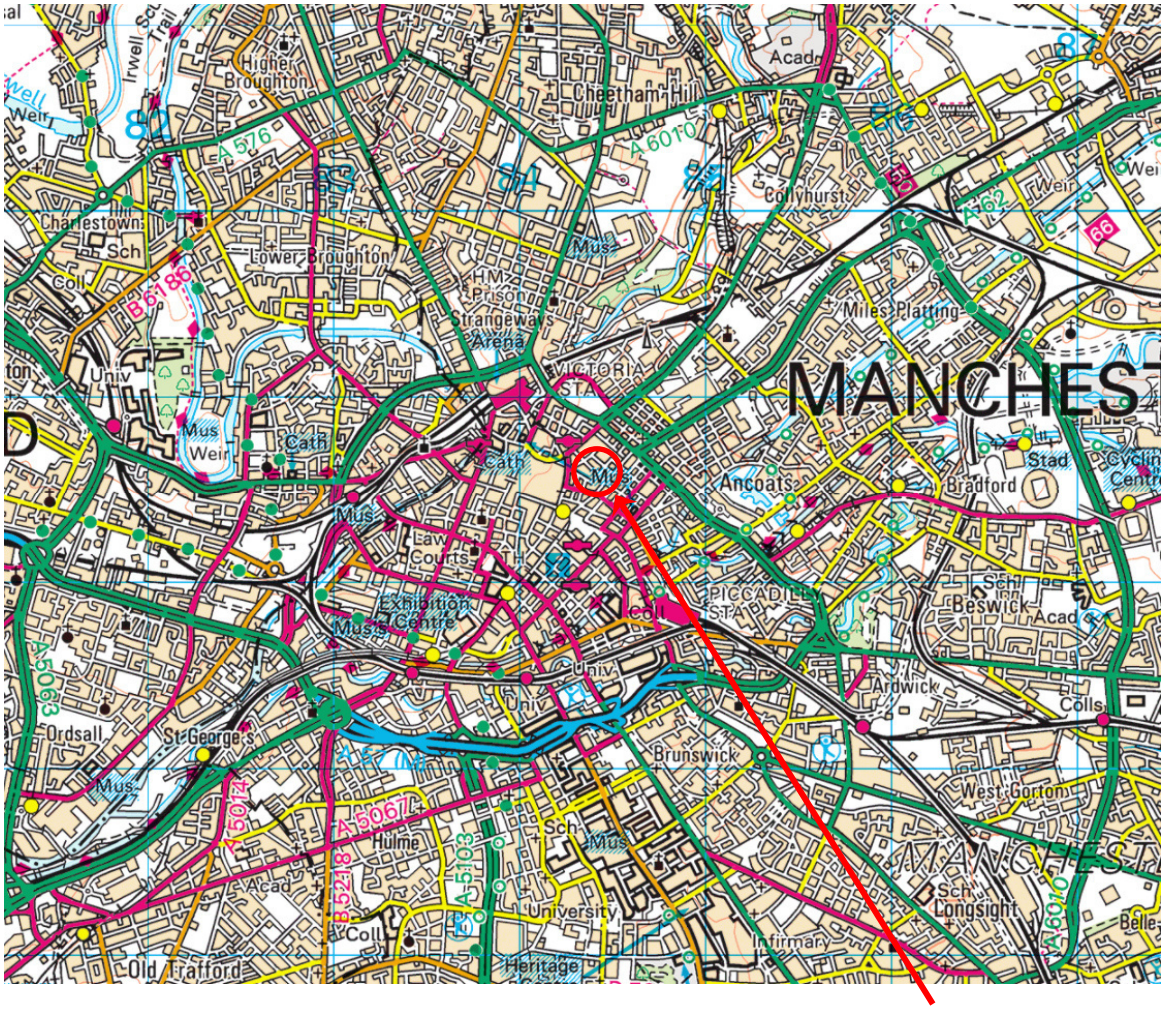
UKTAG-WFD. UKTAG River & Lake Assessment Method, Specific Pollutants (Metals), Metal Bioavailability Assessment Tool (M-BAT). Water Framework Directive – United Kingdom Technical Advisory Group. 2014.-

UKWIR Report 10/WM/03/21 2010 'Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites' 2010.

Water Framework Directive, 2000.

Water UK HBF. Contaminated Land Assessment Guidance. Water UK and the Home Builders Federation.

# DRAWINGS







BROWNFIELD SOLUTIONS LTD
GEO-ENVIRONMENTAL ENGINEERING EXCELLENCE

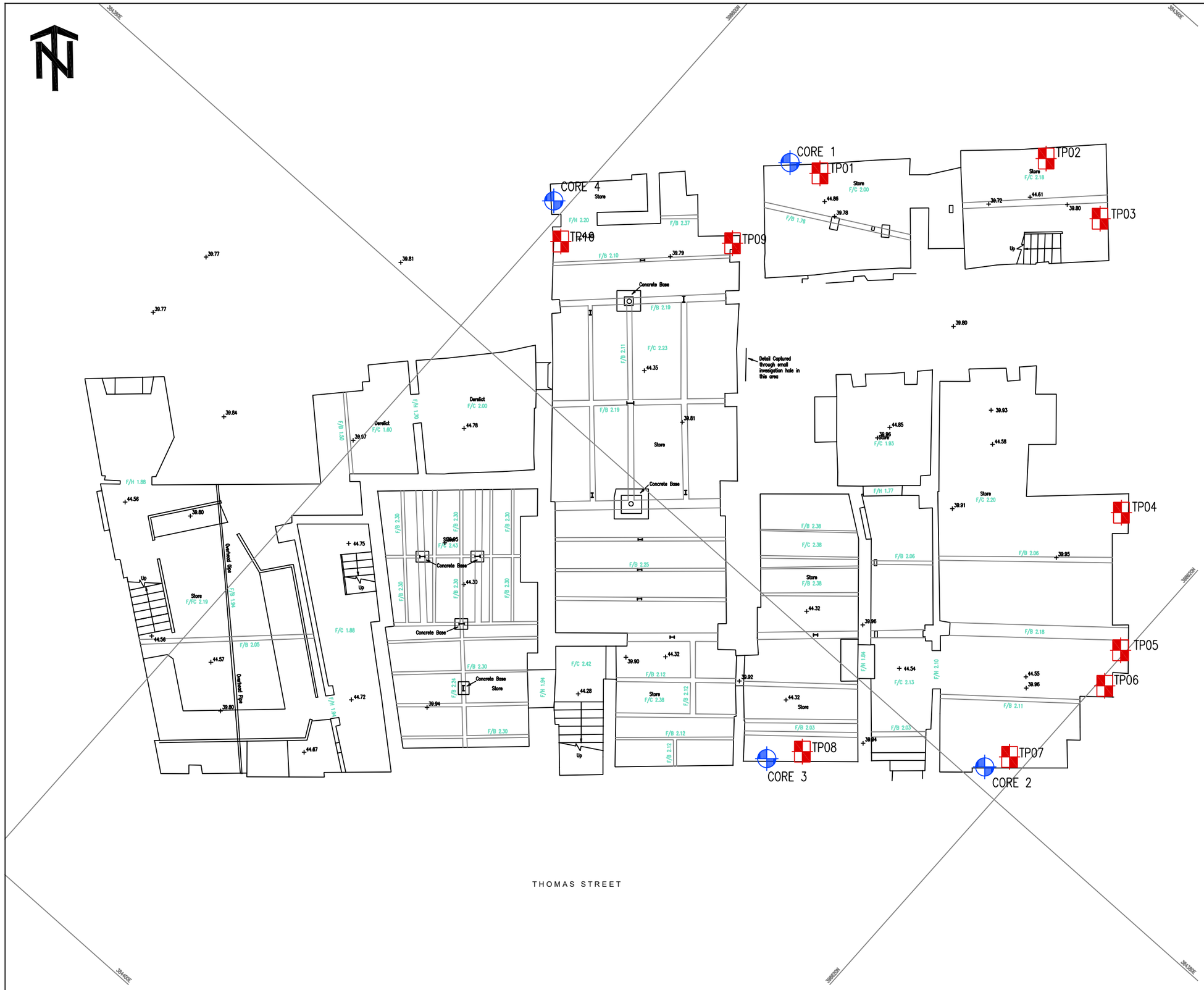
THOMAS STREET, MANCHESTER

SITE LOCATION PLAN

Drawing Number C3742/01

Scale: NTS

| Drawn By: DI | Checked By: JW |
|---|---|




## KEY

CORE 1 — CORE HOLE (CORE 1 – CORE 4)

TP01 — HAND DUG TRIAL PIT (TP01 – TP10)

NOTES

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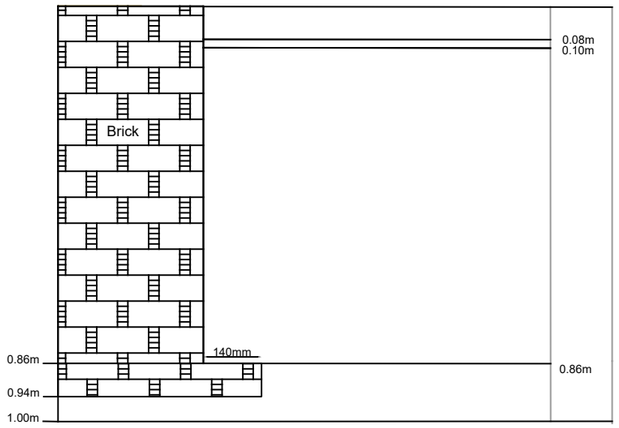
PROJECT TITLE
THOMAS STREET, MANCHESTER

DRAWING DETAIL
EXPLORATORY HOLE LOCATION PLAN

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| DATE | APRIL 2018 | SCALE | NTS |

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## TP101




GL

MADE GROUND: Paving Slab.

MADE GROUND: Yellowish brown gravelly SAND. Sand is fine to coarse. Gravel is subangular fine to medium of sandstone.

MADE GROUND: Soft brown slightly gravelly slightly sandy clay with occasional coal and brick fragments. Sand is fine to coarse. Gravel is subangular fine to medium of sandstone.

Stiff brown slightly sandy CLAY with rare coal fragments. Sand is fine to medium.

## TP102



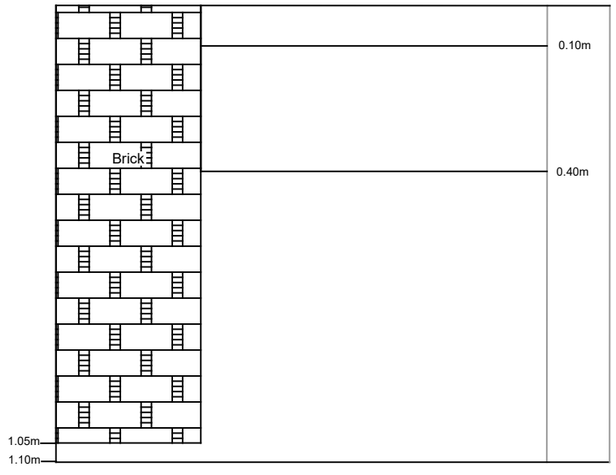

GL

MADE GROUND: Concrete.

MADE GROUND: Soft brown slightly gravelly slightly sandy clay with occasional ash, coal and brick fragments. Sand is fine to coarse. Gravel is subangular fine to medium of sandstone.

Stiff brown slightly sandy CLAY with rare coal fragments. Sand is fine to medium.

## TP103



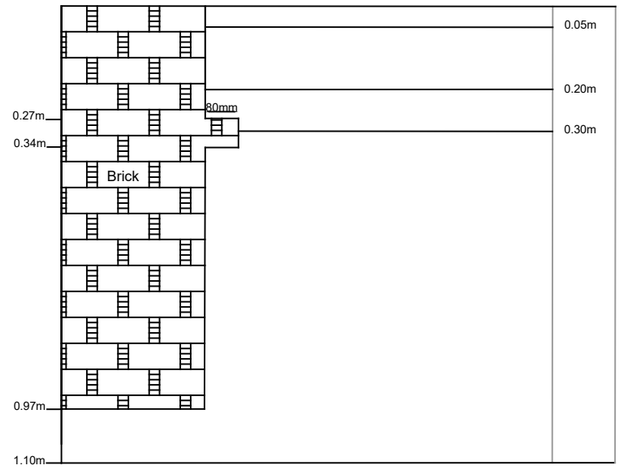

GL

MADE GROUND: Concrete.

MADE GROUND: Soft brown slightly gravelly slightly sandy clay with occasional ash, coal and brick fragments. Sand is fine to coarse. Gravel is subangular fine to medium of sandstone.

Stiff brown slightly sandy CLAY with rare coal fragments. Sand is fine to medium.

## TP104




GL

MADE GROUND: Concrete.

MADE GROUND: Reddish brown sandy gravel with frequent brick cobbles and fragments. Sand is fine to medium. Gravel is subangular fine to medium.

MADE GROUND: Soft brown slightly gravelly slightly sandy clay with occasional ash, coal and brick fragments. Sand is fine to coarse. Gravel is subangular fine to medium of sandstone.

Stiff brown slightly sandy CLAY with rare coal fragments. Sand is fine to medium.

NOTES

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CLIENT
RENAISSANCE ENGINEERS

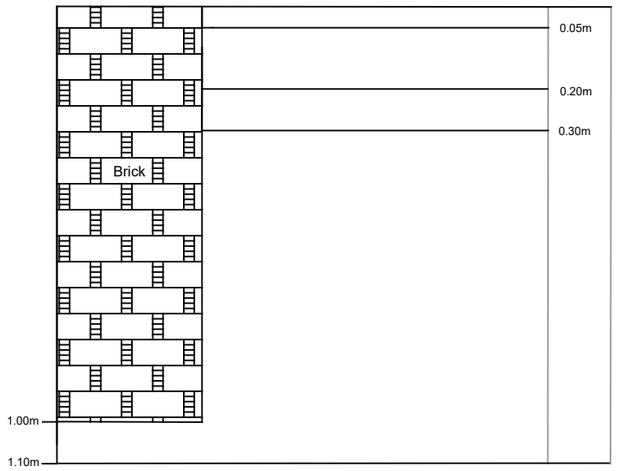
PROJECT TITLE
THOMAS STREET, MANCHESTER

DRAWING DETAIL
FOUNDATION LOGS
TP01 – TP04

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| APRIL 2018 | NTS |

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## TP105




GL

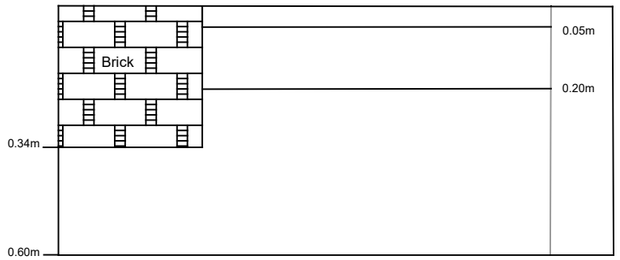
MADE GROUND: Concrete.

MADE GROUND: Reddish brown sandy gravel with frequent brick cobbles and fragments. Sand is fine to medium. Gravel is subangular fine to medium.

MADE GROUND: Soft brown slightly gravelly slightly sandy clay with occasional ash, coal and brick fragments. Sand is fine to coarse. Gravel is subangular fine to medium of sandstone.

Stiff brown slightly sandy CLAY with rare coal fragments. Sand is fine to medium.

## TP106



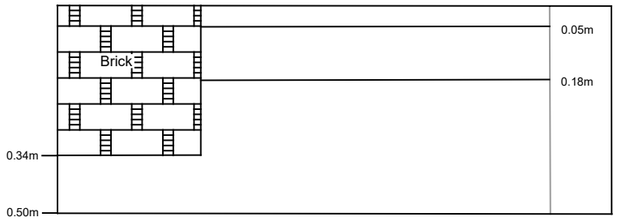

GL

MADE GROUND: Concrete.

MADE GROUND: Reddish brown sandy gravel with frequent brick cobbles and fragments. Sand is fine to medium. Gravel is subangular fine to medium.

Stiff brown slightly sandy CLAY with rare coal fragments. Sand is fine to medium.

## TP107



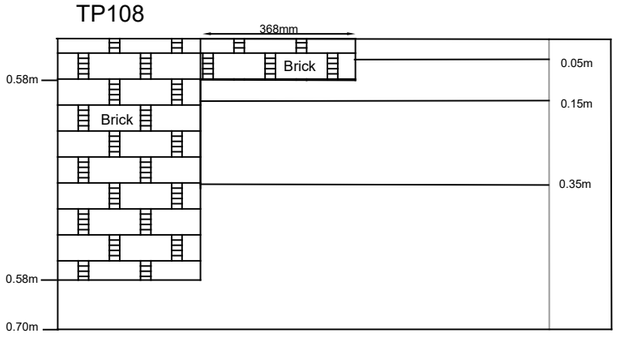

GL

MADE GROUND: Concrete.

MADE GROUND: Reddish brown sandy gravel with frequent brick cobbles and fragments. Sand is fine to medium. Gravel is subangular fine to medium.

Stiff brown slightly sandy CLAY with rare coal fragments. Sand is fine to medium.

## TP108




GL

MADE GROUND: Concrete.

MADE GROUND: Reddish brown sandy gravel with frequent brick cobbles and fragments. Sand is fine to medium. Gravel is subangular fine to medium.

MADE GROUND: Soft brown slightly gravelly slightly sandy clay with occasional ash, coal and brick fragments. Sand is fine to coarse. Gravel is subangular fine to medium of sandstone.

Stiff brown slightly sandy CLAY with rare coal fragments. Sand is fine to medium.

NOTES

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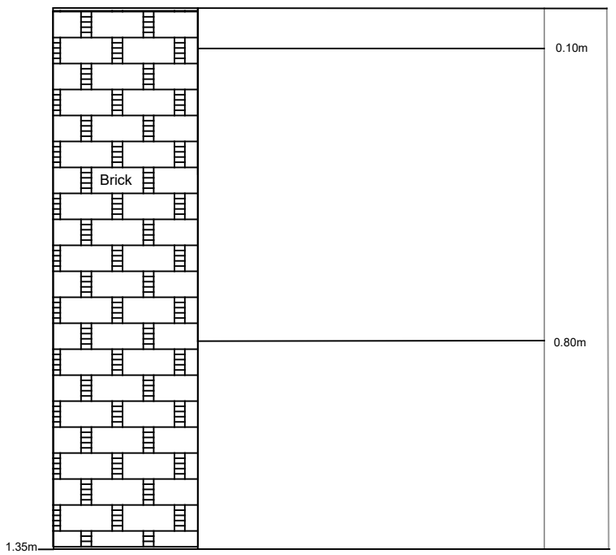
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PROJECT TITLE
THOMAS STREET, MANCHESTER

DRAWING DETAIL
FOUNDATION LOGS
TP05–TP08

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## TP109



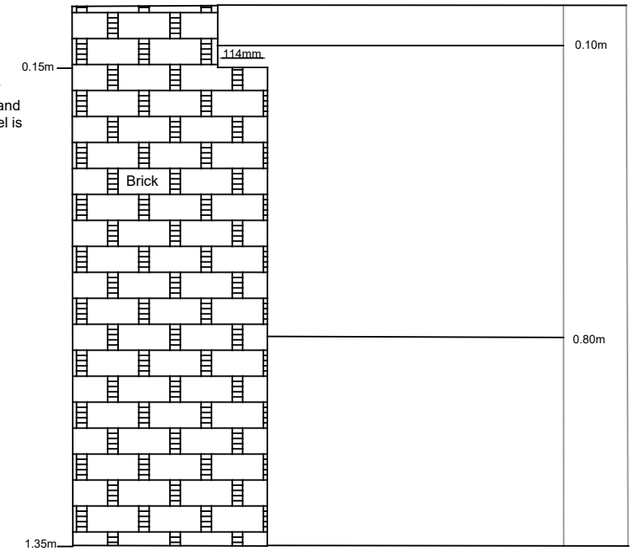

GL

MADE GROUND: Concrete.

