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Our reference: 077873-CUR-00-XX-RP-GE-044-P01

29th November 2022

Mr Aidan Jackson
The Guinness Partnership
Bower House
1 Stable Street
Hollinwood
Oldham
OL9 7LH

Dear Aidan,

**Re: Phase 2 Geo-Environmental and Geotechnical Report for Palgrave Avenue, Project 500 Sites**

## 1.0 Introduction

Curtins Consulting were instructed by The Guinness Partnership to undertake a ground investigation of Palgrave Avenue, Manchester M40 8JW. The site is currently vacant, and one of six sites currently being investigated on behalf of The Guinness Partnership, as part of Project 500, Manchester City Councils program to deliver affordable homes in the northeast of the city.

The site is located off Palgrave Avenue, to the east of Queens Road. The grass covered site appears to be public open space with two footpaths cutting through the site to provide access from Palgrave Avenue to Queens Road. There are a number of mature trees on Site. The site is at a slightly higher elevation than Queens Road to the west.

The ground investigation was undertaken to determine the ground conditions pertaining to the development site, and to aid contamination risk assessment and foundation design. It is understood that the site is to be developed for residential dwellings. At the time of witing, no proposed site plans were available for review.

## 2.0 Background Information

Residential development is proposed at a plot of land located east of Queens Road. The site location plan is presented in Figure 1, overleaf.

Earliest mapping (1848) shows that the site was occupied by the residential properties with the surrounding area predominantly vacant/agricultural land. Significant residential development was undertaken on-site in the late 1800s with a road dissecting the centre of the site, east to west. By the 1960s the residential properties and road on-site was demolished/removed and replaced with public open space in the configuration it lies in to the present day.

BGS mapping indicates the site is underlain by Glacial Till Deposits (interbedded granular and cohesive soils), and Pennine Middle Coal Measures Formation bedrock. The BGS records from a borehole 300m north-east of the site, encountered boulder clay, to a depth of approximately 12m bgl.



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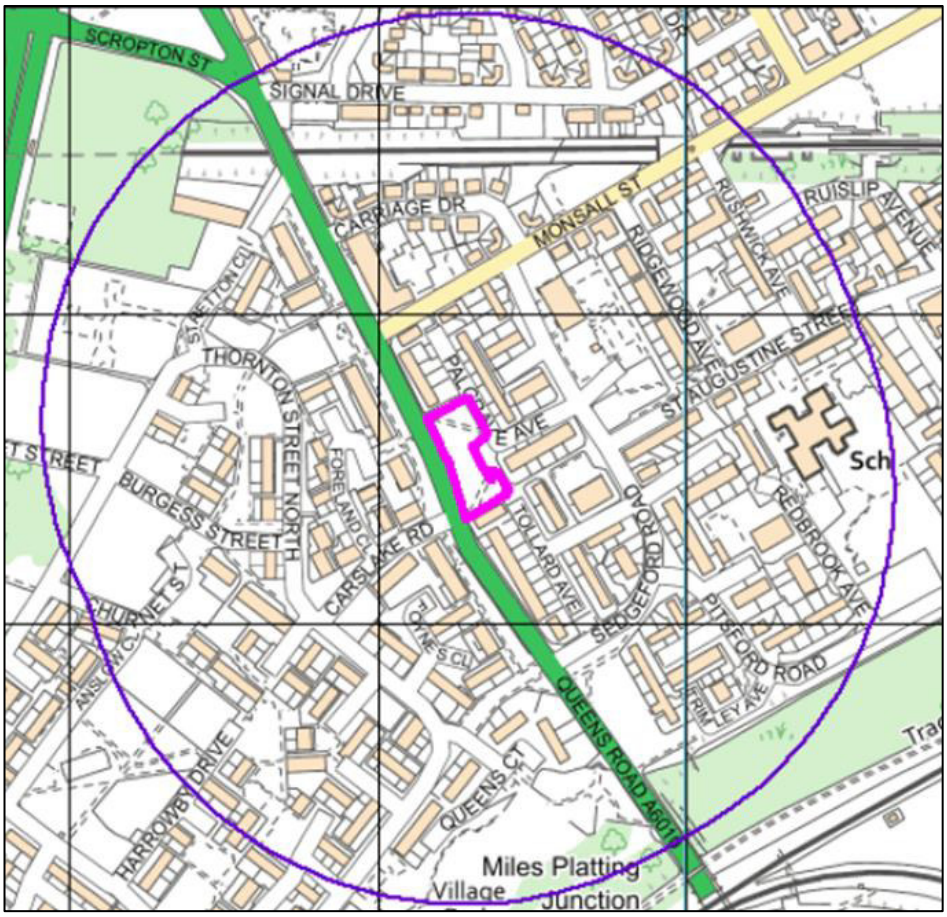