MADE GROUND: Soft brown slightly gravelly slightly sandy clay with occasional ash, coal and brick fragments. Sand is fine to coarse. Gravel is subangular fine to medium of sandstone.

Soft dark brown / black organic CLAY with occasional degrading wood content.

## TP110




GL

MADE GROUND: Concrete.

MADE GROUND: Soft brown slightly gravelly slightly sandy clay with occasional ash, coal and brick fragments. Sand is fine to coarse. Gravel is subangular fine to medium of sandstone.

Soft dark brown / black organic CLAY with occasional degrading wood content.

NOTES

1. ALL DIMENSIONS TO BE CHECKED ON SITE BEFORE COMMENCING WORKS. ANY DISCREPANCIES ARE TO BE REPORTED TO THE ARCHITECT & ENGINEER FOR VERIFICATION. FIGURED DIMENSIONS ONLY ARE TO BE TAKEN FROM THIS DRAWING.
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CLIENT
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PROJECT TITLE
THOMAS STREET, MANCHESTER

DRAWING DETAIL
FOUNDATION LOGS
TP09 – TP10

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# APPENDIX A

**BSL Methodology and Guidance**

**BSL Methodology and Guidance – Geo-Environmental Assessment Reports**

This Appendix provides information on the approaches, methods and guidance used by Brownfield Solutions Ltd in the preparation of this report.

The term 'geo-environmental' is used to describe aspects relating to ground-related environmental issues (such as potential soils and groundwater contamination). The term 'geotechnical' is used to describe aspects relating to the physical nature of the site (such as foundation requirements). It should be noted that this is an integrated investigation and these two main aspects are related, unless otherwise specified within the report.

Desk Studies are written in broad agreement with BS 10175:2011+A2:2017. The first stage of a two-staged investigation and assessment of a site is the Preliminary Investigation (BS 10175:2011+A2:2017), often referred to as a Phase 1 Desk Study Assessment, comprising a desk study and walk-over survey, which culminates in the Preliminary Risk Assessment. A preliminary conceptual site model (CSM) is developed. From this are identified any geotechnical and geo-environmental hazards and the qualitative degree of risk associated with them.

From the geo-environmental perspective, the hazard Identification process uses professional judgement to evaluate all the hazards in terms of possible contaminant linkages (of source-pathway-receptor). Possible contaminant linkages are potentially unacceptable risks in terms of the current contaminated land regime legal framework and require either remediation or further assessment. These are normally addressed via intrusive ground investigation and generic risk assessment.

The second stage is the Ground Investigation, Generic Risk Assessment and Geotechnical Interpretation. This represents the further assessment mentioned above. The Ground Investigation comprises field work and laboratory testing based on the findings of the Preliminary Risk Assessment, to reduce uncertainty in the geotechnical and geo-environmental hazard identification. This may include the exploratory, main and supplementary Investigations described in BS 10175:2011+A2:2017.

## Legislative Background

Environmental liabilities and risks have been evaluated in terms of a source -pathway - target relationship in accordance with the approach set out in:

- The 1995 Environment Act;
- The Contaminated Land (England) Regulations 2000;
- The DETR circular 02/2000 Environmental Protection Act 1990: Part IIA Contaminated Land.

Contaminated land is defined within the legislative framework as land which is in such condition by reason of substances in, on or under the land that:

1) Significant harm is being caused or there is a significant possibility of such harm being caused;
2) Significant pollution of controlled waters is being or is likely to be caused.

The potential for harm is based on the presence of three factors:

- **Source** - substances that are potential contaminants or pollutants that may cause harm;
- **Pathway** - a potential route by which contaminants can move from the source to the receptor;
- **Receptor** - a receptor that may be harmed, for example the water environment, humans and water.

Where a source, pathway and target are all present a pollutant linkage exists and there is potential for harm to be caused. The presence of a source does not automatically imply that a contamination problem exists, since contamination must be defined in terms of pollutant linkages and unacceptable risk of harm. The nature and importance of both pathways and receptors are site specific and will vary according to the intended end use of the site, its characteristics and its surroundings.

The key principle which supports the SPR approach is 'suitable for use' criteria. This requires remedial action only where contamination is considered to pose unacceptable actual or potential risks to health or the environment and, taking into account the proposed use of the site.

*Relevant Guidance Documents*
This report has been prepared in accordance with the list of guidance below however the list is not exhaustive:

- DETR Circular 02/2000, Contaminated Land: Implementation of Part IIA of the Environmental Protection Act 1990.
- CLR11 – Model Procedures.
- Brownfields – Managing the development of previously developed land – A client's guide, CIRIA 2002.
- DEFRA and Environment Agency publications CLR7 – 10, supported by the TOX guides and SGV guides, dated March 2002.
- Environment Agency technical advice to third parties on Pollution of Controlled Waters for Part IIA of the EPA1990, May 2002.
- Contamination and Environmental Matters - Their implications for Property Professionals (2nd Edition RICS Nov 2003).
- BS 10175:2011+A2:2017.

*Relevant Legislative Documents*
The following is a non-exhaustive list of legislative framework documents that has been considered in the production of this report:

- The Environmental Protection Act 1990: Part 2A Contaminated Land Statutory Guidance (2012).
- The Environment Protection Act (1990).
- The Water Resources Act (1991).
- The Environment Act (1995).
- The Contaminated Land (England) Act (2000).
- The Pollution Prevention and Control (England and Wales) Regulations (2000).
- The Landfill Regulations (England and Wales) Regulations (2002).
- The Landfill (England and Wales) (Amendment) Regulations (2004).
- Contaminated Land (England) Regulations (2012).
- Health and Safety at Work Act.

## Contaminated Land Risk Assessment

Contaminated Land Risk Assessment is a technique that identifies and considers the associated risk, determines whether the risks are significant and whether action needs to be taken. The four main stages of risk assessment are:

Hazard Identification → Hazard Assessment → Risk Estimation → Risk Evaluation

CLR11 outlines the framework to be followed for risk assessment in the UK. The framework is designed to be consistent with UK legislation and policies including planning. The starting point of the risk assessment is to identify the context of the problem and the objectives of the process. Under CLR11, three tiers of risk assessment exist - Preliminary, Generic Quantitative and Detailed Quantitative.

Formulating and developing a conceptual model for the site is an important requirement of risk assessment, this supports the identification and assessment of pollutant linkages. Development of the conceptual model forms the main part of preliminary risk assessment, and the model is subsequently refined or revised as more information and understanding is obtained through the risk assessment process.

Risk is a combination of the likelihood of an event occurring and the magnitude of its consequences. Therefore, both the likelihood and the consequences of an event must be taken into account when assessing risk.

The risk assessment process needs to take into account the degree of confidence required in decisions. Identification of uncertainties is an essential step in risk assessment.

The likelihood of an event is classified on a four-point system using the following terms and definitions from CIRIA C552:

- **High likelihood**: There is a pollution linkage and an event 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 pollution linkage and all the elements are present and in the right place, which means it is probable that an event will occur. Circumstances are such that the event is not inevitable, but possible in the short term and likely over the long term;

- **Low likelihood**: There is a pollution linkage and circumstances are possible under which an event could occur. However, it is by no means certain even over a longer period such event would take place, and is less likely in the short term;

- **Unlikely**: There is a pollution linkage but circumstances are such that it is improbable the event would occur even in the long term.

The severity is also classified using a system based on CIRIA C552. The terms and definitions are:

- **Severe**: Short term (acute) risk to human health likely to result in 'significant harm' as defined by the Environment Protection Act 1990, Part IIA. Short-term risk of pollution of sensitive water resources. Catastrophic damage to buildings or property. A short-term risk to a particular ecosystem or organism forming part of that ecosystem (note definition of ecosystem in 'Draft Circular on Contaminated Land', DETR 2000);
  *Examples – High concentrations of contaminant on surface of recreation area, major spillage of contaminants from site into controlled waters, explosion causing building to collapse;*

- **Medium**: Chronic damage to human health ('significant harm' as defined in DETR 2000). Pollution of sensitive water resources. A significant change in a particular ecosystem or organism forming part of that ecosystem (note definition of ecosystem in 'Draft Circular on Contaminated Land', DETR 2000);
  *Examples - Concentrations of contaminants exceed the generic assessment criteria, leaching of contaminants from a site to a Principal or Secondary Aquifer, death of 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 'Draft Circular on Contaminated Land', DETR 2000). Damage to sensitive buildings, structures, services or the environment;
  *Examples – Pollution of non-classified groundwater or damage to buildings rendering it unsafe to occupy.*

- **Minor**: harm, not necessarily significant harm, which may result in financial loss or expenditure to resolve. Non-permanent health effects to human health (easily prevented by use of personal protective clothing etc). Easily repairable effects of damage to buildings, structures and services.

*Examples – Presence of contaminants at such concentrations PPE is required during site work, loss of plants in landscaping scheme or discolouration of concrete.*

Once the likelihood and severity have been determined, a risk category can be assigned using the table below.

| | | Consequences | | | |
|---|---|---|---|---|---|
| | | Severe | Medium | Mild | Minor |
| Probability | Highly likely | Very high | High | Moderate | Moderate/low |
| | Likely | High | Moderate | Moderate/low | Low |
| | Low likelihood | Moderate | Moderate/low | Low | Very low |
| | Unlikely | Moderate/low | Low | Very Low | Very low |
| | No Linkage | No risk | | | |

Definitions of the risk categories obtained from the above table are as follows together with an assessment of the further work that might be required:

- **Very high**: 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 is currently happening. This risk, if realised, could result in substantial liability. Urgent investigation and remediation are likely to be required;

- **High**: 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 is required and remedial works may be necessary in the short term and are likely over the longer term;

- **Moderate**: 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 would be more likely to be relatively mild. Investigation is normally required to clarify the risk and determine the liability. Some remedial works may be required in the longer term;

- **Low**: 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**: 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.

Some linkages may be identified which constitutes a theoretical connection between a source and a receptor, but professional judgement shows them not to be possible for some reason. These are labelled 'no linkage' in the summary table and no further action is required.

## Ground Gas Guidance

Redevelopment on brownfield sites is an ever increasing occurrence, including those sites where a potential ground gas issue is present.

BS8485:2015+A1:2019 and CIRIA C665 is the current guidance which gives up-to-date advice on all aspects of ground gas. It outlines good practice in investigation, the collection of relevant data and monitoring programmes in a risk-based approach to gas contaminated land. Two semi-quantitative methods are set out for the assessment of risk:

1 For low rise housing with a ventilated under floor void at minimum 150 mm (Boyle and Witherington);
2 For all other development types (Wilson and Card).

Both methods use the concept of Gas Screening Values (GSVs) to identify levels of risk. The mitigation and management of potentially unacceptable risk is described with reference to both passive and active systems of gas. Source removal is also discussed as an option.

CIRIA C665 and the advice it contains has been prepared to be generally consistent with CLR11 *Model Procedures for the management of land contamination* (Defra and Environment Agency, 2004a). The aim of CIRIA C665 is a consistent approach to decision making, particularly relating to the scope of protective design measures on a site specific basis.

*Legislative Framework*
CIRIA C665 provides technical guidance however also recognises the context into which the guidance has to be employed. Government policy is based upon a "suitable for use approach", which is relevant to both the current and proposed future use of land. When considering the current use of land, Part IIA of the Environment Protection Act 1990 provides the regulatory regime. The presence of hazardous ground gases could provide the "source" in a "pollutant linkage" which could lead the regulator to determine that considerable harm or there is a significant possibility of such harm being caused. Under such circumstances, the regulator would determine the land to be "contaminated land" under the provisions of the Act, setting out the process of remediation as described in the DETR Circular 02/2000 *Statutory guidance on contaminated land* (DETR, 2000a).

*Frequency and Duration of Monitoring*
The monitoring period for a specific site covers the "worst case" scenario. A "worst case" scenario will occur during falling atmospheric pressure and, in particular, weather conditions such as rainfall, frost and dry weather.

The benefits of the additional information and whether it is likely to change the scope of gas protection should be considered, as are the consequences of failing to characterise adequately pollutant linkages. Investigations concerned with soil gas are required to provide monitoring data sufficient to allow prediction of worst case conditions enabling the confident assessment of risk and subsequent design of appropriate gas protection schemes. Monitoring programmes should not be an academic exercise in data collection.

Below are matrices that will aid in determining an appropriate number of gas monitoring visits and the length of monitoring period.

*Typical/idealised periods of monitoring*

| | | Generation of Potential Source | | | | |
|---|---|---|---|---|---|---|
| | | Very Low | Low | Moderate | High | Very High |
| Sensitivity of Development | Low (Commercial) | 1 month | 2 months | 3 months | 6 months | 12 months |
| | Moderate (Flats) | 2 months | 3 months | 6 months | 12 months | 24 months |
| | High (Residential with Gardens) | 3 months | 6 months | 6 months | 12 months | 24 months |

*Typical/idealised frequency of monitoring*

| | | Generation of Potential Source | | | | |
|---|---|---|---|---|---|---|
| | | Very Low | Low | Moderate | High | Very High |
| Sensitivity of Development | Low (Commercial) | 4 | 6 | 6 | 12 | 12 |
| | Moderate (Flats) | 6 | 6 | 9 | 12 | 24 |
| | High (Residential with Gardens) | 6 | 9 | 12 | 24 | 24 |

**Note**

1 NHBC guidance also recommends this period of monitoring (Boyle and Witherington, 2007).
2 There is no industry consent over "high", "medium" or "low" generation potential of source.
3 At least two sets of readings should be at low and falling atmospheric pressure (but not restricted to periods below <1000 mb) known as worst case conditions. Historical data can be used as part of the data set (Table 5.5b).

It is recommended that newly installed monitoring wells are left for 24 hours to allow the soil gas to reach equilibrium. It should be recognised, however, that some soil gas regimes could take considerably longer (up to seven days). Interpretation of any initial readings should take this equilibrium process into account.

## Contaminated Land Screening Values

In assessing the potential for contamination Brownfield Solutions Limited (BSL) follows UK guidance and current best practice.

*General*
The current recommended method for assessing contamination is on the basis of:

**Source-Pathway-Receptor**

Where any one of these "pollution linkages" is absent there is deemed to be no risk.

Fundamentally receptors can be considered as humans and controlled waters (surface and ground waters).

The purpose of using Tier 1 screening levels is to have a simple means of assessing the potential contamination of a site and to inform decisions on whether further investigation is warranted or whether an option to undertake clean up based on the data to hand is cost effective.

*Human Health*
Current UK guidance is provided by DEFRA and the Environment Agency (EA). Publications forming part of the guidance include; CLEA Model, toxicological reports and soil guideline values (SGV), collectively referred to as the CLEA Guidance. The CLEA Guidance has included a number of publications which have provided initial screening values for soil contamination based on standard land uses and soil assumptions.

CLEA guidance has gone through a number of revisions, all of the original SGV's that were published have been withdrawn and publication of new SGV's commenced in 2009.

For determinands where no SGVs are available, S4UL values have been published using the CLEA 1.06 Model. These are the third set of generic assessment criteria generated by CIEH, and replace the previous two sets of GACs. The revised S4UL values are based on greater knowledge of relevant toxicology and further consideration of exposure frequencies.

No SGV or S4UL is available for lead as this is derived based on blood lead levels. C4SL values for six determinands including lead was published by DEFRA/CL:AIRE in December 2014 and they represent a low risk as opposed to minimal risk. The C4SL values are based on a sandy loam with 6% Soil Organic Matter. These screening values were published by DEFRA for Part 2A use, although with the dual purpose for use under planning. However these have not been officially accepted by Local Government for use under planning. S4ULs remain the first reference due to the broader range of end uses and soil organic content.

The preference from the EA is that site specific screening levels are used wherever possible. Due to numerous factors it is not always possible to utilise site specific values. In these instances the following data sources are used in the order of preference given below:

- CIEH S4UL values (derived by CIEH/LQM)
- DEFRA/CL:AIRE C4SL's
- CL:AIRE GAC values
- Current UK SGV's
- Guidance from other European countries
- Guidance from the outside Europe

*Controlled Waters*
The European Water Framework Directive (WFD) became UK law in December 2003. It was created to ensure that European countries manage their rivers, groundwater and lakes so that they stay healthy for people and for wildlife.

This is achieved by the use of chemical standards for surface waters and groundwater. These values describe concentrations of chemicals that are not expected to cause harm to environmental organisms or human health, provided they are not exceeded. The same chemical may have several standards for different environmental regimes, and for different protection objectives.

Statutory Standards are set in legislation and if exceeded, this constitutes non-compliance with statutory obligations. European Directives are implemented in England and Wales by corresponding statutory instruments (i.e. regulations). The statutory instruments can be the exact same standards as they appear in the Directive or be more stringent.

A number of non-statutory standards also exist, these are set by various organisations (including the EA) for chemicals that are considered to be of concern, but are not covered by any specific legislation.

The chemical standards used in the UK to control impaction of contamination on controlled waters are Environmental Quality Standards (EQS). The EQS's cover a large number of compounds.

Where certain compounds are not covered by the EQS these are commonly compared to the UK Drinking Water Standards (DWS).

*Further Assessment*

When screening values are exceeded then further consideration is required. This could include the use of simple measures to break the pollution pathway and mitigate the risk, further more detailed investigation, including the deriving of site specific values to better define the risk and to design appropriate remedial measures.

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| | | | Proposed End Use | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Source | Contaminant | Unit | Residential with Homegrown Produce | | | Residential without Homegrown Produce | | | Commercial | | | Public Open Space (POS) resi | | | Public Open Space (POS) park | | |
| | | SOM (%) | 1 | 2.5 | 6 | 1 | 2.5 | 6 | 1 | 2.5 | 6 | 1 | 2.5 | 6 | 1 | 2.5 | 6 |
| LQM S4UL | Arsenic | mg/kg | 37 | 37 | 37 | 40 | 40 | 40 | 640 | 640 | 640 | 79 | 79 | 79 | 170 | 170 | 170 |
| LQM S4UL | Cadmium | mg/kg | 11 | 11 | 11 | 85 | 85 | 85 | 190 | 190 | 190 | 120 | 120 | 120 | 532 | 532 | 532 |
| LQM S4UL | Chromium (III) | mg/kg | 910 | 910 | 910 | 910 | 910 | 910 | 8600 | 8600 | 8600 | 1500 | 1500 | 1500 | 33000 | 33000 | 33000 |
| LQM S4UL | Chromium (VI) | mg/kg | 6 | 6 | 6 | 6 | 6 | 6 | 33 | 33 | 33 | 7.7 | 7.7 | 7.7 | 220 | 220 | 220 |
| LQM S4UL | Copper | mg/kg | 2400 | 2400 | 2400 | 7100 | 7100 | 7100 | 68000 | 68000 | 68000 | 12000 | 12000 | 12000 | 44000 | 44000 | 44000 |
| C4SL | Lead | mg/kg | 200 | 200 | 200 | 330 | 330 | 330 | 2300 | 2300 | 2300 | 760 | 760 | 760 | 1400 | 1400 | 1400 |
| LQM S4UL | Mercury, Elemental | mg/kg | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 58 | 58 | 58 | 16 | 16 | 16 | 30 | 30 | 30 |
| LQM S4UL | Nickel | mg/kg | 180 | 180 | 180 | 180 | 180 | 180 | 980 | 980 | 980 | 230 | 230 | 230 | 3400 | 3400 | 3400 |
| LQM S4UL | Selenium | mg/kg | 250 | 250 | 250 | 430 | 430 | 430 | 12000 | 12000 | 12000 | 1100 | 1100 | 1100 | 1800 | 1800 | 1800 |
| LQM S4UL | Zinc | mg/kg | 3700 | 3700 | 3700 | 40000 | 40000 | 40000 | 730000 | 730000 | 730000 | 81000 | 81000 | 81000 | 170000 | 170000 | 170000 |
| LQM S4UL | Phenol (total) | mg/kg | 280 | 550 | 1100 | 750 | 1300 | 2300 | 760 | 1500 | 3200 | 760 | 1500 | 3200 | 760 | 1500 | 3200 |
| LQM S4UL | Acenaphthene | mg/kg | 210 | 510 | 1100 | 3000 | 4700 | 6000 | 84000 | 97000 | 100000 | 15000 | 15000 | 15000 | 29000 | 30000 | 30000 |
| LQM S4UL | Acenaphthylene | mg/kg | 170 | 420 | 920 | 2900 | 4600 | 6000 | 83000 | 97000 | 100000 | 15000 | 15000 | 15000 | 29000 | 30000 | 30000 |
| LQM S4UL | Anthracene | mg/kg | 2400 | 5400 | 11000 | 31000 | 35000 | 37000 | 520000 | 540000 | 540000 | 74000 | 74000 | 74000 | 150000 | 150000 | 150000 |
| LQM S4UL | Benz(a)anthracene | mg/kg | 7.2 | 11 | 13 | 11 | 14 | 15 | 170 | 170 | 180 | 29 | 29 | 29 | 49 | 56 | 62 |
| LQM S4UL | Benzo(a)pyrene | mg/kg | 2.2 | 2.7 | 3.0 | 3.2 | 3.2 | 3.2 | 35 | 35 | 36 | 5.7 | 5.7 | 5.7 | 11 | 12 | 13 |
| LQM S4UL | Benzo(b)fluoranthene | mg/kg | 2.6 | 3.3 | 3.7 | 3.9 | 4 | 4 | 44 | 44 | 45 | 7.1 | 7.2 | 7.2 | 13 | 15 | 16 |
| LQM S4UL | Benzo(ghi)perylene | mg/kg | 320 | 340 | 350 | 360 | 360 | 360 | 3900 | 4000 | 4000 | 640 | 640 | 640 | 1400 | 1500 | 1600 |
| LQM S4UL | Benzo(k)fluoranthene | mg/kg | 77 | 93 | 100 | 110 | 110 | 110 | 1200 | 1200 | 1200 | 190 | 190 | 190 | 370 | 410 | 440 |
| LQM S4UL | Chrysene | mg/kg | 15 | 22 | 27 | 30 | 31 | 32 | 350 | 350 | 350 | 57 | 57 | 57 | 93 | 110 | 120 |
| LQM S4UL | Dibenz(a,h)anthracene | mg/kg | 0.24 | 0.28 | 0.30 | 0.31 | 0.32 | 0.32 | 3.5 | 3.6 | 3.6 | 0.57 | 0.57 | 0.58 | 1.1 | 1.3 | 1.4 |
| LQM S4UL | Fluoranthene | mg/kg | 280 | 560 | 890 | 1500 | 1600 | 1600 | 23000 | 23000 | 23000 | 3100 | 3100 | 3100 | 6300 | 6300 | 6400 |
| LQM S4UL | Fluorene | mg/kg | 170 | 400 | 860 | 2800 | 3800 | 4500 | 63000 | 68000 | 71000 | 9900 | 9900 | 9900 | 20000 | 20000 | 20000 |
| LQM S4UL | Indeno(1,2,3,cd)pyrene | mg/kg | 27 | 36 | 41 | 45 | 46 | 46 | 500 | 510 | 510 | 82 | 82 | 82 | 150 | 170 | 180 |
| LQM S4UL | Naphthalene | mg/kg | 2.3 | 5.6 | 13 | 2.3 | 5.6 | 13 | 190 | 460 | 1100 | 4900 | 4900 | 4900 | 1200 | 1900 | 3000 |
| LQM S4UL | Phenanthrene | mg/kg | 95 | 220 | 440 | 1300 | 1500 | 1500 | 22000 | 22000 | 23000 | 3100 | 3100 | 3100 | 6200 | 62000 | 6300 |
| LQM S4UL | Pyrene | mg/kg | 620 | 1200 | 2000 | 3700 | 3800 | 3800 | 54000 | 54000 | 54000 | 7400 | 7400 | 7400 | 15000 | 15000 | 15000 |
| LQM S4UL | Petroleum Hydrocarbons Aliphatic EC 5 - 6 | mg/kg | 42 | 78 | 160 | 42 | 78 | 160 | 3200 | 5900 | 12000 | 570000 | 590000 | 600000 | 95000 | 130000 | 180000 |
| LQM S4UL | Petroleum Hydrocarbons Aliphatic EC 6 - 8 | mg/kg | 100 | 230 | 530 | 100 | 230 | 530 | 7800 | 17000 | 40000 | 600000 | 610000 | 620000 | 150000 | 220000 | 320000 |
| LQM S4UL | Petroleum Hydrocarbons Aliphatic EC 8 - 10 | mg/kg | 27 | 65 | 150 | 27 | 65 | 150 | 2000 | 4800 | 11000 | 13000 | 13000 | 13000 | 14000 | 18000 | 21000 |
| LQM S4UL | Petroleum Hydrocarbons Aliphatic EC 10 - 12 | mg/kg | 130 | 330 | 760 | 130 | 330 | 770 | 9700 | 23000 | 47000 | 13000 | 13000 | 13000 | 21000 | 23000 | 24000 |
| LQM S4UL | Petroleum Hydrocarbons Aliphatic EC 12 - 16 | mg/kg | 1100 | 2400 | 4300 | 1100 | 2400 | 4400 | 59000 | 82000 | 90000 | 13000 | 13000 | 13000 | 25000 | 25000 | 26000 |
| LQM S4UL | Petroleum Hydrocarbons Aliphatic EC 16 - 35 | mg/kg | 65000 | 92000 | 110000 | 65000 | 92000 | 110000 | 1600000 | 1700000 | 1800000 | 250000 | 250000 | 250000 | 450000 | 480000 | 490000 |
| LQM S4UL | Petroleum Hydrocarbons Aliphatic EC 35 - 44 | mg/kg | 65000 | 92000 | 110000 | 65000 | 92000 | 110000 | 1600000 | 1700000 | 1800000 | 250000 | 250000 | 250000 | 450000 | 480000 | 490000 |
| LQM S4UL | Petroleum Hydrocarbons Aromatic EC 5 - 7 | mg/kg | 70 | 140 | 300 | 370 | 690 | 1400 | 26000 | 46000 | 86000 | 56000 | 56000 | 56000 | 76000 | 84000 | 92000 |
| LQM S4UL | Petroleum Hydrocarbons Aromatic EC 7 - 8 | mg/kg | 130 | 290 | 660 | 860 | 1800 | 3900 | 56000 | 110000 | 180000 | 56000 | 56000 | 56000 | 87000 | 95000 | 100000 |
| LQM S4UL | Petroleum Hydrocarbons Aromatic EC 8 - 10 | mg/kg | 34 | 83 | 190 | 47 | 110 | 270 | 3500 | 8100 | 17000 | 5000 | 5000 | 5000 | 7200 | 8500 | 9300 |
| LQM S4UL | Petroleum Hydrocarbons Aromatic EC 10 - 12 | mg/kg | 74 | 180 | 380 | 250 | 590 | 1200 | 16000 | 28000 | 34000 | 5000 | 5000 | 5000 | 9200 | 9700 | 10000 |
| LQM S4UL | Petroleum Hydrocarbons Aromatic EC 12 -16 | mg/kg | 140 | 330 | 660 | 1800 | 2300 | 2500 | 36000 | 37000 | 38000 | 5100 | 5100 | 5000 | 10000 | 10000 | 10000 |
| LQM S4UL | Petroleum Hydrocarbons Aromatic EC 16 - 21 | mg/kg | 260 | 540 | 930 | 1900 | 1900 | 1900 | 28000 | 28000 | 28000 | 3800 | 3800 | 3800 | 7600 | 7700 | 7800 |
| LQM S4UL | Petroleum Hydrocarbons Aromatic EC 21 - 35 | mg/kg | 1100 | 1500 | 1700 | 1900 | 1900 | 1900 | 28000 | 28000 | 28000 | 3800 | 3800 | 3800 | 7800 | 7800 | 7900 |
| LQM S4UL | Petroleum Hydrocarbons Aromatic EC 35 - 44 | mg/kg | 1100 | 1500 | 1700 | 1900 | 1900 | 1900 | 28200 | 28200 | 28200 | 3800 | 3800 | 3800 | 7800 | 7800 | 7900 |
| LQM S4UL | Benzene | mg/kg | 0.087 | 0.17 | 0.37 | 0.38 | 0.7 | 1.4 | 27 | 47 | 90 | 72 | 72 | 73 | 90 | 100 | 110 |
| LQM S4UL | Toluene | mg/kg | 130 | 290 | 660 | 880 | 1900 | 3900 | 56000 | 110000 | 180000 | 56000 | 56000 | 56000 | 87000 | 95000 | 100000 |
| LQM S4UL | Ethyl Benzene | mg/kg | 47 | 110 | 260 | 83 | 190 | 440 | 5700 | 13000 | 27000 | 24000 | 24000 | 25000 | 17000 | 22000 | 27000 |
| LQM S4UL | Xylene - o | mg/kg | 60 | 140 | 330 | 88 | 210 | 480 | 6600 | 15000 | 33000 | 41000 | 42000 | 43000 | 17000 | 24000 | 33000 |
| LQM S4UL | Xylene - m | mg/kg | 59 | 140 | 320 | 82 | 190 | 450 | 6200 | 14000 | 31000 | 41000 | 42000 | 43000 | 17000 | 24000 | 32000 |
| LQM S4UL | Xylene - p | mg/kg | 56 | 130 | 310 | 79 | 180 | 430 | 5900 | 14000 | 30000 | 41000 | 42000 | 43000 | 17000 | 23000 | 31000 |
| CL:AIRE 2010 | MTBE (methyl tert-butyl ether) | mg/kg | 49 | 84 | 160 | 49 | 84 | 160 | 7900 | 13000 | 24000 | 49 | 84 | 160 | 49 | 84 | 160 |
| LQM S4UL | Chloroethene (Vinyl Chloride) | mg/kg | 0.00064 | 0.00087 | 0.0014 | 0.00077 | 0.001 | 0.0015 | 0.059 | 0.077 | 0.12 | 3.5 | 3.5 | 3.5 | 4.8 | 5 | 5.4 |
| LQM S4UL | 1,2-Dichloroethane (1,2-DCA) | mg/kg | 0.0071 | 0.011 | 0.019 | 0.0092 | 0.013 | 0.023 | 0.67 | 0.97 | 1.7 | 29 | 29 | 29 | 21 | 24 | 28 |
| LQM S4UL | 1,1,1-Trichloroethane | mg/kg | 8.8 | 1.8 | 39 | 9 | 18 | 40 | 660 | 1300 | 3000 | 14000 | 14000 | 14000 | 57000 | 76000 | 100000 |
| LQM S4UL | 1,1,2,2-Tetrachloroethane | mg/kg | 1.6 | 3.4 | 7.5 | 3.9 | 8 | 17 | 270 | 550 | 11000 | 1400 | 1400 | 1400 | 1800 | 2100 | 2300 |
| LQM S4UL | 1,1,1,2-Tetrachloroethane | mg/kg | 1.2 | 2.8 | 6.4 | 1.5 | 3.5 | 8.2 | 0.79 | 1.9 | 4.4 | 1400 | 1400 | 1400 | 1500 | 1800 | 2100 |
| LQM S4UL | Tetrachloroethene (PCE) | mg/kg | 0.18 | 0.39 | 0.9 | 0.18 | 0.4 | 0.92 | 19 | 42 | 95 | 1400 | 1400 | 1400 | 810 | 1100 | 1500 |
| LQM S4UL | Tetrachloromethane (carbon tetrachloride) | mg/kg | 0.026 | 0.056 | 0.13 | 0.026 | 0.056 | 0.13 | 2.9 | 6.3 | 14 | 890 | 920 | 950 | 190 | 270 | 400 |

| | | | Proposed End Use | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Residential with Homegrown Produce | | | Residential without Homegrown Produce | | | Commercial | | | Public Open Space (POS) resi | | | Public Open Space (POS) park | | |
| Source | Contaminant | Unit SOM (%) | 1 | 2.5 | 6 | 1 | 2.5 | 6 | 1 | 2.5 | 6 | 1 | 2.5 | 6 | 1 | 2.5 | 6 |
| LQM S4UL | Trichloroethene **(TCE)** | mg/kg | 0.016 | 0.034 | 0.075 | 0.017 | 0.036 | 0.08 | 1.2 | 2.6 | 5.7 | 120 | 120 | 120 | 70 | 91 | 120 |
| LQM S4UL | Trichloromethane (chloroform) | mg/kg | 0.91 | 1.7 | 3.4 | 1.2 | 2.1 | 4.2 | 99 | 170 | 350 | 2500 | 2500 | 2500 | 2600 | 2800 | 3100 |
| LQM S4UL | Chlorobenzene | mg/kg | 0.45 | 1 | 2.4 | 0.46 | 1 | 2.4 | 56 | 130 | 290 | 11000 | 13000 | 14000 | 1300 | 2000 | 2900 |
| LQM S4UL | 1, 2 Dichlorobenzene | mg/kg | 23 | 55 | 130 | 24 | 57 | 130 | 2000 | 4800 | 11000 | 90000 | 95000 | 98000 | 24000 | 26000 | 51000 |
| LQM S4UL | 1, 3 Dichlorobenzene | mg/kg | 0.4 | 1 | 2.3 | 0.44 | 1.1 | 2.5 | 30 | 73 | 170 | 300 | 300 | 300 | 390 | 440 | 470 |
| LQM S4UL | 1, 4 Dichlorobenzene | mg/kg | 61 | 150 | 350 | 61 | 150 | 340 | 4400 | 10000 | 25000 | 17000 | 17000 | 17000 | 26000 | 36000 | 36000 |
| LQM S4UL | 1, 2, 3 Trichlorobenzene | mg/kg | 1.5 | 3.6 | 8.6 | 1.5 | 3.7 | 8.8 | 102 | 250 | 590 | 1800 | 1800 | 1800 | 770 | 1100 | 1600 |
| LQM S4UL | 1, 2, 4 Trichlorobenzene | mg/kg | 2.6 | 6.4 | 15 | 2.6 | 6.4 | 15 | 220 | 530 | 1300 | 15000 | 17000 | 19000 | 1700 | 2600 | 4000 |
| LQM S4UL | 1, 2, 3, 4 Trichlorobenzene | mg/kg | 0.33 | 0.81 | 1.9 | 0.33 | 0.81 | 1.9 | 23 | 55 | 130 | 1700 | 1700 | 1800 | 280 | 580 | 860 |
| LQM S4UL | 1, 2, 3, 4 Tetrachlorobenzene | mg/kg | 15 | 36 | 78 | 24 | 56 | 120 | 1700 | 3080 | 4400 | 830 | 830 | 830 | 1500 | 1600 | 1600 |
| LQM S4UL | 1, 2, 3, 5 Tetrachlorobenzene | mg/kg | 0.66 | 1.6 | 3.7 | 0.75 | 1.9 | 4.3 | 49 | 120 | 240 | 78 | 79 | 79 | 110 | 120 | 130 |
| LQM S4UL | 1, 2, 4, 5 Tetrachlorobenzene | mg/kg | 0.33 | 0.77 | 1.6 | 0.73 | 1.7 | 3.5 | 42 | 72 | 96 | 13 | 13 | 13 | 25 | 26 | 26 |
| LQM S4UL | Pentachlorobenzene | mg/kg | 5.8 | 12 | 22 | 19 | 30 | 38 | 640 | 770 | 830 | 100 | 100 | 100 | 190 | 190 | 190 |
| LQM S4UL | Hexachlorobenze | mg/kg | 1.8 | 3.3 | 4.9 | 4.1 | 5.7 | 6.7 | 110 | 120 | 120 | 16 | 16 | 16 | 30 | 30 | 30 |

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See LQM/CIEH S4ULs for Human Health Risk Assessment document for notes regarding derivation.

## Re-Use Of Waste - Guidance Note

*Definition of Waste*
The Environment Agency considers waste to be *"...any material that is discarded, or intended to be discarded..."* This includes any soil from trenches, footing, site strip etc. It is no longer required in its original location, therefore it is considered to be waste.

*CL:AIRE: Code of Practice*
Where materials are excavated for construction purposes, wherever possible these should be retained on site for engineering purposes if they are suitable for use. This can be implemented under the CL:AIRE "Development Industry Code of Practice for the Definition of Waste" (CL:AIRE DoWCoP), also commonly referred to as a "Materials Management Plan".

The developer/contractor is advised to complete all works under the DoWCoP.

Potential scenarios where soils may be able to be re-used:

- Material capable of being used in another place on the same site without treatment.
- Material capable of being used in another place on the same site following ex-situ treatment on site.
- Material capable of being used in another development site without treatment (Direct Transfer).
- Material capable of being used in another development site following ex-situ treatment on another site eg Hub site.

The Code of Practice requires 4 No. Factors to be addressed:

1. Protection of human health and protection of the environment.
2. Suitability of use, without further treatment.
3. Certainty of use.
4. Quantity of material.

In order to satisfy these requirements the following are required:

i) Consultation/approval with Local Authority & Environment Agency to confirm they have no objections to the proposed re-use of waste soils, or the risk assessments for the site.
ii) Risk Assessments to demonstrate that the site does not present an Environmental Hazard.
iii) Remediation Strategy for contaminated sites (or Design Statement for non-contaminated sites).
iv) Materials Management Plan (MMP) which details material generated stockpiles and the end use.
v) Volume calculations.
vi) Planning permission for the development.
vii) Contractual details to be clear, regarding who steps in is a contractor goes into administration/liquidation.

The use of the CoP is effectively industry regulated, there is a requirement to appoint an independent Qualified Person (QP) who checks all the requirements have been met and registers the documentation with the Environment Agency. This person must not have had any involvement with the preparing of the risk assessments or remedial strategy on the site.
Soils which require treatment on site (eg bioremediation, stabilisation) will require an Environmental Permit for treatment, together with justification and validation to prove, once treated, this material is suitable for use.
Site management procedures need to be in place to ensure that material is tracked through from excavation stockpiling, treatment and remediation processes. Should the process of material tracking be considered non-robust, or not adhered to, this may fail the test whether excavated materials may be considered non-waste.

## Waste Classification For Soils

*Introduction*

Waste producers have a duty of care to classify the waste they are producing:

- before it is collected, disposed of or recovered.
- to identify the controls that apply to the movement of the waste.
- to complete waste documents and records.
- to identify suitably authorised waste management options.
- to prevent harm to people and the environment.

The most sustainable and economic method of dealing with waste soil is usually the retention and re-use on site. Where this is not possible there are three main options for the disposal of soils:

1. Disposal to a permitted waste recycling facility.
2. Re-use on another site (subject to the suitability).
3. Disposal to a landfill site.

The disposal to a permitted facility will be subject to the **specific conditions of the permits for each individual facility** and will vary dependent on location and environmental sensitivity of the receiving site. Re-use on another site will also be subject to the acceptability criteria of that site.

The guidance below relates to disposal to **landfill sites only**.