***Figure 1*** *– Site Location Plan (site boundary shown in pink and 250m buffer in purple). Crown Copyright. License Number 100022432.*

The site is located within a Coal Mining reporting area. A review of available online data indicates the site is not located within the vicinity of recorded mine entries, or a development high risk area. The risk from shallow coal mining is therefore considered to be **Low**.

The site is underlain by a Secondary A Aquifer associated with the bedrock formation. The superficial deposits are designated as a Secondary Undifferentiated Aquifer. The site is not located within a Source Protection Zone (SPZ). There are no potable groundwater abstraction points within 500m. The nearest surface water feature is the Moston Brook location 293m to the north. There are no surface water abstractions within 500m. The nearest discharge consent is noted 158m to the north west, licensed by United Utilities Water Limited for the of a storm sewage overflow to the Moston Brook.

The risk from UXO associated with WWII bombing to future intrusive investigation works is considered to be **Low.**

The risk from Made Ground posed to the site's end-users and groundwater is considered to be **Moderate** / **Low** due to the anticipated lack of contamination in the Made Ground. The risk posed to surface water is considered to be **Low** due to the distance to the nearest surface water feature. The risk posed to site end-users from ground generating gases arising from organic / putrescible soils near the site is considered to be **Moderate**.

# 3.0 Curtins Ground Investigation (2022)

Ground investigation works were undertaken on the 10th August 2022.

The scope of the ground investigation was designed in general accordance with current UK guidance including:

- Land Contamination Risk Management (Ref. 1);
- British Standard (BS) 10175:2011 + A2:2017 Investigation of Potentially Contaminated Sites (Ref. 2);
- BS5930:2015 + A1:2020 Code of Practice for Ground Investigations (Ref. 3); and
- BS EN1997: Part 2:2007 Eurocode 7 (Ref. 4).

## 3.1 Scope of Works

The site works consisted of four window sample boreholes, WS01 to WS04, advanced to a maximum depth of 5.45m bgl. In-situ testing, including Standard Penetration Tests (SPTs) were undertaken at, generally, 1m intervals within the superficial soils.

An exploratory hole plan is included at the end of this report, Ref. 077873-CUR-00-XX-DR-GE-80004-P02.

4 No. of soil samples, all from the Made Ground, were obtained and underwent environmental chemical testing, as detailed in Table 3.1. Analysis was undertaken to assess the contamination risk presented to site end users and construction works in this area of the site. Where asbestos was encountered, asbestos quantification was undertaken (1 location).

***Table 3.1 -*** *Environmental testing suite (Soils)*

| Suite Ref. | Analyte | LOD |
|---|---|---|
| **Soils Suite A** | Asbestos Screen | - |
| | pH Value | 0.01 pH Units |
| | 2:1 Water Soluble Sulphate | 0.01 g/l |
| | Soil Organic Matter (SOM) | 0.1 $\%^{w}/_{w}$ |
| | Arsenic, Chromium, Chromium VI, Copper, Lead, Selenium, Nickel | 1 mg/kg |
| | Zinc | 5 mg/kg |
| | Boron (water soluble) | 1 mg/kg |
| | Cadmium | 0.5 mg/kg |
| | Mercury | 0.17 mg/kg |
| | Cyanide (total) | 1 mg/kg |
| | Phenols (screen) | 0.2 mg/kg |
| | PAHs (USEPA 16) | 0.01 to 0.08 mg/kg |
| | TPH (Aro/Ali Split) | 0.01 to 1.0 mg/kg |

The following laboratory geotechnical testing was undertaken in accordance with methods outlines in BS1377: Part 1:2016 (Ref. 5), to enable a foundation assessment for the proposed residential development:

- 3 No. 4pt Atterberg Tests
- 3 No. 2:1 Water Soluble Sulphate & pH

## 3.2 Ground Conditions

A summary of the ground conditions encountered during the site investigation works is presented in *Table 3.2,* below, with detailed information presented in the exploratory hole logs included at the end of this report. A summary of each strata is presented below.