*Background for Landfill Disposal*

In July 2005 the United Kingdom implemented the European Directive 1999/31/EC (The Landfill Directive), this introduced the current regime for waste and waste disposal to landfill. The Landfill Directive places controls on waste disposal. These controls include requirements to follow the waste acceptance procedures and criteria that have been agreed by the Council of the European Union and are laid out in Council Decision 2003/33/EC.

Before a waste can be accepted at a landfill site, the landfill **operator** must be satisfied that the waste meets his permit conditions, the waste acceptance procedures (WAP) and waste acceptance criteria (WAC).

If disposal to landfill is the best management option for the waste soils, these procedures **must** be followed or the operator may refuse to accept the waste.

Key Points

- Not all waste can be landfilled
- Landfills are classified according to whether they can accept **hazardous**, **non-hazardous** or **inert** wastes.
- Wastes can only be accepted at a landfill if they meet the waste acceptance criteria (WAC) for that class of landfill.
- Most wastes must be treated before you can send them to landfill.
- There are formal processes for identifying and checking wastes that must be followed before wastes can be accepted at a landfill site.

*Classification*

Wastes are listed in the European Waste Catalogue (EWC 2002) and grouped according to generic industry, process or waste types. Wastes within the EWC are either hazardous or non-hazardous. Some of these wastes are hazardous without further assessment (absolute entries) or are 'mirror' entries that require further assessment of their hazardous properties in order to determine whether they are hazardous waste.

Waste soil has mirror entries on the EWC and as such the first phase of the waste classification process is that of determining if the waste is hazardous or not i.e the hazard assessment. The most common EWC waste codes related to soil are:

| **17 05** | **soil (including excavated soil from contaminated sites), stones and dredging spoil** |
|---|---|
| 17 05 03* | soil and stones containing dangerous substances |
| 17 05 04 | soil and stones other than those mentioned in 17 05 03 |

Soils may contain certain contaminants (eg asbestos, oil,) which have prescribed concentration thresholds, that if breached will render the material hazardous waste. These are based on specific "hazardous properties" which include hazards such as carcinogenicity, flammability and toxicity.

In the first instance the concentrations of plausible contaminants within the soil should be identified and wastes should be **classified based on their total concentrations**.

*Waste Definitions*

| | |
|---|---|
| Inert | • Will not undergo any significant physical, chemical or biological transformations.<br>• Will not dissolve.<br>• Will not burn.<br>• Will not physically or chemically react.<br>• Will not biodegrade.<br>• Will not adversely affect other matter with which it comes into contact in a way likely to give rise to environmental pollution or harm to human health.<br>• Has insignificant total leachability and pollutant content.<br>• Produces a leachate with an ecotoxicity that is insignificant (if it produces leachate). |
| Non-Hazardous | Is not inert (see above)<br>Is not hazardous (see below) |
| Hazardous | Soil has hazardous properties as defined in WM3 (Guidance on the classification and assessment of waste (1st edition 2015)- Technical Guidance) |
| Stable Non-reactive hazardous waste# | Hazardous waste, the leaching behaviour of which will not change adversely in the long-term, under landfill design conditions or foreseeable accidents either: in the waste alone (for example, by biodegradation), under the impact of long-term ambient conditions (for example, water, air, temperature or mechanical constraints) or by the impact of other wastes (including waste products such as leachate and gas). |

# This option allows hazardous waste that is stable and thus has a low leaching potential to be deposited in cells with a standard of containment consistent with non-hazardous wastes.

*WAC Testing*

The purpose of WAC analysis is to confirm that the waste complies with the relevant WAC for the receiving landfill. If the waste has any disposal route other than a landfill site (e.g. recycling facility, incineration etc) the **WAC is not relevant.** Furthermore the WAC limits **cannot be used to make an assessment of whether a waste is hazardous**. WAC testing does however define if a non-hazardous waste is suitable for an inert landfill.

| Classification based on Total Concentrations[1] | Non-Hazardous Waste | | Hazardous Waste | |
|---|---|---|---|---|
| WAC testing | Below inert WAC limit values: | Above inert WAC limit values: | Below hazardous WAC limit values | Above hazardous WAC limit values |
| Landfill requirements | INERT landfill | NON-HAZARDOUS landfill[2] | HAZARDOUS landfill | PRE-TREATMENT[3] |

1 Total concentrations are defined as tests results on solids as opposed to leachate (i.e. a liquid).
2 Individual sites may have certain limit values pre-determined in their licence.
3 After pre-treatment the material characteristics may have changed to an extent that allow the soil to be re-classified.

*Hydrocarbons in Soils*

WM3 uses the term Oil or Waste Oil to cover hydrocarbons products such as fuel oil, petrol or diesel. These are defined by WM3 as hazardous under an absolute entry in the List of Wastes. However hydrocarbons in soils are a mixture rather than a pure product and are therefore not absolute entries.

*Known Oils*

The simplest scenario is where the identity of the contaminating oil is known or can be identified. If the oil is known the manufacturer's or supplier's REACH compliant safety data sheet for the specific oil can be obtained and the hazard statement codes on that Safety Data Sheet can be used for the hazardous waste assessment.

Where the identity of the oil can only be identified down to a petroleum group level (i.e. the contaminating oil is known to be diesel, but the specific type/brand is unknown), then the classification of that petroleum group should be used in the assessment. The marker compounds associated with that petroleum group may be used to confirm carcinogenicity.

Oils may contain a range of hydrocarbons, so the presence of for instance Diesel Range Organics (DRO) does not enable the assessor to conclude that diesel is present. These hydrocarbons may have arisen from other oils, the laboratory needs

to provide an interpretation of the chromatograph to determine if it is consistent with diesel or weathered diesel as a whole.

The concentration of known oils should be determined using a method that as a minimum spans the range in which the carbon numbers for that known oil fall.

*Unknown Oils*

Where hydrocarbons are contaminating soils it is likely that the oil will be unknown or cannot be determined.

WM3 states that:

> For contaminated land specific consideration must be given to the following before proceeding;
>
> - The presence of other organic contaminants, for example solvents or coal tar that could be detected as hydrocarbons. Coal Tar is not an oil and is considered separately in WM3 example 2. Where the site history or investigation indicates the presence of hydrocarbons from oil and other sources (e.g. coal tar), and the origin of the hydrocarbons cannot reliably be assigned to either, then a worst case approach of considering the hydrocarbons both as waste oil (in accordance with this example) and from other sources, for example coal tar should be taken.
> - The presence of diesel, or weathered diesel, should be specifically considered by the laboratory and where this is confirmed by the hydrocarbon profile the oil should be assessed as a known or identified oil (diesel).

The use of **marker compounds** is optional; however it is recommended that where possible the marker compounds should be used. WM3 states:

> If the identity of the oil is unknown, and the petroleum group cannot be established, then the oil contaminating the waste can be classified as non-carcinogenic/mutagenic due to the presence of oil if all three of the following criteria are met:
>
> - The waste contains benzo[a]pyrene (BaP) at a concentration of less than 0.01% (1/10,000th) of the TPH concentration (This is the carcinogenic limit specified in table 3.1 of the CLP for BaP)
> - This has been determined by an appropriate and representative sampling approach in accordance with the principles set out in Appendix D of WM3, and
> - The analysis clearly demonstrates, for example by carbon bands or chromatograph, and the laboratory has reasonably concluded that the hydrocarbons present have not arisen from petrol or diesel.

For example:

| TPH Concentration (mg/kg) | Petrol or Diesel | BaP (mg/kg) | Classification |
|---|---|---|---|
| 10,000 | No | 0.9 | Non- Hazardous |
| 1,000 | No | Not available | Hazardous |
| 1,000 | Yes | Not relevant | Hazardous |

*References*

1. Environmental Permitting (England and Wales) Regulations 2010 (as amended) (EP Regulations), the Landfill Directive (1999/31/EC) and the subsequent Council Decisions.
2. Environment Agency Environmental Permitting Regulations: "Inert Waste Guidance- Standards and Measures for the Deposit of Inert Waste on Land" 2009.
3. Environment Agency "Waste acceptance at landfills - Guidance on waste acceptance procedures and criteria" Nov 2010.
4. Environment Agency "Guidance on the classification and assessment of waste (Technical Guidance WM3)".
5. Classification, Labelling and Packaging of Substances Regulation (EC 1272/2008) (CLP).
6. Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste and repealing certain Directives
7. 2014/955/EU: Commission Decision of 18 December 2014 amending Decision 2000/532/EC on the list of waste pursuant to Directive 2008/98/EC of the European Parliament
8. Environmental Permitting Guidance The Landfill Directive For the Environmental Permitting (England and Wales) Regulations 2010 Updated March 2010 Version 3.1
9. Classification, Labelling and Packaging of Substances Regulation (EC 1272/2008) (CLP).

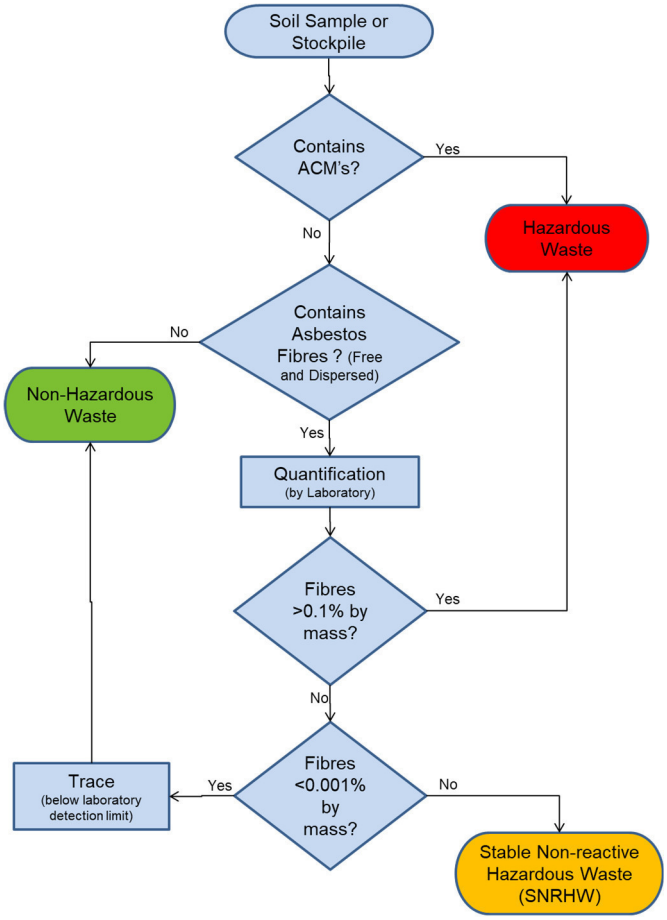
## Additional Asbestos Guidance Notes

*Disposal*

The 1st Edition of WM3 "Guidance on the classification and assessment of waste", details the way in which Asbestos is assessed within soils.

The assessment of asbestos containing waste is dependent on whether the asbestos is present as:

- Fibres that are free and dispersed, or
- Identifiable pieces of asbestos containing materials (ACM's)




Identifiable pieces of asbestos are any particle of a size that can be identified as potentially being asbestos by a competent person if examined by the naked eye. The result is that commonly soils with visible ACM's are sorted and the ACM's removed by hand picking and separate disposal.

Asbestos concentrations below 0.001% by mass are below standard laboratory detection limits and are not currently regarded as containing asbestos for the purposes of disposal and may be disposed of to an inert landfill site[1]. These levels are often termed "trace" by laboratories.

Asbestos concentrations between 0.001% and 0.1% are stable non-reactive hazardous waste (SNRHW)[1]. Waste transfer stations where soil recycling takes place may be able to take SNRHW, but are unlikely to take soils containing asbestos above trace concentrations.

The following codes should be assigned to the asbestos waste as appropriate:

| **17 06** | **Insulation materials and asbestos-containing construction materials** |
|---|---|
| 17 06 01 | Insulation materials containing asbestos |
| 17 06 03 | Other insulation materials consisting of or containing hazardous substances |
| 17 06 04 | Insulation materials other than those mentioned in 17 06 01 and 17 06 03 |
| 17 06 05 | Construction material containing asbestos |

WM3 indicates that 17 06 05 would normally be used in preference to 17 06 01 for the asbestos in asbestos contaminated soil and stones.

Construction materials containing asbestos and "*other suitable materials*" may be landfilled at landfills for non-hazardous waste in accordance with the Landfill Directive without testing.

This means that wastes that are only hazardous because of their asbestos content can be disposed of at landfills for non-hazardous waste in separate landfill cells that only accept asbestos wastes and other suitable materials. The Landfill Directive requires that stable non-reactive hazardous waste shall not be deposited with biodegradable waste (for example organic material, household waste, paper etc..) and must meet the waste acceptance criteria set out in accordance with Annex II.

*Construction*

Health and Safety Executive (HSE) guidance on asbestos is not directly related to soil and much of the guidance focuses on the removal of asbestos from buildings. The overarching legislation is the Control of Asbestos Regulation (CAR 2012). However where work involves (or is likely to involve) contact with asbestos then CAR 2012 requires a risk assessment including whether or not the work is licensed or notifiable non-licensed work and may require an Asbestos Management Plan. Work becomes notifiable if it is considered that the control limit could be exceeded.

Brownfield sites frequently have soils that contain asbestos and the presence of asbestos needs to be considered within the context of construction, particularly in relation to groundworks. The exposure of soils and the use of excavators and plant to move soil around increases the possibility of fibres becoming airborne. However it is good site practice to not generate dusts and to employ dust suppression on all sites regardless of the presence of asbestos.

The legal control limit for asbestos is 0.1f/ml over a continuous four hour period. The control limit is not a '*safe*' level and exposure from work activities involving asbestos must be reduced to as far below the control limit as possible.

Clearly the higher the concentrations in the soil the greater potential there is for fibres to be released, however IOM publication TM/88/14 "the release of dispersed asbestos fibres from soil" 1988 concludes that:

- Mixtures of asbestos in dry soils with asbestos content as low as 0.001% can produce airborne respirable asbestos concentrations greater than 0.1f/ml in dust clouds where the respirable dust concentrations are less than 5mg/m$^3$.
- An action limit is recommended of no higher than 0.001% asbestos in soils above which steps should be taken to minimise exposure to airborne fibres (eg by wetting).
- The addition of relatively small quantities (10%) of water can reduce the airborne fibre concentrations by an order of magnitude.

Where asbestos has been identified at concentrations above 0.001% as free and dispersed fibres in the soil precautions need to be adopted. Concentrations below this are considered to be normal background, although good site practice dictates that the generation of dusts should be avoided and therefore any fugitive fibre release from minor concentrations should be kept to a practical minimum.

*End Use*

The use of materials containing asbestos and material containing asbestos is prohibited under EU legislation. There is currently a Joint Industry Working Group (JIWG) tasked with producing a Code of Practice for Asbestos in Soil, Made Ground and Construction & Demolition Material that will clarify in due course the position of the various government agencies.

Asbestos containing materials can remain in situ under a suitable cover system which may be hardsurfacing or soft landscaping (with or without hard dig layers and markers).

There is a risk that future maintenance may compromise such systems and details of the presence of asbestos should be kept in the Health and Safety File.

Preliminary publications from JIWG (April 2015) provide guides for decision making in relation to construction. These are at a "Beta" test stage and further publications will be provided in due course.

The re-use of waste soils should be undertaken in accordance with the CL:AIRE Code of Practice and is subject to suitable risk assessments demonstrating low risk . There is nothing that specifically excludes the re-use of soils containing asbestos as fill to raise levels. However the movement of materials increases the risk of fibres becoming airborne and suitable precautions will be required.

The re-use of soils containing asbestos at concentrations above hazardous waste levels is likely to meet with regulatory opposition. Assuming a suitable strategy could be agreed this would take a considerable amount of time and is only likely to be feasible where there is a long program for implementation.

## Asbestos in Soil as Free Fibres

| Concentration (by weight) | Waste Disposal | | | | Construction Issues | End Use | |
|---|---|---|---|---|---|---|---|
| | Recycle | Inert | SNR Hazardous | Hazardous | | Suitable for re-use on site | Precautions |
| Not detected | √ | √ | | | No precautions necessary, however on a brownfield site asbestos not previously identified may be found during works and a statement within the contractors method statement for how they will deal with this unforeseen asbestos would be good practice to ensure compliance with CAR2012. | Yes | None |
| Trace (<0.001%) | | √ [2] | | | Precautions are unlikely to be required, however a detailed method statement may be required to ensure compliance with CAR2012.<br>Basic asbestos management good practice will be required. Typically precautions would include:<br>• Ensuring soils do not dry out to become dusty.<br>• Site personnel have the risk communicated at induction stage. | Yes<br>Soils can be re-used under CL:AIRE CoP with the correct precautions in place. | Generally clean cover or hardstanding cover required. |
| 0.001% – 0.099% | | | √ | | Contractor needs to produce an Asbestos Management Plan in accordance with CAR2012 as part of their method statement.<br>Typical precautions would include:<br>• Site personnel have the risk communicated at induction stage.<br>• Ensuring personnel have suitable training.<br>• Task monitoring to inform PPE requirements.<br>• Ensuring soils do not dry out to become dusty and that misting is available during groundworks.<br>• Separate stockpiling.<br>• Clean haulage routes. | Possibly<br><br>Soils may be able to be re-used under CL:AIRE CoP, subject to a satisfactory Risk Assessment and regulatory agreement with the correct precautions in place. | Clean cover or hardstanding cover required. |
| 0.1+% | | | | √ | Contractor needs to produce an Asbestos Management Plan in accordance with CAR2012 as part of their method statement.<br>Typical precautions would include:<br>• Site personnel have the risk communicated at induction stage.<br>• Ensuring personnel have suitable training.<br>• Task monitoring to inform PPE requirements.<br>• Site wide and or perimeter monitoring.<br>• Ensuring soils do not dry out to become dusty and that misting is available during groundworks.<br>• Separate stockpiling.<br>• Clean haulage routes.<br>• Decontamination unit | Unlikely [3]<br>Re-use of soils containing asbestos within an earthworks scheme will involve significant engineering and the risk for generating dusts will be significantly increased with repeated handling and compaction. | Clean cover and a hard dig layer. A plan should be in place for future excavations as part of the Health and Safety File. |

2 The standard laboratory detection limit is normally 0.001%. Below 0.001% is trace and currently regarded as not containing asbestos for the purposes of disposal off site. However the waste producer has a duty to fully classify the waste and the presence of trace asbestos should be declared. Consequently it is unlikely that a waste treatment site will take this soil and an inert landfill may make a commercial decision to only take it under some circumstances.

3 The re-use of soils containing asbestos at concentrations above hazardous waste is likely to meet with regulatory opposition. Assuming a suitable strategy could be agreed this would take a considerable amount of time and is only likely to be warranted where there a long program for implementation.

# APPENDIX B

**Exploratory Hole Logs**

# Trial Pit Log

Trialpit No **TP01**

Sheet 1 of 1

| | | | |
|---|---|---|---|
| Project Name: THOMAS STREET, MANCHESTER | Project No. C3742 | Co-ords: - Level: | Date 14/02/2018 |
| Location: MANCHESTER | | Dimensions (m): Depth 1.00 | Scale 1:25 |
| Client: RENAISSANCE ENGINEERS LTD | | | Logged NS |

| Water Strike | Samples and In Situ Testing: Depth | Type | Results | Depth (m) | Level (m) | Legend | Stratum Description |
|---|---|---|---|---|---|---|---|
| | 0.10 - 0.80 | ES | | 0.08<br>0.10 | | | MADE GROUND: Paving slab. |
| | | | | | | | MADE GROUND: Yellowish brown gravelly SAND. Sand is fine to coarse. Gravel is subangular fine to medium of sandstone. |
| | | | | | | | MADE GROUND: Soft brown slightly gravelly slightly sandy clay with occasional coal and brick fragments. Sand is fine to coarse. Gravel is subangular fine to medium of sandstone. |
| ▼ | 0.90 - 1.00 | ES | | 0.86 | | | Stiff brown slightly sandy CLAY with rare coal fragments. Sand is fine to medium. |
| | | | | 1.00 | | | End of pit at 1.00 m |

1 2 3 4 5

Remarks:

Stability:

# Trial Pit Log

Trialpit No **TP02** Sheet 1 of 1

| | | | |
|---|---|---|---|
| Project Name: THOMAS STREET, MANCHESTER | Project No. C3742 | Co-ords: - Level: | Date 14/02/2018 |
| Location: MANCHESTER | | Dimensions (m): Depth 0.50 | Scale 1:25 |
| Client: RENAISSANCE ENGINEERS LTD | | | Logged NS |

| Water Strike | Samples and In Situ Testing | | | Depth (m) | Level (m) | Legend | Stratum Description |
|---|---|---|---|---|---|---|---|
| | Depth | Type | Results | | | | |
| | | | | 0.10 | | | MADE GROUND: Concrete. |
| | 0.20 | ES | | 0.16 | | | MADE GROUND: Paving slab. |
| | 0.40 | ES | HVP=140 | 0.36 | | | MADE GROUND: Soft brown slightly gravelly slightly sandy clay with occasional ash, coal and brick fragments. Sand is fine to coarse. Gravel is subangular fine to medium of sandstone. |
| | | | | 0.50 | | | Stiff brown slightly sandy CLAY with rare coal fragments. Sand is fine to medium. |
| | | | | | | | End of pit at 0.50 m |

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Remarks:

Stability:

AGS

# Trial Pit Log

Trialpit No **TP03** Sheet 1 of 1

| | | | |
|---|---|---|---|
| Project Name: THOMAS STREET, MANCHESTER | Project No. C3742 | Co-ords: - Level: | Date 14/02/2018 |
| Location: MANCHESTER | | Dimensions (m): Depth 1.10 | Scale 1:25 |
| Client: RENAISSANCE ENGINEERS LTD | | | Logged NS |

| Water Strike | Samples and In Situ Testing: Depth | Type | Results | Depth (m) | Level (m) | Legend | Stratum Description |
|---|---|---|---|---|---|---|---|
| | 0.10 - 0.40 | ES | | 0.10 | | | MADE GROUND: Concrete. |
| | | | | 0.40 | | | MADE GROUND: Black gravelly sand with abundant ash and sandstone masonry / brick cobble content. Sand is fine to medium. Gravel is subangular fine to medium. |
| | 0.50 | ES | | | | | Stiff brown slightly sandy CLAY with rare coal fragments. Sand is fine to medium. |
| | | | | 1.10 | | | End of pit at 1.10 m |

1 2 3 4 5

Remarks:

Stability:

# Trial Pit Log

Trialpit No **TP04** Sheet 1 of 1

| | | | |
|---|---|---|---|
| Project Name: THOMAS STREET, MANCHESTER | Project No. C3742 | Co-ords: - Level: | Date 14/02/2018 |
| Location: MANCHESTER | | Dimensions (m): Depth 1.10 | Scale 1:25 |
| Client: RENAISSANCE ENGINEERS LTD | | | Logged NS |

| Water Strike | Samples and In Situ Testing: Depth | Type | Results | Depth (m) | Level (m) | Legend | Stratum Description |
|---|---|---|---|---|---|---|---|
| | | | | 0.05 | | | MADE GROUND: Concrete. |
| | 0.20 - 0.30 | ES | HVP=140 | 0.20 | | | MADE GROUND: Reddish brown sandy gravel with frequent brick cobbles and fragments. Sand is fine to medium. Gravel is subangular fine to medium. |
| | 0.30 - 0.40 | ES | | 0.30 | | | MADE GROUND: Soft brown slightly gravelly slightly sandy clay with occasional ash, coal and brick fragments. Sand is fine to coarse. Gravel is subangular fine to medium of sandstone. |
| | | | | | | | Stiff brown slightly sandy CLAY with rare coal fragments. Sand is fine to medium. |
| | | | | 1.10 | | | End of pit at 1.10 m |

1 2 3 4 5

Remarks:

Stability:

AGS

# Trial Pit Log

Trialpit No **TP05** Sheet 1 of 1

| | | | |
|---|---|---|---|
| Project Name: THOMAS STREET, MANCHESTER | Project No. C3742 | Co-ords: - Level: | Date 15/02/2018 |
| Location: MANCHESTER | | Dimensions (m): Depth 1.10 | Scale 1:25 |
| Client: RENAISSANCE ENGINEERS LTD | | | Logged NS |

| Water Strike | Samples and In Situ Testing | | | Depth (m) | Level (m) | Legend | Stratum Description |
|---|---|---|---|---|---|---|---|
| | Depth | Type | Results | | | | |
| | | | | 0.05 | | | MADE GROUND: Concrete. |
| | | | | 0.20 | | | MADE GROUND: Reddish brown sandy gravel with frequent brick cobbles and fragments. Sand is fine to medium. Gravel is subangular fine to medium. |
| | 0.40 | ES | | 0.30 | | | MADE GROUND: Soft brown slightly gravelly slightly sandy clay with occasional ash, coal and brick fragments. Sand is fine to coarse. Gravel is subangular fine to medium of sandstone. |
| | | | | | | | Stiff brown slightly sandy CLAY with rare coal fragments. Sand is fine to medium. |
| | | | | 1.10 | | | End of pit at 1.10 m |

1 2 3 4 5

Remarks:

Stability:

# Trial Pit Log

Trialpit No **TP06** Sheet 1 of 1

| | | | |
|---|---|---|---|
| Project Name: THOMAS STREET, MANCHESTER | Project No. C3742 | Co-ords: - Level: | Date 14/02/2018 |
| Location: MANCHESTER | | Dimensions (m): Depth 0.60 | Scale 1:25 |
| Client: RENAISSANCE ENGINEERS LTD | | | Logged NS |

| Water Strike | Samples and In Situ Testing | | | Depth (m) | Level (m) | Legend | Stratum Description |
|---|---|---|---|---|---|---|---|
| | Depth | Type | Results | | | | |
| | 0.10 - 0.20 | ES | HVP=140 | 0.05 | | | MADE GROUND: Concrete. |
| | 0.20 - 0.40 | ES | | 0.20 | | | MADE GROUND: Reddish brown sandy gravel with frequent brick cobbles and fragments. Sand is fine to medium. Gravel is subangular fine to medium. |
| | | | | | | | Stiff brown slightly sandy CLAY with rare coal fragments. Sand is fine to medium. |
| | | | | 0.60 | | | End of pit at 0.60 m |

Remarks:

Stability:

# Trial Pit Log

Trialpit No **TP07**

Sheet 1 of 1

| | | | |
|---|---|---|---|
| Project Name: THOMAS STREET, MANCHESTER | Project No. C3742 | Co-ords: - Level: | Date 15/02/2018 |
| Location: MANCHESTER | | Dimensions (m): Depth 0.50 | Scale 1:25 |
| Client: RENAISSANCE ENGINEERS LTD | | | Logged NS |

| Water Strike | Samples and In Situ Testing: Depth | Type | Results | Depth (m) | Level (m) | Legend | Stratum Description |
|---|---|---|---|---|---|---|---|
| | 0.10 - 0.30 | ES | | 0.05 | | | MADE GROUND: Concrete. |
| | | | | 0.18 | | | MADE GROUND: Reddish brown sandy gravel with frequent brick cobbles and fragments. Sand is fine to medium. Gravel is subangular fine to medium. |
| ▼ | 0.40 - 0.50 | ES | HVP=140 | | | | Stiff brown slightly sandy CLAY with rare coal fragments. Sand is fine to medium. |
| | | | | 0.50 | | | End of pit at 0.50 m |

1 2 3 4 5

Remarks:

Stability:

# Trial Pit Log

Trialpit No **TP08**

Sheet 1 of 1

| | | | |
|---|---|---|---|
| Project Name: THOMAS STREET, MANCHESTER | Project No. C3742 | Co-ords: - Level: | Date 15/02/2018 |
| Location: MANCHESTER | | Dimensions (m): Depth 0.70 | Scale 1:25 |
| Client: RENAISSANCE ENGINEERS LTD | | | Logged NS |

| Water Strike | Samples and In Situ Testing | | | Depth (m) | Level (m) | Legend | Stratum Description |
|---|---|---|---|---|---|---|---|
| | Depth | Type | Results | | | | |
| | 0.10 | ES | | 0.05 | | | MADE GROUND: Concrete. |
| | | | | 0.15 | | | MADE GROUND: Reddish brown sandy gravel with frequent brick cobbles and fragments. Sand is fine to medium. Gravel is subangular fine to medium. |
| ▼ | 0.30 | ES | HVP=25 | 0.35 | | | MADE GROUND: Soft brown slightly gravelly slightly sandy clay with occasional ash, coal and brick fragments. Sand is fine to coarse. Gravel is subangular fine to medium of sandstone. |
| | | | HVP=140 | | | | Stiff brown slightly sandy CLAY with rare coal fragments. Sand is fine to medium. |
| | | | | 0.70 | | | End of pit at 0.70 m |

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Remarks:

Stability:

AGS

# Trial Pit Log

| | | | |
|---|---|---|---|
| BROWNFIELD SOLUTIONS LTD | | | Trialpit No **TP09** Sheet 1 of 1 |
| Project Name: THOMAS STREET, MANCHESTER | Project No. C3742 | Co-ords: - Level: | Date 15/02/2018 |
| Location: MANCHESTER | | Dimensions (m): Depth 1.35 | Scale 1:25 |
| Client: RENAISSANCE ENGINEERS LTD | | | Logged NS |

| Water Strike | Samples and In Situ Testing: Depth | Type | Results | Depth (m) | Level (m) | Legend | Stratum Description |
|---|---|---|---|---|---|---|---|
| | | | | 0.10 | | | MADE GROUND: Concrete. |
| ▼ | | | | 0.80 | | | MADE GROUND: Soft brown slightly gravelly slightly sandy clay with occasional ash, coal and brick fragments. Sand is fine to coarse. Gravel is subangular fine to medium of sandstone. |
| | | | | 1.35 | | | Soft dark brown / black organic CLAY with occasional degrading wood content. |
| | | | | | | | End of pit at 1.35 m |

1 2 3 4 5

Remarks:

Stability:

AGS

# Trial Pit Log

Trialpit No **TP10** Sheet 1 of 1

| | | | |
|---|---|---|---|
| Project Name: THOMAS STREET, MANCHESTER | Project No. C3742 | Co-ords: - Level: | Date 15/02/2018 |
| Location: MANCHESTER | | Dimensions (m): Depth 1.35 | Scale 1:25 |
| Client: RENAISSANCE ENGINEERS LTD | | | Logged NS |

| Water Strike | Samples and In Situ Testing: Depth | Type | Results | Depth (m) | Level (m) | Legend | Stratum Description |
|---|---|---|---|---|---|---|---|
| | | | | 0.10 | | | MADE GROUND: Concrete. |
| ▼ | 0.30 | ES | | | | | MADE GROUND: Soft brown slightly gravelly slightly sandy clay with occasional ash, coal and brick fragments. Sand is fine to coarse. Gravel is subangular fine to medium of sandstone. |
| | 0.80 | ES | | 0.80 | | | Soft dark brown / black organic CLAY with occasional degrading wood content. |
| | | | | 1.35 | | | End of pit at 1.35 m |

1 2 3 4 5

Remarks:

Stability:

AGS

# Borehole Log

BROWNFIELD SOLUTIONS LTD

Borehole No. **Core 1**

Sheet 1 of 1

| | | | | |
|---|---|---|---|---|
| Project Name: | THOMAS STREET, MANCHESTER | Project No. C3742 | Co-ords: - | Hole Type RC |
| Location: | MANCHESTER | | Level: | Scale 1:15 |
| Client: | RENAISSANCE ENGINEERS LTD | | Dates: 14/02/2018 - | Logged By NS |

| Well | Water Strikes | Samples and In Situ Testing | | | Depth (m) | Level (m) | Legend | Stratum Description |
|---|---|---|---|---|---|---|---|---|
| | | Depth (m) | Type | Results | | | | |
| | | | | | | | | MADE GROUND: Brick with grout. |
| | | | | | 0.35 | | | |
| | | | | | 0.36 | | | MADE GROUND: Soft brown slightly gravelly slightly sandy clay with occasional ash, coal and brick fragments. Sand is fine to coarse. Gravel is subangular fine to medium of sandstone. |
| | | | | | | | | End of borehole at 0.35 m |

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Remarks

AGS

# Borehole Log

BROWNFIELD SOLUTIONS LTD

Borehole No. **Core 2**

Sheet 1 of 1

| | | | | |
|---|---|---|---|---|
| Project Name: | THOMAS STREET, MANCHESTER | Project No. C3742 | Co-ords: - | Hole Type RC |
| Location: | MANCHESTER | | Level: | Scale 1:15 |
| Client: | RENAISSANCE ENGINEERS LTD | | Dates: 14/02/2018 - | Logged By NS |

| Well | Water Strikes | Samples and In Situ Testing | | | Depth (m) | Level (m) | Legend | Stratum Description |
|---|---|---|---|---|---|---|---|---|
| | | Depth (m) | Type | Results | | | | |
| | | | | | 0.24 | | | MADE GROUND: Brick with grout. |
| | | | | | 0.25 | | | MADE GROUND: Soft brown slightly gravelly slightly sandy clay with occasional ash, coal and brick fragments. Sand is fine to coarse. Gravel is subangular fine to medium of sandstone. |
| | | | | | | | | End of borehole at 0.24 m |

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Remarks

AGS

# Borehole Log

Borehole No. **Core 3**

Sheet 1 of 1

| | | | | |
|---|---|---|---|---|
| Project Name: | THOMAS STREET, MANCHESTER | Project No. C3742 | Co-ords: - | Hole Type RC |
| Location: | MANCHESTER | | Level: | Scale 1:15 |
| Client: | RENAISSANCE ENGINEERS LTD | | Dates: 14/02/2018 - | Logged By NS |

| Well | Water Strikes | Samples and In Situ Testing | | | Depth (m) | Level (m) | Legend | Stratum Description |
|---|---|---|---|---|---|---|---|---|
| | | Depth (m) | Type | Results | | | | |
| | | | | | | | | MADE GROUND: Brick with grout. |
| | | | | | 0.35 | | | |
| | | | | | 0.36 | | | MADE GROUND: Yellowish brown gravelly SAND. Sand is fine to coarse. Gravel is subangular fine to medium of sandstone. |
| | | | | | | | | End of borehole at 0.35 m |

Remarks

# Borehole Log

BROWNFIELD SOLUTIONS LTD

Borehole No. **Core 4**

Sheet 1 of 1

| | | | | |
|---|---|---|---|---|
| Project Name: | THOMAS STREET, MANCHESTER | Project No. C3742 | Co-ords: - | Hole Type RC |
| Location: | MANCHESTER | | Level: | Scale 1:15 |
| Client: | RENAISSANCE ENGINEERS LTD | | Dates: 14/02/2018 - | Logged By NS |

| Well | Water Strikes | Samples and In Situ Testing | | | Depth (m) | Level (m) | Legend | Stratum Description |
|---|---|---|---|---|---|---|---|---|
| | | Depth (m) | Type | Results | | | | |
| | | | | | 0.26 | | | MADE GROUND: Brick with grout. |
| | | | | | 0.27 | | | MADE GROUND: Soft brown slightly gravelly slightly sandy clay with occasional ash, coal and brick fragments. Sand is fine to coarse. Gravel is subangular fine to medium of sandstone. |
| | | | | | | | | End of borehole at 0.26 m |

1

2

3

Remarks

AGS

# APPENDIX C

**Chemical Testing Results**

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# Analytical Report Number : 18-76600

| | | | |
|---|---|---|---|
| **Project / Site name:** | Thomas Street, Manchester | **Samples received on:** | 19/02/2018 |
| **Your job number:** | C3742 | **Samples instructed on:** | 20/02/2018 |
| **Your order number:** | | **Analysis completed by:** | 26/02/2018 |
| **Report Issue Number:** | 1 | **Report issued on:** | 26/02/2018 |
| **Samples Analysed:** | 5 soil samples | | |

**Signed:**

Jordan Hill
Reporting Manager
**For & on behalf of i2 Analytical Ltd.**

Standard Geotechnical, Asbestos and Chemical Testing Laboratory located at: ul. Pionierów 39, 41 -711 Ruda Śląska, Poland.

Accredited tests are defined within the report, opinions and interpretations expressed herein are outside the scope of accreditation.

Standard sample disposal times, unless otherwise agreed with the laboratory, are :

| | |
|---|---|
| soils | - 4 weeks from reporting |
| leachates | - 2 weeks from reporting |
| waters | - 2 weeks from reporting |
| asbestos | - 6 months from reporting |

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The results included within the report are representative of the samples submitted for analysis.

**Analytical Report Number: 18-76600**

**Project / Site name: Thomas Street, Manchester**

| **Lab Sample Number** | | | | 911400 | 911401 | 911402 | 911403 | 911404 |
|---|---|---|---|---|---|---|---|---|
| **Sample Reference** | | | | TP01 | TP04 | TP04 | TP08 | TP10 |
| **Sample Number** | | | | None Supplied | None Supplied | None Supplied | None Supplied | None Supplied |
| **Depth (m)** | | | | 0.10-0.80 | 0.20-0.30 | 0.30-0.40 | 0.30 | 0.30 |
| **Date Sampled** | | | | 14/02/2018 | 14/02/2018 | 14/02/2018 | 15/02/2018 | 15/02/2018 |
| **Time Taken** | | | | None Supplied | None Supplied | None Supplied | None Supplied | None Supplied |
| **Analytical Parameter (Soil Analysis)** | **Units** | **Limit of detection** | **Accreditation Status** | | | | | |
| Stone Content | % | 0.1 | NONE | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 |
| Moisture Content | % | N/A | NONE | 19 | 13 | 14 | 24 | 29 |
| Total mass of sample received | kg | 0.001 | NONE | 1.5 | 1.1 | 1.0 | 1.3 | 1.2 |
| **General Inorganics** | | | | | | | | |
| pH - Automated | pH Units | N/A | MCERTS | 6.2 | 9.3 | 8.6 | 8.3 | 7.3 |
| Free Cyanide | mg/kg | 1 | MCERTS | < 1 | < 1 | < 1 | < 1 | < 1 |
| Organic Matter | % | 0.1 | MCERTS | 2.3 | 3.0 | 1.5 | 3.3 | 2.4 |
| **Phenols by HPLC** | | | | | | | | |
| Catechol | mg/kg | 0.1 | ISO 17025 | < 0.10 | < 0.10 | < 0.10 | < 0.10 | < 0.10 |
| Resorcinol | mg/kg | 0.1 | ISO 17025 | < 0.10 | < 0.10 | < 0.10 | < 0.10 | < 0.10 |
| Cresols (o-, m-, p-) | mg/kg | 0.3 | ISO 17025 | < 0.30 | < 0.30 | < 0.30 | < 0.30 | < 0.30 |
| Total Naphthols (sum of 1- and 2- Naphthol) | mg/kg | 0.2 | ISO 17025 | < 0.20 | < 0.20 | < 0.20 | < 0.20 | < 0.20 |
| 2-Isopropylphenol | mg/kg | 0.1 | ISO 17025 | < 0.10 | < 0.10 | < 0.10 | < 0.10 | < 0.10 |
| Phenol | mg/kg | 0.1 | ISO 17025 | < 0.10 | < 0.10 | < 0.10 | < 0.10 | < 0.10 |
| Trimethylphenol (2,3,5-) | mg/kg | 0.1 | ISO 17025 | < 0.10 | < 0.10 | < 0.10 | < 0.10 | < 0.10 |
| Total Xylenols and Ethylphenols | mg/kg | 0.3 | ISO 17025 | < 0.30 | < 0.30 | < 0.30 | < 0.30 | < 0.30 |
| **Total Phenols** | | | | | | | | |
| Total Phenols (HPLC) | mg/kg | 1.3 | ISO 17025 | < 1.3 | < 1.3 | < 1.3 | < 1.3 | < 1.3 |



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The results included within the report are representative of the samples submitted for analysis.