***Table 3.2 -*** *Summary of encountered ground conditions:*

| Stratum | Depth to Top of Strata m bgl (m AOD) | Thickness (m) | | Description |
|---|---|---|---|---|
| | | Min | Max | |
| MADE GROUND | 0.00 | 1.00 | 2.45 | Surface cover of grass over MADE GROUND: loose dark brown slightly gravelly sand with cobbles and abundant rootlets. Gravel is angular to subangular, fine to coarse of brick, concrete, sandstone and granite. Cobbles are subangular of concrete.<br>**Overlying**<br>MADE GROUND: Loose dark brown slightly gravelly sand. Gravel is angular to subangular fine to coarse of brick, concrete, sandstone, granite and mudstone.<br>**Or**<br>MADE GROUND: Soft to firm dark brown and black slightly gravelly sandy clay. Sand is fine to medium. Gravel is angular to subangular fine to medium of brick. |
| GLACIAL TILL | 1.00 – 2.45 (63.00 – 60.89) | 2.00[1] | 4.45[1] | Firm to stiff brown and light grey slightly sandy clay. |

*1 – Base of strata not encountered.*

## 3.3 Groundwater

No water strikes were recorded within the exploratory boreholes during the ground investigation works.

Two boreholes were installed to enable gas and groundwater monitoring. The borehole response zones are detailed in *Table 3.3b*. The boreholes were recorded as being 'dry' on all monitoring occasions.

***Table 3.3b –*** *Monitoring Well Response Zones*

| Borehole Ref. | Installation Strata | Response Zone m bgl (m AOD) | Depth to water level m bgl (m AOD) | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | 24/08/22 | 01/09/22 | 21/09/22 | 28/09/22 | 14/10/22 | 28/10/22 |
| **WS02** | Made Ground | 0.50 –2.00 (62.85 – 61.34) | Dry | Dry | Dry | Dry | Dry | Dry |
| **WS04** | Made Ground | 0.50 –2.00 (63.65 – 62.15) | Dry | Dry | Dry | Dry | Dry | Dry |

## 3.4 Obstructions

No obstructions were noted during the site investigation.

## 3.5 Observed Potential Contamination

No evidence of visual or olfactory contamination was observed during the ground investigation works.

## 4.0 Ground Contamination Assessment

4 samples were taken from the Made Ground and analysed according to the testing Suite A outlined in *Table 3.1*. The laboratory chosen by Curtins to undertake the analysis was Envirolab, a UKAS and MCERTS accredited laboratory.

Soil samples were obtained to provide adequate and representative coverage for the proposed end use, accounting for the site's history.

Considering the sites proposed end-use for residential dwellings were compared against adopted '*Residential with homegrown'* Generic Assessment Criteria (GACs).

Soil Organic Matter (SOM) content has an influence on the volatilisation of organic contaminants (i.e. the higher the SOM, the lower the volatilisation rate and therefore inhalation exposure risk). Soil organic matter (SOM) value for the soils was 7.5 $^{w}/_{w}$ to 11.3% $^{w}/_{w}$. With consideration for a calculated geometric average, soil features determine an SOM of 5.29% $^{w}/$. As such, a comparison against Tier 1 thresholds for SOM of 2.5% $^{w}/_{w}$ for A '*Residential with homegrown'* end use has been adopted.

The full chemical testing results and adopted GAC's are listed in at the end of this report.

Exceedances were noted within the soil samples for Metals, and PAHs. Exceedances are detailed below within *Table 4.0*.

***Table 4.0 –*** *Exceedances within Made Ground*

| Exploratory Hole I.D. | Depth m bgl (m AOD) | Strata | Determinant | Concentration (mg/kg) | GAC (mg/kg) |
|---|---|---|---|---|---|
| **WS01** | 0.45 | Made Ground | Mercury | 1.02 | 1 |
| | | | Benzo(a)pyrene | 6.07 | 2.7 |
| | | | Benzo(b) fluoranthene | 6.18 | 3.3 |
| | | | Dibenzo(ah) anthracene | 1.01 | 0.28 |
| **WS03** | 0.60 | Made Ground | Lead | 297 | 200 |
| | | | Mercury | 1.75 | 1 |
| **WS04** | 0.40 | Made Ground | Lead | 297 | 200 |
| | | | Mercury | 1.75 | 1 |

No suspected asbestos containing materials (AMCs) were identified in the exploratory hole logs. However, asbestos fibres were positively identified during laboratory screening in one sample location. WS01 identified loose fibres of chrysotile (<0.001 %).