**Analytical Report Number: 18-76600**

**Project / Site name: Thomas Street, Manchester**

| Lab Sample Number | | | | 911400 | 911401 | 911402 | 911403 | 911404 |
|---|---|---|---|---|---|---|---|---|
| Sample Reference | | | | TP01 | TP04 | TP04 | TP08 | TP10 |
| Sample Number | | | | None Supplied | None Supplied | None Supplied | None Supplied | None Supplied |
| Depth (m) | | | | 0.10-0.80 | 0.20-0.30 | 0.30-0.40 | 0.30 | 0.30 |
| Date Sampled | | | | 14/02/2018 | 14/02/2018 | 14/02/2018 | 15/02/2018 | 15/02/2018 |
| Time Taken | | | | None Supplied | None Supplied | None Supplied | None Supplied | None Supplied |
| **Analytical Parameter (Soil Analysis)** | **Units** | **Limit of detection** | **Accreditation Status** | | | | | |
| **Speciated PAHs** | | | | | | | | |
| Naphthalene | mg/kg | 0.05 | MCERTS | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 |
| Acenaphthylene | mg/kg | 0.05 | MCERTS | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 |
| Acenaphthene | mg/kg | 0.05 | MCERTS | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 |
| Fluorene | mg/kg | 0.05 | MCERTS | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 |
| Phenanthrene | mg/kg | 0.05 | MCERTS | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 |
| Anthracene | mg/kg | 0.05 | MCERTS | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 |
| Fluoranthene | mg/kg | 0.05 | MCERTS | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 |
| Pyrene | mg/kg | 0.05 | MCERTS | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 |
| Benzo(a)anthracene | mg/kg | 0.05 | MCERTS | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 |
| Chrysene | mg/kg | 0.05 | MCERTS | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 |
| Benzo(b)fluoranthene | mg/kg | 0.05 | MCERTS | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 |
| Benzo(k)fluoranthene | mg/kg | 0.05 | MCERTS | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 |
| Benzo(a)pyrene | mg/kg | 0.05 | MCERTS | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 |
| Indeno(1,2,3-cd)pyrene | mg/kg | 0.05 | MCERTS | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 |
| Dibenz(a,h)anthracene | mg/kg | 0.05 | MCERTS | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 |
| Benzo(ghi)perylene | mg/kg | 0.05 | MCERTS | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 |
| **Total PAH** | | | | | | | | |
| Speciated Total EPA-16 PAHs | mg/kg | 0.8 | MCERTS | < 0.80 | < 0.80 | < 0.80 | < 0.80 | < 0.80 |
| **Heavy Metals / Metalloids** | | | | | | | | |
| Arsenic (aqua regia extractable) | mg/kg | 1 | MCERTS | 11 | 20 | 8.9 | 7.9 | 9.8 |
| Cadmium (aqua regia extractable) | mg/kg | 0.2 | MCERTS | < 0.2 | 22 | < 0.2 | < 0.2 | < 0.2 |
| Chromium (hexavalent) | mg/kg | 1.2 | MCERTS | < 1.2 | < 1.2 | < 1.2 | < 1.2 | < 1.2 |
| Chromium (III) | mg/kg | 1 | NONE | 24 | 35 | 32 | 29 | 29 |
| Chromium (aqua regia extractable) | mg/kg | 1 | MCERTS | 25 | 36 | 32 | 30 | 29 |
| Copper (aqua regia extractable) | mg/kg | 1 | MCERTS | 34 | 52 | 25 | 18 | 35 |
| Lead (aqua regia extractable) | mg/kg | 1 | MCERTS | 110 | 180 | 13 | 16 | 72 |
| Mercury (aqua regia extractable) | mg/kg | 0.3 | MCERTS | 1.9 | < 0.3 | < 0.3 | < 0.3 | < 0.3 |
| Nickel (aqua regia extractable) | mg/kg | 1 | MCERTS | 33 | 33 | 38 | 30 | 39 |
| Selenium (aqua regia extractable) | mg/kg | 1 | MCERTS | < 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 |
| Zinc (aqua regia extractable) | mg/kg | 1 | MCERTS | 67 | 1500 | 62 | 46 | 69 |



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**Analytical Report Number : 18-76600**

**Project / Site name: Thomas Street, Manchester**

* These descriptions are only intended to act as a cross check if sample identities are questioned. The major constituent of the sample is intended to act with respect to MCERTS validation. The laboratory is accredited for sand, clay and loam (MCERTS) soil types. Data for unaccredited types of solid should be interpreted with care.

Stone content of a sample is calculated as the % weight of the stones not passing a 10 mm sieve. Results are not corrected for stone content.

| Lab Sample Number | Sample Reference | Sample Number | Depth (m) | Sample Description * |
|---|---|---|---|---|
| 911400 | TP01 | None Supplied | 0.10-0.80 | Brown clay and sand with gravel. |
| 911401 | TP04 | None Supplied | 0.20-0.30 | Brown loam and sand with brick and rubble. |
| 911402 | TP04 | None Supplied | 0.30-0.40 | Brown clay. |
| 911403 | TP08 | None Supplied | 0.30 | Brown clay and sand. |
| 911404 | TP10 | None Supplied | 0.30 | Brown clay with gravel. |



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**Analytical Report Number : 18-76600**

**Project / Site name: Thomas Street, Manchester**

**Water matrix abbreviations: Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Water (PrW)**

| Analytical Test Name | Analytical Method Description | Analytical Method Reference | Method number | Wet / Dry Analysis | Accreditation Status |
|---|---|---|---|---|---|
| Cr (III) in soil | In-house method by calculation from total Cr and Cr VI. | In-house method by calculation | L080-PL | W | NONE |
| Free cyanide in soil | Determination of free cyanide by distillation followed by colorimetry. | In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (Skalar) | L080-PL | W | MCERTS |
| Hexavalent chromium in soil (Lower Level) | Determination of hexavalent chromium in soil by extraction in water then by acidification, addition of 1,5 diphenylcarbazide followed by colorimetry. | In-house method | L080-PL | W | MCERTS |
| Metals in soil by ICP-OES | Determination of metals in soil by aqua-regia digestion followed by ICP-OES. | In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil. | L038-PL | D | MCERTS |
| Moisture Content | Moisture content, determined gravimetrically. | In-house method based on BS1377 Part 2, 1990, Chemical and Electrochemical Tests | L019-UK/PL | W | NONE |
| Organic matter (Automated) in soil | Determination of organic matter in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate. | BS1377 Part 3, 1990, Chemical and Electrochemical Tests"" | L009-PL | D | MCERTS |
| pH in soil (automated) | Determination of pH in soil by addition of water followed by automated electrometric measurement. | In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests | L099-PL | D | MCERTS |
| Phenols, speciated, in soil, by HPLC | Determination of speciated phenols by HPLC. | In house method based on Blue Book Method. | L030-PL | W | ISO 17025 |
| Speciated EPA-16 PAHs in soil | Determination of PAH compounds in soil by extraction in dichloromethane and hexane followed by GC-MS with the use of surrogate and internal standards. | In-house method based on USEPA 8270 | L064-PL | D | MCERTS |
| Stones content of soil | Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight. | In-house method based on British Standard Methods and MCERTS requirements. | L019-UK/PL | D | NONE |

**For method numbers ending in 'UK' analysis have been carried out in our laboratory in the United Kingdom.**
**For method numbers ending in 'PL' analysis have been carried out in our laboratory in Poland.**
**Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.**


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The results included within the report are representative of the samples submitted for analysis.

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**e:** reception@i2analytical.com

# Analytical Report Number : 18-76603

| | | | |
|---|---|---|---|
| **Project / Site name:** | Thomas Street, Manchester | **Samples received on:** | 19/02/2018 |
| **Your job number:** | C3742 | **Samples instructed on:** | 20/02/2018 |
| **Your order number:** | | **Analysis completed by:** | 28/02/2018 |
| **Report Issue Number:** | 1 | **Report issued on:** | 28/02/2018 |
| **Samples Analysed:** | 1 10:1 WAC soil sample | | |

**Signed:**

Jordan Hill
Reporting Manager
**For & on behalf of i2 Analytical Ltd.**

Standard Geotechnical, Asbestos and Chemical Testing Laboratory located at: ul. Pionierów 39, 41 -711 Ruda Śląska, Poland.

Accredited tests are defined within the report, opinions and interpretations expressed herein are outside the scope of accreditation.

Standard sample disposal times, unless otherwise agreed with the laboratory, are :

| | |
|---|---|
| soils | - 4 weeks from reporting |
| leachates | - 2 weeks from reporting |
| waters | - 2 weeks from reporting |
| asbestos | - 6 months from reporting |

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The results included within the report are representative of the samples submitted for analysis.

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email:reception@i2analytical.com

## Waste Acceptance Criteria Analytical Results

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Report No:** | **18-76603** | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | **Client:** | **BSL** | |
| | | | | | | | |
| **Location** | **Thomas Street, Manchester** | | | | | | |
| **Lab Reference (Sample Number)** | 911426 / 911427 | | | | **Landfill Waste Acceptance Criteria** | | |
| | | | | | **Limits** | | |
| **Sampling Date** | 14/02/2018 | | | | Inert Waste Landfill | Stable Non-reactive HAZARDOUS waste in non-hazardous Landfill | Hazardous Waste Landfill |
| **Sample ID** | TP03 | | | | | | |
| **Depth (m)** | 0.10-0.40 | | | | | | |
| **Solid Waste Analysis** | | | | | | | |
| TOC (%)** | 2.2 | | | | 3% | 5% | 6% |
| Loss on Ignition (%) ** | 8.5 | | | | -- | -- | 10% |
| BTEX (µg/kg) ** | < 10 | | | | 6000 | -- | -- |
| Sum of PCBs (mg/kg) ** | < 0.007 | | | | 1 | -- | -- |
| Mineral Oil (mg/kg) | < 10 | | | | 500 | -- | -- |
| Total PAH (WAC-17) (mg/kg) | 4.6 | | | | 100 | -- | -- |
| pH (units)** | 10.2 | | | | -- | >6 | -- |
| Acid Neutralisation Capacity (mol / kg) | 57 | | | | -- | To be evaluated | To be evaluated |
| **Eluate Analysis** | 10:1 | | | 10:1 | Limit values for compliance leaching test | | |
| (BS EN 12457 - 2 preparation utilising end over end leaching procedure) | mg/l | | | mg/kg | using BS EN 12457-2 at L/S 10 l/kg (mg/kg) | | |
| Arsenic * | < 0.0011 | | | < 0.0110 | 0.5 | 2 | 25 |
| Barium * | 0.0069 | | | 0.0550 | 20 | 100 | 300 |
| Cadmium * | < 0.0001 | | | < 0.0008 | 0.04 | 1 | 5 |
| Chromium * | 0.0085 | | | 0.068 | 0.5 | 10 | 70 |
| Copper * | 0.024 | | | 0.19 | 2 | 50 | 100 |
| Mercury * | < 0.0005 | | | < 0.0050 | 0.01 | 0.2 | 2 |
| Molybdenum * | 0.0097 | | | 0.0775 | 0.5 | 10 | 30 |
| Nickel * | 0.0005 | | | 0.0036 | 0.4 | 10 | 40 |
| Lead * | 0.0058 | | | 0.046 | 0.5 | 10 | 50 |
| Antimony * | 0.026 | | | 0.21 | 0.06 | 0.7 | 5 |
| Selenium * | < 0.0040 | | | < 0.040 | 0.1 | 0.5 | 7 |
| Zinc * | 0.0019 | | | 0.016 | 4 | 50 | 200 |
| Chloride * | 5.0 | | | 40 | 800 | 4000 | 25000 |
| Fluoride | 0.38 | | | 3.0 | 10 | 150 | 500 |
| Sulphate * | 17 | | | 130 | 1000 | 20000 | 50000 |
| TDS | 110 | | | 900 | 4000 | 60000 | 100000 |
| Phenol Index (Monohydric Phenols) * | < 0.010 | | | < 0.10 | 1 | - | - |
| DOC | 5.69 | | | 45.6 | 500 | 800 | 1000 |
| | | | | | | | |
| | | | | | | | |
| **Leach Test Information** | | | | | | | |
| | | | | | | | |
| Stone Content (%) | < 0.1 | | | | | | |
| Sample Mass (kg) | 0.98 | | | | | | |
| Dry Matter (%) | 86 | | | | | | |
| Moisture (%) | 14 | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

Results are expressed on a dry weight basis, after correction for moisture content where applicable.
*= UKAS accredited (liquid eluate analysis only)
Stated limits are for guidance only and i2 cannot be held responsible for any discrepancies with current legislation
** = MCERTS accredited

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes as defined by the Waste (England and Wales) Regulations 2011 (as amended) and EA Guidance WM3.
This analysis is only applicable for landfill acceptance criteria (The Environmental Permitting (England and Wales) Regulations) and does not give any indication as to whether a waste may be hazardous or non-hazardous.



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The results included within the report are representative of the samples submitted for analysis.

**Analytical Report Number : 18-76603**

**Project / Site name: Thomas Street, Manchester**

* These descriptions are only intended to act as a cross check if sample identities are questioned. The major constituent of the sample is intended to act with respect to MCERTS validation. The laboratory is accredited for sand, clay and loam (MCERTS) soil types. Data for unaccredited types of solid should be interpreted with care.

Stone content of a sample is calculated as the % weight of the stones not passing a 10 mm sieve. Results are not corrected for stone content.

| Lab Sample Number | Sample Reference | Sample Number | Depth (m) | Sample Description * |
|---|---|---|---|---|
| 911426 | TP03 | None Supplied | 0.10-0.40 | Brown clay and loam with rubble and gravel. |


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The results included within the report are representative of the samples submitted for analysis.

**Analytical Report Number : 18-76603**

**Project / Site name: Thomas Street, Manchester**

**Water matrix abbreviations: Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Water (PrW)**

| Analytical Test Name | Analytical Method Description | Analytical Method Reference | Method number | Wet / Dry Analysis | Accreditation Status |
|---|---|---|---|---|---|
| Acid neutralisation capacity of soil | Determination of acid neutralisation capacity by addition of acid or alkali followed by electronic probe. | In-house method based on Guidance an Sampling and Testing of Wastes to Meet Landfill Waste Acceptance"" | L046-UK | W | NONE |
| BS EN 12457-2 (10:1) Leachate Prep | 10:1 (as recieved, moisture adjusted) end over end extraction with water for 24 hours. Eluate filtered prior to analysis. | In-house method based on BSEN12457-2. | L043-PL | W | NONE |
| BTEX in soil (Monoaromatics) | Determination of BTEX in soil by headspace GC-MS. | In-house method based on USEPA8260 | L073B-PL | W | MCERTS |
| Chloride 10:1 WAC | Determination of Chloride colorimetrically by discrete analyser. | In house based on MEWAM Method ISBN 0117516260. | L082-PL | W | ISO 17025 |
| Dissolved organic carbon 10:1 WAC | Determination of dissolved inorganic carbon in leachate by TOC/DOC NDIR Analyser. | In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton | L037-PL | W | NONE |
| Fluoride 10:1 WAC | Determination of fluoride in leachate by 1:1ratio with a buffer solution followed by Ion Selective Electrode. | In-house method based on Use of Total Ionic Strength Adjustment Buffer for Electrode Determination" | L033B-PL | W | ISO 17025 |
| Loss on ignition of soil @ 450oC | Determination of loss on ignition in soil by gravimetrically with the sample being ignited in a muffle furnace. | In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests | L047-PL | D | MCERTS |
| Metals in leachate by ICP-OES | Determination of metals in leachate by acidification followed by ICP-OES. | In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil"" | L039-PL | W | ISO 17025 |
| Mineral Oil (Soil) C10 - C40 | Determination of mineral oil fraction extractable hydrocarbons in soil by GC-MS/GC-FID. | in-house method | L076-PL | D | NONE |
| Moisture Content | Moisture content, determined gravimetrically. | In-house method based on BS1377 Part 2, 1990, Chemical and Electrochemical Tests | L019-UK/PL | W | NONE |
| Monohydric phenols 10:1 WAC | Determination of phenols in leachate by distillation followed by colorimetry. | In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton | L080-PL | W | ISO 17025 |
| PCB's By GC-MS in soil | Determination of PCB by extraction with acetone and hexane followed by GC-MS. | In-house method based on USEPA 8082 | L027-PL | D | MCERTS |
| pH in soil | Determination of pH in soil by addition of water followed by electrometric measurement. | In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests | L005-PL | W | MCERTS |



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**Analytical Report Number : 18-76603**

**Project / Site name: Thomas Street, Manchester**

**Water matrix abbreviations: Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Water (PrW)**

| Analytical Test Name | Analytical Method Description | Analytical Method Reference | Method number | Wet / Dry Analysis | Accreditation Status |
|---|---|---|---|---|---|
| Speciated WAC-17 PAHs in soil | Determination of PAH compounds in soil by extraction in dichloromethane and hexane followed by GC-MS with the use of surrogate and internal standards. | In-house method based on USEPA 8270 | L064-PL | D | NONE |
| Stones content of soil | Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight. | In-house method based on British Standard Methods and MCERTS requirements. | L019-UK/PL | D | NONE |
| Sulphate 10:1 WAC | Determination of sulphate in leachate by ICP-OES | In-house method based on MEWAM 1986 Methods for the Determination of Metals in Soil"" | L039-PL | W | ISO 17025 |
| Total dissolved solids 10:1 WAC | Determination of total dissolved solids in water by electrometric measurement. | In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton | L004-PL | W | NONE |
| Total organic carbon (Automated) in soil | Determination of organic matter in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate. | In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests"" | L009-PL | D | MCERTS |

**For method numbers ending in 'UK' analysis have been carried out in our laboratory in the United Kingdom.**
**For method numbers ending in 'PL' analysis have been carried out in our laboratory in Poland.**
**Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.**


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The results included within the report are representative of the samples submitted for analysis.