# 5.0 Geotechnical Laboratory Analysis

A programme of geotechnical testing was scheduled by Curtins to determine the ground model for the site, based on the ground conditions detailed in Section 3.1.

## 5.1 Geotechnical Testing and Engineering Properties

The program of geotechnical testing undertaken during this investigation is detailed in Section 3.1.

Where necessary, determination of characteristic parameters has been based on appropriate assessment of results derived from in-situ tests, laboratory analysis and published correlations, complemented with engineering judgement and consideration of the relevant limit state. The parameters are not considered to be absolute and should be referenced with the specific strata text in this section and reviewed when considering a specific area of the site.

### 5.1.1 Made Ground

A surface cover of grass was generally underlain by dark brown or grey sandy gravel or gravelly sand. The gravel fraction is described as being sandstone, brick, metal, plastic, concrete and glass.

Due to inherent variability in the Made Ground soils, and it's compressible nature, it is not considered to be a suitable bearing stratum for the proposed residential development, and therefore only one geotechnical test has been undertaken in this stratum.

### 5.1.2 Glacial Till

Glacial Till was recorded underlying the Made Ground in all exploratory hole locations.

The Glacial Till encountered comprises predominantly cohesive deposits, described as firm to stiff, slightly gravelly or gravelly, sandy to very sandy clay.

The geotechnical test results recorded within the superficial deposits are summarised in *Table 5.1.2.*

***Table 5.1.2 –*** *Summary of Glacial Till geotechnical test results*

| Parameter | | No. of tests | Minimum | Maximum | Average |
|---|---|---|---|---|---|
| pH | | 3 | 7.5 | 8.5 | 8.13 |
| Water Soluble Sulphate | | 3 | 24 | 56 | 37 |
| SPT 'N' Value | | 14 | 8 | 50 | - |
| Moisture Content (%) | | 3 | 17 | 19 | 17.66 |
| Atterberg Test | Liquid Limit (%) | 3 | 41 | 47 | 44 |
| | Plastic Limit (%) | 3 | 20 | 21 | 20.33 |
| | Plasticity Index (%) | 3 | 21 | 27 | 23.66 |
| | Modified Plasticity Index (%) | 3 | 21 | 27 | 23.59 |

***Cohesive Glacial Till***

A total of twelve SPT 'N' values were recorded in cohesive Glacial Till, ranging from between 8 and 33, where full penetration was met. The SPT 'N' results generally show an increase in N value with depth, as summarised in Figure 5.1.2a.

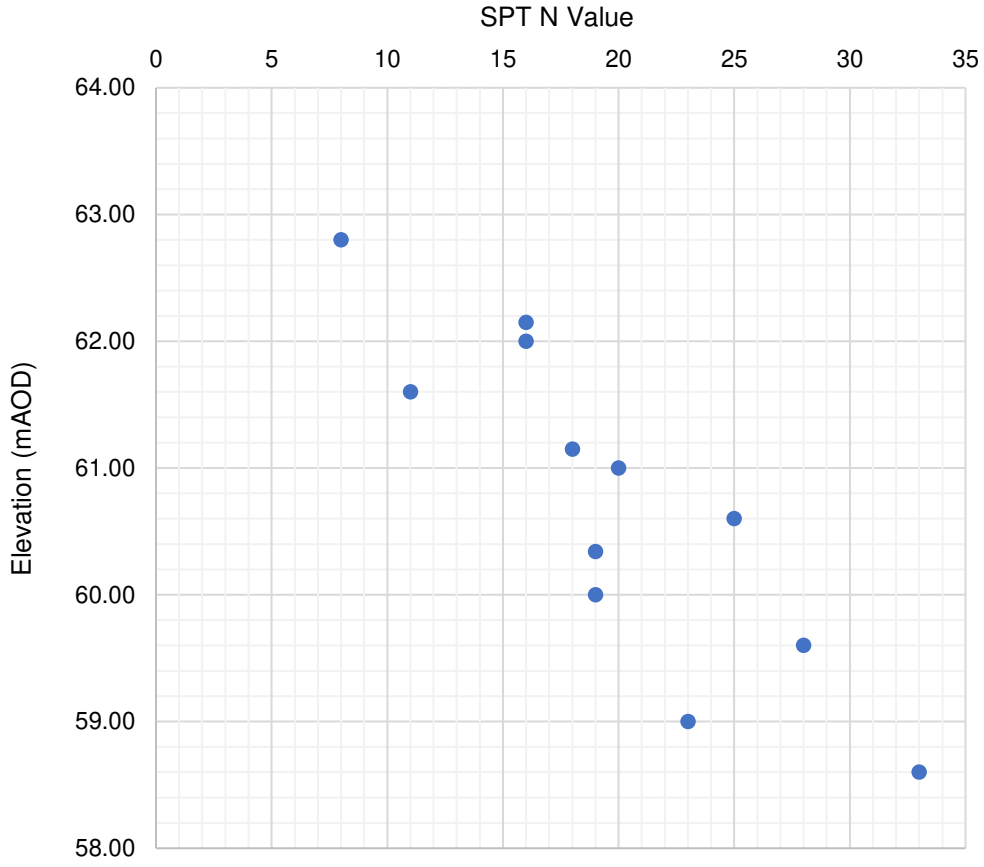



***Figure 5.1.2a –*** *SPT 'N' Value versus Elevation (m AOD) – Cohesive Glacial Till*

Three Atterberg tests were undertaken during the ground investigation. All results indicate the cohesive Glacial Till behaves as a medium plasticity clay with a moderate volume change. The volume change potential of the cohesive soils has been determined in accordance with guidance from NHBC Standards Chapter 4.2 (Ref. 6).

The results of SPT can be correlated to an Undrained Shear Strength ($c_u$) when undertaken within cohesive deposits. For overconsolidated clays, Stroud (1974) reported good correlations between N and $c_u$, where:

$$\boldsymbol{cu = f1\ x\ SPT\ 'N'\ Value}$$

*where values of $f_1$ are the conversion factor based on the plasticity of the clay.*

Based on an average plasticity Index of 23% and utilising an $f_1$ factor of 5 derived undrained shear strengths ranged between 40kPa and 165kPa are estimated.

The derived undrained shear strengths of the cohesive Glacial Till appears to show some increase with depth, as illustrated in *Figure 5.1.2b*. The graph illustrates that the clays are predominantly medium to very high strength.