# APPENDIX D

**Waste Assessment Report**

# Waste Classification Report

T3X36-446KV-CCNU7

## Job name

Thomas Street, Manchester

## Description/Comments

## Project

C3742

## Site

Thomas Street, Manchester

## Related Documents

| # | Name | Description |
|---|---|---|
| None | | |

## Waste Stream Template

BSL Suite

## Classified by

Name:
**Dan Gates**
Date:
**18 Jun 2020 15:14 GMT**
Telephone:
**01606 334844**

Company:
**Brownfield Solutions Ltd**
**William Smith House**
**173-183 Witton Street**
**Northwich**
**CW9 5LP**

HazWasteOnline™ Training Record:

| Course | Date |
|---|---|
| Hazardous Waste Classification | 18 Sep 2018 |
| Advanced Hazardous Waste Classification | 19 Sep 2018 |

## Report

Created by: Dan Gates
Created date: 18 Jun 2020 15:14 GMT

## Job summary


| # | Sample Name | Depth [m] | Classification Result | Hazard properties | Page |
|---|---|---|---|---|---|
| 1 | TP01 | 0.10-0.80 | Non Hazardous | | 2 |
| 2 | TP04 | 0.20-0.30 | Non Hazardous | | 4 |
| 3 | TP04[1] | 0.30-0.40 | Non Hazardous | | 6 |
| 4 | TP08 | 0.30 | Non Hazardous | | 8 |
| 5 | TP10 | 0.30 | 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: TP01

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

## Sample details

Sample Name:
**TP01**
Sample Depth:
**0.10-0.80 m**
Moisture content:
**19%**
(no correction)

LoW Code:
Chapter: 17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
Entry: 17 05 04 (Soil and stones other than those mentioned in 17 05 03)

## Hazard properties

None identified

## Determinands

Moisture content: 19% No Moisture Correction applied (MC)

| # | Determinand | CLP index number | EC Number | CAS Number | CLP Note | User entered data | Conv. Factor | Compound conc. | Classification value | MC Applied | Conc. Not Used |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | arsenic { arsenic trioxide } | 033-003-00-0 | 215-481-4 | 1327-53-3 | | 11 mg/kg | 1.32 | 14.524 mg/kg | 0.00145 % | | |
| 2 | cadmium { cadmium sulfide } | 048-010-00-4 | 215-147-8 | 1306-23-6 | 1 | <0.2 mg/kg | 1.285 | <0.257 mg/kg | <0.00002 % | | <LOD |
| 3 | chromium in chromium(III) compounds { chromium(III) oxide } | | 215-160-9 | 1308-38-9 | | 24 mg/kg | 1.462 | 35.077 mg/kg | 0.00351 % | | |
| 4 | copper { dicopper oxide; copper (I) oxide } | 029-002-00-X | 215-270-7 | 1317-39-1 | | 34 mg/kg | 1.126 | 38.28 mg/kg | 0.00383 % | | |
| 5 | lead { lead chromate } | 082-004-00-2 | 231-846-0 | 7758-97-6 | 1 | 110 mg/kg | 1.56 | 171.58 mg/kg | 0.011 % | | |
| 6 | mercury { mercury dichloride } | 080-010-00-X | 231-299-8 | 7487-94-7 | | 1.9 mg/kg | 1.353 | 2.572 mg/kg | 0.000257 % | | |
| 7 | nickel { nickel dihydroxide } | 028-008-00-X | 235-008-5 [1]<br>234-348-1 [2] | 12054-48-7 [1]<br>11113-74-9 [2] | | 33 mg/kg | 1.579 | 52.123 mg/kg | 0.00521 % | | |
| 8 | selenium { selenium compounds with the exception of cadmium sulphoselenide and those specified elsewhere in this Annex } | 034-002-00-8 | | | | <1 mg/kg | 2.554 | <2.554 mg/kg | <0.000255 % | | <LOD |
| 9 | zinc { zinc oxide } | 030-013-00-7 | 215-222-5 | 1314-13-2 | | 67 mg/kg | 1.245 | 83.396 mg/kg | 0.00834 % | | |
| 10 | naphthalene | 601-052-00-2 | 202-049-5 | 91-20-3 | | <0.05 mg/kg | | <0.05 mg/kg | <0.000005 % | | <LOD |
| 11 | acenaphthylene | | 205-917-1 | 208-96-8 | | <0.05 mg/kg | | <0.05 mg/kg | <0.000005 % | | <LOD |
| 12 | acenaphthene | | 201-469-6 | 83-32-9 | | <0.05 mg/kg | | <0.05 mg/kg | <0.000005 % | | <LOD |
| 13 | fluorene | | 201-695-5 | 86-73-7 | | <0.05 mg/kg | | <0.05 mg/kg | <0.000005 % | | <LOD |
| 14 | phenanthrene | | 201-581-5 | 85-01-8 | | <0.05 mg/kg | | <0.05 mg/kg | <0.000005 % | | <LOD |

| # | | 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 | | anthracene | | | | <0.05 | mg/kg | | <0.05 | mg/kg | <0.000005 % | | <**LOD** |
| | | | 204-371-1 | 120-12-7 | | | | | | | | | |
| 16 | | fluoranthene | | | | <0.05 | mg/kg | | <0.05 | mg/kg | <0.000005 % | | <**LOD** |
| | | | 205-912-4 | 206-44-0 | | | | | | | | | |
| 17 | | pyrene | | | | <0.05 | mg/kg | | <0.05 | mg/kg | <0.000005 % | | <**LOD** |
| | | | 204-927-3 | 129-00-0 | | | | | | | | | |
| 18 | | benzo[a]anthracene | | | | <0.05 | mg/kg | | <0.05 | mg/kg | <0.000005 % | | <**LOD** |
| | | 601-033-00-9 | 200-280-6 | 56-55-3 | | | | | | | | | |
| 19 | | chrysene | | | | <0.05 | mg/kg | | <0.05 | mg/kg | <0.000005 % | | <**LOD** |
| | | 601-048-00-0 | 205-923-4 | 218-01-9 | | | | | | | | | |
| 20 | | benzo[a]pyrene; benzo[def]chrysene | | | | <0.05 | mg/kg | | <0.05 | mg/kg | <0.000005 % | | <**LOD** |
| | | 601-032-00-3 | 200-028-5 | 50-32-8 | | | | | | | | | |
| 21 | | indeno[123-cd]pyrene | | | | <0.05 | mg/kg | | <0.05 | mg/kg | <0.000005 % | | <**LOD** |
| | | | 205-893-2 | 193-39-5 | | | | | | | | | |
| 22 | | dibenz[a,h]anthracene | | | | <0.05 | mg/kg | | <0.05 | mg/kg | <0.000005 % | | <**LOD** |
| | | 601-041-00-2 | 200-181-8 | 53-70-3 | | | | | | | | | |
| 23 | | benzo[ghi]perylene | | | | <0.05 | mg/kg | | <0.05 | mg/kg | <0.000005 % | | <**LOD** |
| | | | 205-883-8 | 191-24-2 | | | | | | | | | |
| 24 | | benzo[b]fluoranthene | | | | <0.05 | mg/kg | | <0.05 | mg/kg | <0.000005 % | | <**LOD** |
| | | 601-034-00-4 | 205-911-9 | 205-99-2 | | | | | | | | | |
| 25 | | benzo[k]fluoranthene | | | | <0.05 | mg/kg | | <0.05 | mg/kg | <0.000005 % | | <**LOD** |
| | | 601-036-00-5 | 205-916-6 | 207-08-9 | | | | | | | | | |
| 26 | | phenol | | | | <1.3 | mg/kg | | <1.3 | mg/kg | <0.00013 % | | <**LOD** |
| | | 604-001-00-2 | 203-632-7 | 108-95-2 | | | | | | | | | |
| 27 | | chromium in chromium(VI) compounds { chromium(VI) oxide } | | | | <1.2 | mg/kg | 1.923 | <2.308 | mg/kg | <0.000231 % | | <**LOD** |
| | | 024-001-00-0 | 215-607-8 | 1333-82-0 | | | | | | | | | |
| 28 | | pH | | | | 6.2 | pH | | 6.2 | pH | 6.2 pH | | |
| | | | | PH | | | | | | | | | |
| | | | | | | | | | | Total: | 0.0343 % | | |

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 Deteminand - 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: TP04

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

## Sample details

Sample Name:
**TP04**
Sample Depth:
**0.20-0.30 m**
Moisture content:
**13%**
(no correction)

LoW Code:
Chapter: 17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
Entry: 17 05 04 (Soil and stones other than those mentioned in 17 05 03)

## Hazard properties

None identified

## Determinands

Moisture content: 13% No Moisture Correction applied (MC)

| # | | Determinand | CLP index number | EC Number | CAS Number | CLP Note | User entered data | | Conv. Factor | Compound conc. | | Classification value | MC Applied | Conc. Not Used |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | arsenic { arsenic trioxide } | 033-003-00-0 | 215-481-4 | 1327-53-3 | | 20 | mg/kg | 1.32 | 26.407 | mg/kg | 0.00264 % | | |
| 2 | | cadmium { cadmium sulfide } | 048-010-00-4 | 215-147-8 | 1306-23-6 | 1 | 22 | mg/kg | 1.285 | 28.275 | mg/kg | 0.0022 % | | |
| 3 | | chromium in chromium(III) compounds { chromium(III) oxide } | | 215-160-9 | 1308-38-9 | | 35 | mg/kg | 1.462 | 51.154 | mg/kg | 0.00512 % | | |
| 4 | | copper { dicopper oxide; copper (I) oxide } | 029-002-00-X | 215-270-7 | 1317-39-1 | | 52 | mg/kg | 1.126 | 58.546 | mg/kg | 0.00585 % | | |
| 5 | | lead { lead chromate } | 082-004-00-2 | 231-846-0 | 7758-97-6 | 1 | 180 | mg/kg | 1.56 | 280.767 | mg/kg | 0.018 % | | |
| 6 | | mercury { mercury dichloride } | 080-010-00-X | 231-299-8 | 7487-94-7 | | <0.3 | mg/kg | 1.353 | <0.406 | mg/kg | <0.0000406 % | | <LOD |
| 7 | | nickel { nickel dihydroxide } | 028-008-00-X | 235-008-5 [1]<br>234-348-1 [2] | 12054-48-7 [1]<br>11113-74-9 [2] | | 33 | mg/kg | 1.579 | 52.123 | mg/kg | 0.00521 % | | |
| 8 | | selenium { selenium compounds with the exception of cadmium sulphoselenide and those specified elsewhere in this Annex } | 034-002-00-8 | | | | <1 | mg/kg | 2.554 | <2.554 | mg/kg | <0.000255 % | | <LOD |
| 9 | | zinc { zinc oxide } | 030-013-00-7 | 215-222-5 | 1314-13-2 | | 1500 | mg/kg | 1.245 | 1867.071 | mg/kg | 0.187 % | | |
| 10 | | naphthalene | 601-052-00-2 | 202-049-5 | 91-20-3 | | <0.05 | mg/kg | | <0.05 | mg/kg | <0.000005 % | | <LOD |
| 11 | | acenaphthylene | | 205-917-1 | 208-96-8 | | <0.05 | mg/kg | | <0.05 | mg/kg | <0.000005 % | | <LOD |
| 12 | | acenaphthene | | 201-469-6 | 83-32-9 | | <0.05 | mg/kg | | <0.05 | mg/kg | <0.000005 % | | <LOD |
| 13 | | fluorene | | 201-695-5 | 86-73-7 | | <0.05 | mg/kg | | <0.05 | mg/kg | <0.000005 % | | <LOD |
| 14 | | phenanthrene | | 201-581-5 | 85-01-8 | | <0.05 | mg/kg | | <0.05 | mg/kg | <0.000005 % | | <LOD |

| # | | 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 | | anthracene | | | | <0.05 | mg/kg | | <0.05 | mg/kg | <0.000005 % | | <**LOD** |
| | | | 204-371-1 | 120-12-7 | | | | | | | | | |
| 16 | | fluoranthene | | | | <0.05 | mg/kg | | <0.05 | mg/kg | <0.000005 % | | <**LOD** |
| | | | 205-912-4 | 206-44-0 | | | | | | | | | |
| 17 | | pyrene | | | | <0.05 | mg/kg | | <0.05 | mg/kg | <0.000005 % | | <**LOD** |
| | | | 204-927-3 | 129-00-0 | | | | | | | | | |
| 18 | | benzo[a]anthracene | | | | <0.05 | mg/kg | | <0.05 | mg/kg | <0.000005 % | | <**LOD** |
| | | 601-033-00-9 | 200-280-6 | 56-55-3 | | | | | | | | | |
| 19 | | chrysene | | | | <0.05 | mg/kg | | <0.05 | mg/kg | <0.000005 % | | <**LOD** |
| | | 601-048-00-0 | 205-923-4 | 218-01-9 | | | | | | | | | |
| 20 | | benzo[a]pyrene; benzo[def]chrysene | | | | <0.05 | mg/kg | | <0.05 | mg/kg | <0.000005 % | | <**LOD** |
| | | 601-032-00-3 | 200-028-5 | 50-32-8 | | | | | | | | | |
| 21 | | indeno[123-cd]pyrene | | | | <0.05 | mg/kg | | <0.05 | mg/kg | <0.000005 % | | <**LOD** |
| | | | 205-893-2 | 193-39-5 | | | | | | | | | |
| 22 | | dibenz[a,h]anthracene | | | | <0.05 | mg/kg | | <0.05 | mg/kg | <0.000005 % | | <**LOD** |
| | | 601-041-00-2 | 200-181-8 | 53-70-3 | | | | | | | | | |
| 23 | | benzo[ghi]perylene | | | | <0.05 | mg/kg | | <0.05 | mg/kg | <0.000005 % | | <**LOD** |
| | | | 205-883-8 | 191-24-2 | | | | | | | | | |
| 24 | | benzo[b]fluoranthene | | | | <0.05 | mg/kg | | <0.05 | mg/kg | <0.000005 % | | <**LOD** |
| | | 601-034-00-4 | 205-911-9 | 205-99-2 | | | | | | | | | |
| 25 | | benzo[k]fluoranthene | | | | <0.05 | mg/kg | | <0.05 | mg/kg | <0.000005 % | | <**LOD** |
| | | 601-036-00-5 | 205-916-6 | 207-08-9 | | | | | | | | | |
| 26 | | phenol | | | | <1.3 | mg/kg | | <1.3 | mg/kg | <0.00013 % | | <**LOD** |
| | | 604-001-00-2 | 203-632-7 | 108-95-2 | | | | | | | | | |
| 27 | | chromium in chromium(VI) compounds { chromium(VI) oxide } | | | | <1.2 | mg/kg | 1.923 | <2.308 | mg/kg | <0.000231 % | | <**LOD** |
| | | 024-001-00-0 | 215-607-8 | 1333-82-0 | | | | | | | | | |
| 28 | | pH | | | | 9.3 | pH | | 9.3 | pH | 9.3 pH | | |
| | | | | PH | | | | | | | | | |
| | | | | | | | | | | Total: | 0.226 % | | |

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 Deteminand - 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: TP04[1]

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

## Sample details

Sample Name:
**TP04[1]**
Sample Depth:
**0.30-0.40 m**
Moisture content:
**14%**
(no correction)

LoW Code:
Chapter: 17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
Entry: 17 05 04 (Soil and stones other than those mentioned in 17 05 03)

## Hazard properties

None identified

## Determinands

Moisture content: 14% No Moisture Correction applied (MC)

| # | | Determinand | CLP index number | EC Number | CAS Number | CLP Note | User entered data | | Conv. Factor | Compound conc. | | Classification value | MC Applied | Conc. Not Used |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | arsenic { arsenic trioxide } | 033-003-00-0 | 215-481-4 | 1327-53-3 | | 8.9 | mg/kg | 1.32 | 11.751 | mg/kg | 0.00118 % | | |
| 2 | | cadmium { cadmium sulfide } | 048-010-00-4 | 215-147-8 | 1306-23-6 | 1 | <0.2 | mg/kg | 1.285 | <0.257 | mg/kg | <0.00002 % | | <LOD |
| 3 | | chromium in chromium(III) compounds { chromium(III) oxide } | | 215-160-9 | 1308-38-9 | | 32 | mg/kg | 1.462 | 46.77 | mg/kg | 0.00468 % | | |
| 4 | | copper { dicopper oxide; copper (I) oxide } | 029-002-00-X | 215-270-7 | 1317-39-1 | | 25 | mg/kg | 1.126 | 28.147 | mg/kg | 0.00281 % | | |
| 5 | | lead { lead chromate } | 082-004-00-2 | 231-846-0 | 7758-97-6 | 1 | 13 | mg/kg | 1.56 | 20.278 | mg/kg | 0.0013 % | | |
| 6 | | mercury { mercury dichloride } | 080-010-00-X | 231-299-8 | 7487-94-7 | | <0.3 | mg/kg | 1.353 | <0.406 | mg/kg | <0.0000406 % | | <LOD |
| 7 | | nickel { nickel dihydroxide } | 028-008-00-X | 235-008-5 [1]<br>234-348-1 [2] | 12054-48-7 [1]<br>11113-74-9 [2] | | 38 | mg/kg | 1.579 | 60.021 | mg/kg | 0.006 % | | |
| 8 | | selenium { selenium compounds with the exception of cadmium sulphoselenide and those specified elsewhere in this Annex } | 034-002-00-8 | | | | <1 | mg/kg | 2.554 | <2.554 | mg/kg | <0.000255 % | | <LOD |
| 9 | | zinc { zinc oxide } | 030-013-00-7 | 215-222-5 | 1314-13-2 | | 62 | mg/kg | 1.245 | 77.172 | mg/kg | 0.00772 % | | |
| 10 | | naphthalene | 601-052-00-2 | 202-049-5 | 91-20-3 | | <0.05 | mg/kg | | <0.05 | mg/kg | <0.000005 % | | <LOD |
| 11 | | acenaphthylene | | 205-917-1 | 208-96-8 | | <0.05 | mg/kg | | <0.05 | mg/kg | <0.000005 % | | <LOD |
| 12 | | acenaphthene | | 201-469-6 | 83-32-9 | | <0.05 | mg/kg | | <0.05 | mg/kg | <0.000005 % | | <LOD |
| 13 | | fluorene | | 201-695-5 | 86-73-7 | | <0.05 | mg/kg | | <0.05 | mg/kg | <0.000005 % | | <LOD |
| 14 | | phenanthrene | | 201-581-5 | 85-01-8 | | <0.05 | mg/kg | | <0.05 | mg/kg | <0.000005 % | | <LOD |

| # | | 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 | | anthracene | 204-371-1 | 120-12-7 | | <0.05 | mg/kg | | <0.05 | mg/kg | <0.000005 % | | <**LOD** |
| 16 | | fluoranthene | 205-912-4 | 206-44-0 | | <0.05 | mg/kg | | <0.05 | mg/kg | <0.000005 % | | <**LOD** |
| 17 | | pyrene | 204-927-3 | 129-00-0 | | <0.05 | mg/kg | | <0.05 | mg/kg | <0.000005 % | | <**LOD** |
| 18 | | benzo[a]anthracene | 200-280-6 | 56-55-3 | | <0.05 | mg/kg | | <0.05 | mg/kg | <0.000005 % | | <**LOD** |
| | | 601-033-00-9 | | | | | | | | | | | |
| 19 | | chrysene | 205-923-4 | 218-01-9 | | <0.05 | mg/kg | | <0.05 | mg/kg | <0.000005 % | | <**LOD** |
| | | 601-048-00-0 | | | | | | | | | | | |
| 20 | | benzo[a]pyrene; benzo[def]chrysene | 200-028-5 | 50-32-8 | | <0.05 | mg/kg | | <0.05 | mg/kg | <0.000005 % | | <**LOD** |
| | | 601-032-00-3 | | | | | | | | | | | |
| 21 | | indeno[123-cd]pyrene | 205-893-2 | 193-39-5 | | <0.05 | mg/kg | | <0.05 | mg/kg | <0.000005 % | | <**LOD** |
| 22 | | dibenz[a,h]anthracene | 200-181-8 | 53-70-3 | | <0.05 | mg/kg | | <0.05 | mg/kg | <0.000005 % | | <**LOD** |
| | | 601-041-00-2 | | | | | | | | | | | |
| 23 | | benzo[ghi]perylene | 205-883-8 | 191-24-2 | | <0.05 | mg/kg | | <0.05 | mg/kg | <0.000005 % | | <**LOD** |
| 24 | | benzo[b]fluoranthene | 205-911-9 | 205-99-2 | | <0.05 | mg/kg | | <0.05 | mg/kg | <0.000005 % | | <**LOD** |
| | | 601-034-00-4 | | | | | | | | | | | |
| 25 | | benzo[k]fluoranthene | 205-916-6 | 207-08-9 | | <0.05 | mg/kg | | <0.05 | mg/kg | <0.000005 % | | <**LOD** |
| | | 601-036-00-5 | | | | | | | | | | | |
| 26 | | phenol | 203-632-7 | 108-95-2 | | <1.3 | mg/kg | | <1.3 | mg/kg | <0.00013 % | | <**LOD** |
| | | 604-001-00-2 | | | | | | | | | | | |
| 27 | | chromium in chromium(VI) compounds { chromium(VI) oxide } | 215-607-8 | 1333-82-0 | | <1.2 | mg/kg | 1.923 | <2.308 | mg/kg | <0.000231 % | | <**LOD** |
| | | 024-001-00-0 | | | | | | | | | | | |
| 28 | | pH | | PH | | 8.6 | pH | | 8.6 | pH | 8.6 pH | | |
| | | | | | | | | | | Total: | 0.0244 % | | |