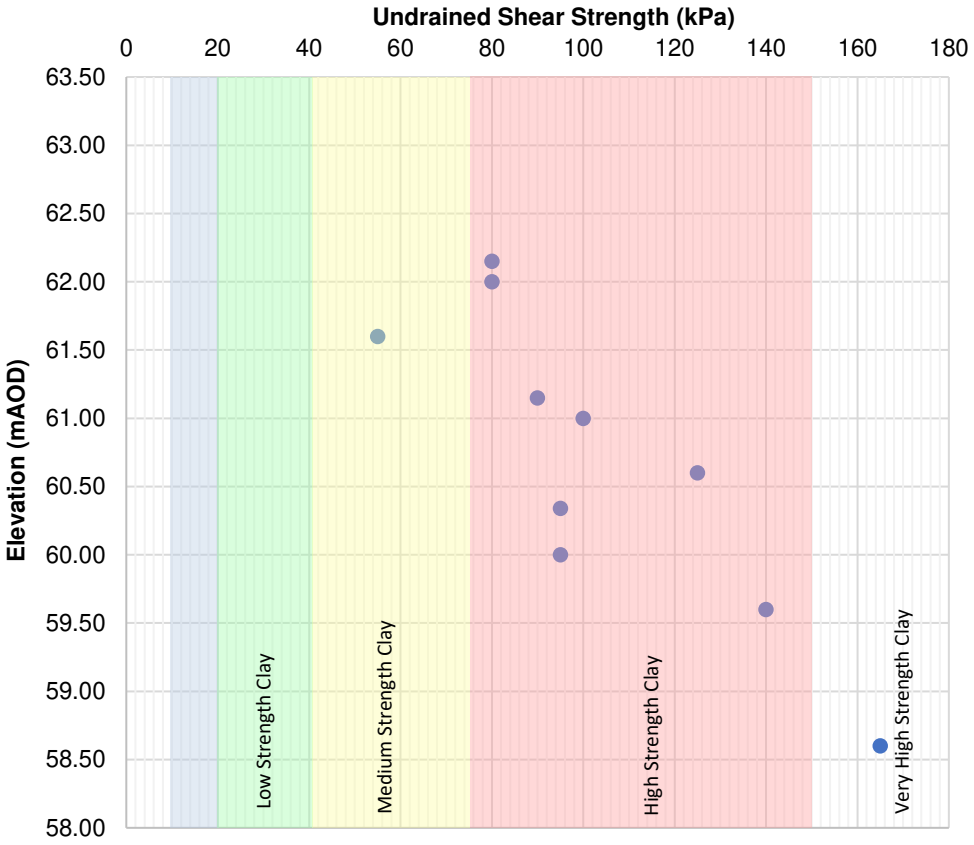



***Figure 5.1.2b –*** *Derived Undrained Shear Strength versus Elevation Plot - Cohesive Glacial Till*

Moderately conservative characteristic unit weights of 17 - 20kN/m$^3$ for a medium strength clay above and below the water table, are deemed appropriate in accordance with BS8002 (Ref. 7).

The results of SPT can be correlated to the modulus of volume compressibility ($m_v$) when undertaken within cohesive deposits. For overconsolidated clays, Stroud (1974) reported correlations between N and $m_v$, where:

$$mv = \frac{1}{f2 \; x \; SPT \; N}$$

*where values of $f_2$ are a factor of the plasticity of the clay.*

Based on an average plasticity index of 23% and utilising an $f_2$ factor of 0.5, $m_v$ values typically range between 0.061 and 0.182 m$^2$/MN (low to medium compressibility), illustrated in *Figure 5.1.2c*.

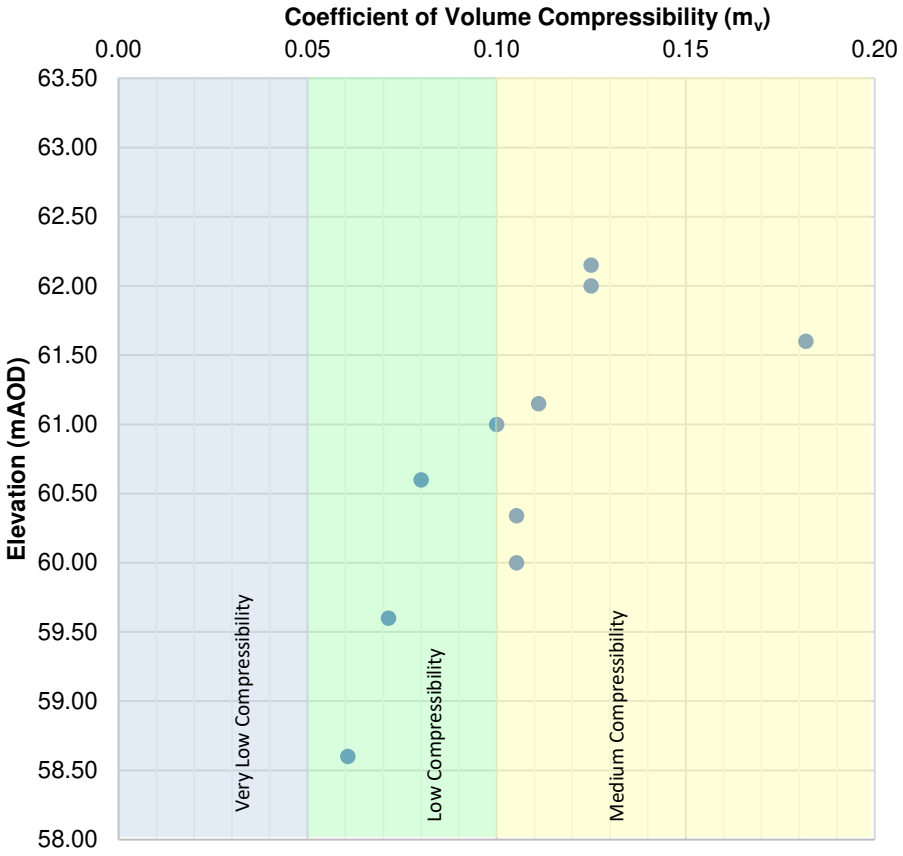



***Figure 5.1.2c –*** *Coefficient of Volume Compressibility versus Elevation Plot - Cohesive Glacial Till*

The exploratory hole logs, and laboratory testing results indicate generally laterally consistent ground conditions across the site, and a decrease in compressibility with depth in the cohesive Glacial Till.