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 Deteminand - 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: TP08

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

## Sample details

Sample Name:
**TP08**
Sample Depth:
**0.30 m**
Moisture content:
**24%**
(no correction)

LoW Code:
Chapter: 17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
Entry: 17 05 04 (Soil and stones other than those mentioned in 17 05 03)

## Hazard properties

None identified

## Determinands

Moisture content: 24% No Moisture Correction applied (MC)

| # | Determinand | CLP index number | EC Number | CAS Number | CLP Note | User entered data | Conv. Factor | Compound conc. | Classification value | MC Applied | Conc. Not Used |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | arsenic { arsenic trioxide } | 033-003-00-0 | 215-481-4 | 1327-53-3 | | 7.9 mg/kg | 1.32 | 10.431 mg/kg | 0.00104 % | | |
| 2 | cadmium { cadmium sulfide } | 048-010-00-4 | 215-147-8 | 1306-23-6 | 1 | <0.2 mg/kg | 1.285 | <0.257 mg/kg | <0.00002 % | | <LOD |
| 3 | chromium in chromium(III) compounds { chromium(III) oxide } | | 215-160-9 | 1308-38-9 | | 29 mg/kg | 1.462 | 42.385 mg/kg | 0.00424 % | | |
| 4 | copper { dicopper oxide; copper (I) oxide } | 029-002-00-X | 215-270-7 | 1317-39-1 | | 18 mg/kg | 1.126 | 20.266 mg/kg | 0.00203 % | | |
| 5 | lead { lead chromate } | 082-004-00-2 | 231-846-0 | 7758-97-6 | 1 | 16 mg/kg | 1.56 | 24.957 mg/kg | 0.0016 % | | |
| 6 | mercury { mercury dichloride } | 080-010-00-X | 231-299-8 | 7487-94-7 | | <0.3 mg/kg | 1.353 | <0.406 mg/kg | <0.0000406 % | | <LOD |
| 7 | nickel { nickel dihydroxide } | 028-008-00-X | 235-008-5 [1]<br>234-348-1 [2] | 12054-48-7 [1]<br>11113-74-9 [2] | | 30 mg/kg | 1.579 | 47.385 mg/kg | 0.00474 % | | |
| 8 | selenium { selenium compounds with the exception of cadmium sulphoselenide and those specified elsewhere in this Annex } | 034-002-00-8 | | | | <1 mg/kg | 2.554 | <2.554 mg/kg | <0.000255 % | | <LOD |
| 9 | zinc { zinc oxide } | 030-013-00-7 | 215-222-5 | 1314-13-2 | | 46 mg/kg | 1.245 | 57.257 mg/kg | 0.00573 % | | |
| 10 | naphthalene | 601-052-00-2 | 202-049-5 | 91-20-3 | | <0.05 mg/kg | | <0.05 mg/kg | <0.000005 % | | <LOD |
| 11 | acenaphthylene | | 205-917-1 | 208-96-8 | | <0.05 mg/kg | | <0.05 mg/kg | <0.000005 % | | <LOD |
| 12 | acenaphthene | | 201-469-6 | 83-32-9 | | <0.05 mg/kg | | <0.05 mg/kg | <0.000005 % | | <LOD |
| 13 | fluorene | | 201-695-5 | 86-73-7 | | <0.05 mg/kg | | <0.05 mg/kg | <0.000005 % | | <LOD |
| 14 | phenanthrene | | 201-581-5 | 85-01-8 | | <0.05 mg/kg | | <0.05 mg/kg | <0.000005 % | | <LOD |

| # | | 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 | | anthracene | 204-371-1 | 120-12-7 | | <0.05 | mg/kg | | <0.05 | mg/kg | <0.000005 % | | <**LOD** |
| 16 | | fluoranthene | 205-912-4 | 206-44-0 | | <0.05 | mg/kg | | <0.05 | mg/kg | <0.000005 % | | <**LOD** |
| 17 | | pyrene | 204-927-3 | 129-00-0 | | <0.05 | mg/kg | | <0.05 | mg/kg | <0.000005 % | | <**LOD** |
| 18 | | benzo[a]anthracene | 200-280-6 | 56-55-3 | | <0.05 | mg/kg | | <0.05 | mg/kg | <0.000005 % | | <**LOD** |
| | | 601-033-00-9 | | | | | | | | | | | |
| 19 | | chrysene | 205-923-4 | 218-01-9 | | <0.05 | mg/kg | | <0.05 | mg/kg | <0.000005 % | | <**LOD** |
| | | 601-048-00-0 | | | | | | | | | | | |
| 20 | | benzo[a]pyrene; benzo[def]chrysene | 200-028-5 | 50-32-8 | | <0.05 | mg/kg | | <0.05 | mg/kg | <0.000005 % | | <**LOD** |
| | | 601-032-00-3 | | | | | | | | | | | |
| 21 | | indeno[123-cd]pyrene | 205-893-2 | 193-39-5 | | <0.05 | mg/kg | | <0.05 | mg/kg | <0.000005 % | | <**LOD** |
| 22 | | dibenz[a,h]anthracene | 200-181-8 | 53-70-3 | | <0.05 | mg/kg | | <0.05 | mg/kg | <0.000005 % | | <**LOD** |
| | | 601-041-00-2 | | | | | | | | | | | |
| 23 | | benzo[ghi]perylene | 205-883-8 | 191-24-2 | | <0.05 | mg/kg | | <0.05 | mg/kg | <0.000005 % | | <**LOD** |
| 24 | | benzo[b]fluoranthene | 205-911-9 | 205-99-2 | | <0.05 | mg/kg | | <0.05 | mg/kg | <0.000005 % | | <**LOD** |
| | | 601-034-00-4 | | | | | | | | | | | |
| 25 | | benzo[k]fluoranthene | 205-916-6 | 207-08-9 | | <0.05 | mg/kg | | <0.05 | mg/kg | <0.000005 % | | <**LOD** |
| | | 601-036-00-5 | | | | | | | | | | | |
| 26 | | phenol | 203-632-7 | 108-95-2 | | <1.3 | mg/kg | | <1.3 | mg/kg | <0.00013 % | | <**LOD** |
| | | 604-001-00-2 | | | | | | | | | | | |
| 27 | | chromium in chromium(VI) compounds { chromium(VI) oxide } | 215-607-8 | 1333-82-0 | | <1.2 | mg/kg | 1.923 | <2.308 | mg/kg | <0.000231 % | | <**LOD** |
| | | 024-001-00-0 | | | | | | | | | | | |
| 28 | | pH | | PH | | 8.3 | pH | | 8.3 | pH | 8.3 pH | | |
| | | | | | | | | | | Total: | 0.0201 % | | |

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 Deteminand - 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: TP10

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

## Sample details

Sample Name:
**TP10**
Sample Depth:
**0.30 m**
Moisture content:
**29%**
(no correction)

LoW Code:
Chapter: 17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
Entry: 17 05 04 (Soil and stones other than those mentioned in 17 05 03)

## Hazard properties

None identified

## Determinands

Moisture content: 29% No Moisture Correction applied (MC)

| # | Determinand | CLP index number | EC Number | CAS Number | CLP Note | User entered data | Conv. Factor | Compound conc. | Classification value | MC Applied | Conc. Not Used |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | arsenic { arsenic trioxide } | 033-003-00-0 | 215-481-4 | 1327-53-3 | | 9.8 mg/kg | 1.32 | 12.939 mg/kg | 0.00129 % | | |
| 2 | cadmium { cadmium sulfide } | 048-010-00-4 | 215-147-8 | 1306-23-6 | 1 | <0.2 mg/kg | 1.285 | <0.257 mg/kg | <0.00002 % | | <LOD |
| 3 | chromium in chromium(III) compounds { chromium(III) oxide } | | 215-160-9 | 1308-38-9 | | 29 mg/kg | 1.462 | 42.385 mg/kg | 0.00424 % | | |
| 4 | copper { dicopper oxide; copper (I) oxide } | 029-002-00-X | 215-270-7 | 1317-39-1 | | 35 mg/kg | 1.126 | 39.406 mg/kg | 0.00394 % | | |
| 5 | lead { lead chromate } | 082-004-00-2 | 231-846-0 | 7758-97-6 | 1 | 72 mg/kg | 1.56 | 112.307 mg/kg | 0.0072 % | | |
| 6 | mercury { mercury dichloride } | 080-010-00-X | 231-299-8 | 7487-94-7 | | <0.3 mg/kg | 1.353 | <0.406 mg/kg | <0.0000406 % | | <LOD |
| 7 | nickel { nickel dihydroxide } | 028-008-00-X | 235-008-5 [1]<br>234-348-1 [2] | 12054-48-7 [1]<br>11113-74-9 [2] | | 39 mg/kg | 1.579 | 61.6 mg/kg | 0.00616 % | | |
| 8 | selenium { selenium compounds with the exception of cadmium sulphoselenide and those specified elsewhere in this Annex } | 034-002-00-8 | | | | <1 mg/kg | 2.554 | <2.554 mg/kg | <0.000255 % | | <LOD |
| 9 | zinc { zinc oxide } | 030-013-00-7 | 215-222-5 | 1314-13-2 | | 69 mg/kg | 1.245 | 85.885 mg/kg | 0.00859 % | | |
| 10 | naphthalene | 601-052-00-2 | 202-049-5 | 91-20-3 | | <0.05 mg/kg | | <0.05 mg/kg | <0.000005 % | | <LOD |
| 11 | acenaphthylene | | 205-917-1 | 208-96-8 | | <0.05 mg/kg | | <0.05 mg/kg | <0.000005 % | | <LOD |
| 12 | acenaphthene | | 201-469-6 | 83-32-9 | | <0.05 mg/kg | | <0.05 mg/kg | <0.000005 % | | <LOD |
| 13 | fluorene | | 201-695-5 | 86-73-7 | | <0.05 mg/kg | | <0.05 mg/kg | <0.000005 % | | <LOD |
| 14 | phenanthrene | | 201-581-5 | 85-01-8 | | <0.05 mg/kg | | <0.05 mg/kg | <0.000005 % | | <LOD |

| # | | 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 | | anthracene | | | | <0.05 | mg/kg | | <0.05 | mg/kg | <0.000005 % | | <**LOD** |
| | | | 204-371-1 | 120-12-7 | | | | | | | | | |
| 16 | | fluoranthene | | | | <0.05 | mg/kg | | <0.05 | mg/kg | <0.000005 % | | <**LOD** |
| | | | 205-912-4 | 206-44-0 | | | | | | | | | |
| 17 | | pyrene | | | | <0.05 | mg/kg | | <0.05 | mg/kg | <0.000005 % | | <**LOD** |
| | | | 204-927-3 | 129-00-0 | | | | | | | | | |
| 18 | | benzo[a]anthracene | | | | <0.05 | mg/kg | | <0.05 | mg/kg | <0.000005 % | | <**LOD** |
| | | 601-033-00-9 | 200-280-6 | 56-55-3 | | | | | | | | | |
| 19 | | chrysene | | | | <0.05 | mg/kg | | <0.05 | mg/kg | <0.000005 % | | <**LOD** |
| | | 601-048-00-0 | 205-923-4 | 218-01-9 | | | | | | | | | |
| 20 | | benzo[a]pyrene; benzo[def]chrysene | | | | <0.05 | mg/kg | | <0.05 | mg/kg | <0.000005 % | | <**LOD** |
| | | 601-032-00-3 | 200-028-5 | 50-32-8 | | | | | | | | | |
| 21 | | indeno[123-cd]pyrene | | | | <0.05 | mg/kg | | <0.05 | mg/kg | <0.000005 % | | <**LOD** |
| | | | 205-893-2 | 193-39-5 | | | | | | | | | |
| 22 | | dibenz[a,h]anthracene | | | | <0.05 | mg/kg | | <0.05 | mg/kg | <0.000005 % | | <**LOD** |
| | | 601-041-00-2 | 200-181-8 | 53-70-3 | | | | | | | | | |
| 23 | | benzo[ghi]perylene | | | | <0.05 | mg/kg | | <0.05 | mg/kg | <0.000005 % | | <**LOD** |
| | | | 205-883-8 | 191-24-2 | | | | | | | | | |
| 24 | | benzo[b]fluoranthene | | | | <0.05 | mg/kg | | <0.05 | mg/kg | <0.000005 % | | <**LOD** |
| | | 601-034-00-4 | 205-911-9 | 205-99-2 | | | | | | | | | |
| 25 | | benzo[k]fluoranthene | | | | <0.05 | mg/kg | | <0.05 | mg/kg | <0.000005 % | | <**LOD** |
| | | 601-036-00-5 | 205-916-6 | 207-08-9 | | | | | | | | | |
| 26 | | phenol | | | | <1.3 | mg/kg | | <1.3 | mg/kg | <0.00013 % | | <**LOD** |
| | | 604-001-00-2 | 203-632-7 | 108-95-2 | | | | | | | | | |
| 27 | | chromium in chromium(VI) compounds { chromium(VI) oxide } | | | | <1.2 | mg/kg | 1.923 | <2.308 | mg/kg | <0.000231 % | | <**LOD** |
| | | 024-001-00-0 | 215-607-8 | 1333-82-0 | | | | | | | | | |
| 28 | | pH | | | | 7.3 | pH | | 7.3 | pH | 7.3 pH | | |
| | | | | PH | | | | | | | | | |
| | | | | | | | | | | Total: | 0.0322 % | | |

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 Deteminand - 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** (EC Number: 215-160-9, CAS Number: 1308-38-9)

Conversion factor: 1.462
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
Risk Phrases: R61 , R60 , R50/53 , R43 , R42 , R38 , R37 , R36 , R22 , R20
Hazard Statements: Aquatic Chronic 1 H410 , Aquatic Acute 1 H400 , Repr. 1B H360FD , Skin Sens. 1 H317 , Resp. Sens. 1 H334 , Skin Irrit. 2 H315 , STOT SE 3 H335 , Eye Irrit. 2 H319 , Acute Tox. 4 H302 , Acute Tox. 4 H332

- **dicopper oxide; copper (I) oxide** (EC Number: 215-270-7, CAS Number: 1317-39-1)

CLP index number: 029-002-00-X
Description/Comments: M-factor for long-term aquatic hazard not included as per paragraph (5), ATP9
Data source: Regulation (EU) 2016/1179 of 19 July 2016 (ATP9)
Additional Risk Phrases: N R50/53 >= 0.25 %, N R50/53
Additional Hazard Statement(s): None.
Reason for additional Hazards Statement(s):
10 Oct 2016 - N R50/53 >= 0.25 % risk phrase sourced from: WM3 v1 still uses ecotoxic risk phrases
10 Oct 2016 - N R50/53 risk phrase sourced from: WM3 v1 still uses ecotoxic risk phrases

- **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
Risk Phrases: R38 , R37 , R36 , R27 , R26 , R22
Hazard Statements: Skin Irrit. 2 H315 , STOT SE 3 H335 , Eye Irrit. 2 H319 , Acute Tox. 1 H310 , Acute Tox. 1 H330 , Acute Tox. 4 H302

- **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
Risk Phrases: N R51/53 , N R50/53 , R38 , R37 , R36
Hazard Statements: Aquatic Chronic 2 H411 , Aquatic Chronic 1 H410 , Aquatic Acute 1 H400 , Skin Irrit. 2 H315 , STOT SE 3 H335 , Eye Irrit. 2 H319

- **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
Risk Phrases: N R50/53
Hazard Statements: Aquatic Chronic 1 H410 , Aquatic Acute 1 H400

- **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
Risk Phrases: N R50/53 , R43 , R40 , R38 , R37 , R36 , R22
Hazard Statements: Skin Irrit. 2 H315 , Aquatic Chronic 1 H410 , Aquatic Acute 1 H400 , Skin Sens. 1 H317 , Carc. 2 H351 , STOT SE 3 H335 , Eye Irrit. 2 H319 , Acute Tox. 4 H302

- **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
Risk Phrases: N R50/53 , R43 , R38 , R37 , R36
Hazard Statements: Aquatic Chronic 1 H410 , Aquatic Acute 1 H400 , Skin Sens. 1 H317 , Skin Irrit. 2 H315 , STOT SE 3 H335 , Eye Irrit. 2 H319

- **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
Risk Phrases: N R50/53 , Xn R22
Hazard Statements: Aquatic Chronic 1 H410 , Aquatic Acute 1 H400 , Acute Tox. 4 H302

**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
Risk Phrases: N R50/53 , Xi R36/37/38
Hazard Statements: Aquatic Chronic 1 H410 , Aquatic Acute 1 H400 , STOT SE 3 H335 , Eye Irrit. 2 H319 , Skin Irrit. 2 H315

**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
Risk Phrases: R40
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
Risk Phrases: N R50/53
Hazard Statements: Aquatic Chronic 1 H410 , Aquatic Acute 1 H400

**pH** (CAS Number: PH)

Description/Comments: Appendix C4
Data source: WM3 1st Edition 2015
Data source date: 25 May 2015
Risk Phrases: None.
Hazard Statements: None.

## Appendix B: Rationale for selection of metal species

**arsenic {arsenic trioxide}**

Worst case species based on hazard statements

**cadmium {cadmium sulfide}**

Worst case species based on hazard statements

**chromium in chromium(III) compounds {chromium(III) oxide}**

Worst case species based on hazard statements

**copper {dicopper oxide; copper (I) oxide}**

Most likely common species

**lead {lead chromate}**

Worst case species based on hazard statements

**mercury {mercury dichloride}**

Worst case species based on hazard statements

**nickel {nickel dihydroxide}**

Worst case species based on hazard statements

**selenium {selenium compounds with the exception of cadmium sulphoselenide and those specified elsewhere in this Annex}**

Worst case species based on hazard statements

**zinc {zinc oxide}**

The absence of hexavalent chromium indicates that the presence of zinc chromate is not possible. Given that the site soils have remained under hardstanding since the date of construction a soluble form of zinc is considered possible.

**chromium in chromium(VI) compounds {chromium(VI) oxide}**

Worst case species based on hazard statements

## Appendix C: Version

HazWasteOnline Classification Engine: WM3 1st Edition, May 2015
HazWasteOnline Classification Engine Version: 2020.169.4370.8575 (17 Jun 2020)
HazWasteOnline Database: 2020.169.4370.8575 (17 Jun 2020)

This classification utilises the following guidance and legislation:
**WM3 - Waste Classification** - May 2015
**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 Wastes 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
**POPs Regulation 2004** - Regulation 850/2004/EC of 29 April 2004
**1st ATP to POPs Regulation** - Regulation 756/2010/EU of 24 August 2010
**2nd ATP to POPs Regulation** - Regulation 757/2010/EU of 24 August 2010

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