## 6.0 Gas Risk Assessment

The conceptual site model concluded there was a Moderate risk from ground. There was potential for limited Made Ground, containing organic /putrescible content as a potential source of ground gas generation. Noxious and asphyxiate gases were attributed to include, but not limited to, carbon dioxide, carbon monoxide, methane and hydrogen sulphide.

Two boreholes were installed with monitoring wells as detailed in *Table 3.3b*.

Six rounds of gas monitoring were undertaken between 24th August 2022 and 28th October 2022. The results log sheets are contained within Appendix A6 and summarised in *Table 6.0.*

Barometric pressures ranging between 999mb and 1015mb were recorded during the monitoring period.

***Table 6.0 –*** *Summary of Ground Gas Monitoring Results*

| Exploratory Hole ID | Maximum Methane Concentration (%) | Maximum Carbon Dioxide Concentration (%) | Minimum Steady Oxygen Concentration (%) | Maximum Peak Gas Flow (l/hr) | Steady State Gas Flow (l/hr) |
|---|---|---|---|---|---|
| WS02 | <0.1 | 0.5 | 19.6 | 3.2 | <0.1 |
| WS04 | <0.1 | 2.1 | 18.3 | <0.1 | <0.1 |

Methane ($CH_4$) was recorded below the instrument's detection limit within all the monitoring wells.

Carbon Dioxide ($CO_2$) recorded a maximum concentration of 2.1% $^{v}/_{v}$ within WS04 during the fifth and sixth visit.

All monitoring visits for all wells recorded hydrogen sulphide ($H_2S$) and carbon monoxide (CO) below the limit of detection of the monitoring instrument.

The maximum peak air flow rate was recorded in WS02, at 3.2 l/hr on the fifth visit, reducing to a steady state air flow rate of <0.1 l/hr. For the purposes of this assessment, the negative values are taken as absolute values, and it is assumed that a positive air flow rate of the same value may be achieved in natural ground conditions.

Two gas risk assessments have been undertaken, to account for the end use of the site.

**Private residential dwellings**, assumed to be built in accordance with the 'model' low-rise housing development and NHBC guidelines (Ref. 8), will be assessed in accordance with the NHBC Traffic Light Classification.

Hazardous gas flow rates ($Q_{hg}$) can be evaluated using peak air flow rates and maximum methane concentrations, and steady state air flow rates and steady state carbon dioxide concentrations. On the basis that methane concentrations were recorded below the limit of detection of the monitoring instrument throughout the monitoring period, the gas screening value (GSV) will be determined by the carbon dioxide concentrations recorded.

For carbon dioxide, the greatest steady state air flow rate was recorded during all monitoring visits (<0.1 l/hr). The greatest steady state carbon dioxide concentration was recorded in WS04 on the fifth and sixth visit (2.1%v/v). On this basis, the calculated $Q_{hg}$ for the site is taken as 0.002 l/hr.

All monitoring wells were constructed in the Made Ground. The worst case $Q_{hg}$ value for carbon dioxide has been taken as the gas screening value for the site.

The assessment indicates the site is classified as Green, where designs confirm with the NHBC 'model' low rise house.

**Developments which differ significantly from the 'model' construction** will be assessed in accordance with BS8485:2019. This includes low rise apartments.

The dataset obtained is considered to be representative of site conditions beneath the proposed development footprint. A range of data has been collated which captures significant temporal variation including barometric variability and various ground saturation states. As such, the gas risk assessment will utilise steady state flow rates and maximum gas concentrations when determining the maximum $Q_{hg}$.

On the basis that methane concentrations were recorded below the limit of detection of the monitoring instrument throughout the monitoring period, the gas screening value (GSV) will be determined by the carbon dioxide concentrations recorded.

Evaluation of the 'borehole' scenario (highest hazardous gas flow rate that is realistically possible, i.e. in a single borehole) records a maximum $Q_{hg}$ of 0.002 l/hr for carbon dioxide in WS04 on the fifth and sixth visit, where maximum steady state flow reading of <0.1 l/hr is used, and maximum gas concentrations of 2.1% v/v recorded.

Evaluation of the 'worst case' check (highest hazardous gas flow rate irrespective of when the readings were taken within a single strata/zone), records a maximum $Q_{hg}$ of 0.002 l/hr for carbon dioxide.

All monitoring wells were constructed in the Made Ground. The borehole $Q_{hg}$ value for carbon dioxide has been taken as the gas screening value for the site, which is consistent with a Characteristic Situation 1 (CS-1) gas regime, where no gas protection measures are required.

The potential risks from ground gases to the excavations are to be dealt with by the Contractor, in accordance with the Confined Space Regulations, during construction. Appropriate ground gas monitoring and safety measures should be in place during the works, as the potential presence of ground gases could pose a risk in any confined spaces of deep excavations.

## 7.0 Geotechnical Assessment and Recommendations

The recommendations provided within this section are based on a review of the encountered ground conditions across the site.

The ground conditions at site generally comprised Made Ground to a maximum depth of 2.45m bgl, underlain by Glacial Till. Glacial Till was encountered at depths ranging between 1.00m and 2.45m bgl (60.89-63.00m AOD) to the base of the boreholes. The thickness of the Glacial Till was not proven by this investigation.

### 7.1 Foundation Assessment

It is understood the proposed development comprises several two storey residential houses and residential apartments. The loadings of the proposed houses and apartments were not available at the time of writing this report. The loads will pre-determine the suitability of foundations adopted, though are not anticipated to be high.

Due to the sloping nature of the topography, some degree of cut may be required to create a level development platform. Based on this, and the ground and groundwater conditions encountered during the Curtins ground investigation, it is considered that shallow foundations will be possible to support the proposed development.

Foundations will be required to be taken down below any Made Ground and be placed in the firm to stiff cohesive Glacial Till that exhibits an undrained shear strength in excess of 50kPa and cast at a minimum depth of 1.0m bgl. Localised over excavation may be required where there is deep Made Ground and to ensure the minimum undrained shear strength criteria of 50kPa is achieved. To prevent differential settlement foundations should be placed wholly in one material i.e. clay and over excavation through granular sand layers in the Glacial Till may be required to achieve this.

Assuming a 0.6m wide strip foundation at a depth of 1.0m bgl, an allowable bearing capacity of 75kPa is likely to be achievable (limited to less than 25mm settlement). Any changes to the foundation width, depth or founding strata will change this capacity. Should excavation depths become excessive and uneconomical to meet the minimum undrained shear strength of 50kPa, a ground improvement (e.g. vibro) or mini-pile solution may be required.

Specialist contractors should be consulted with regards to the design of an appropriate ground improvement or piling scheme to identify the most feasible and economic technique and options.

A qualified experienced engineer should inspect the founding stratum prior to casting.

Although groundwater was not recorded during the investigation and subsequent monitoring, ingress into shallow excavations from perched groundwater cannot be discounted. Sump pumping is likely to be an effective dewatering technique.

Excavation instability associated with the Made Ground and superficial deposits cannot be discounted, especially if there are granular layers in the Glacial Till and in conjunction with groundwater ingress.

### 7.2 Ground Floor Slab

In accordance with the NHBC Standards (2022) ground bearing floor slabs may only be used where the depth of Made Ground is less than 600mm deep and properly compacted. Any unsuitable or soft soils should be excavated out and replaced with a granular fill, and the formation thoroughly proof rolled prior to casting. Where Made Ground is greater than 600mm thick, excavating and replacing the Made Ground to an engineering specification may enable a ground bearing solution, however approval from the warranty provider should be obtained in advance. Alternatively ground improvement such as vibro would enable a ground bearing solution. A suspended floor slab would be required in conjunction with a piled solution.

### 7.3 Chemical Attack on Buried Concrete

The classification of the site in terms of concrete in aggressive ground is based on the guidance provided in Table C2 of the Building Research Establishment (BRE) Special Digest 1, 3rd edition of 2005. A summary of the results obtained during are summarised in *Table 7.3a*, and *Table 7.3b* details the classification.

***Table 7.3a –*** *Aggressive Chemical Environment for Concrete (ACEC) Site Classification*

| Stratum | Test Type | No. of Tests | Range |
|---|---|---|---|
| Made Ground | pH | 4 | 7.45 – 8.15 |
| | Water Soluble Sulphate (mg/l) | 4 | <10 – 40 |
| Glacial Till | pH | 3 | 7.5 – 8.5 |
| | Water Soluble Sulphate (mg/l) | 3 | 24 – 56 |

***Table 7.3b –*** *Aggressive Chemical Environment for Concrete (ACEC) Site Classification*

| Stratum | Design Sulphate Class | ACEC Class (1) |
|---|---|---|
| Made Ground | DS-1 | AC-1 |
| Glacial Till | DS-1 | AC-1 |

(1) ACEC assessment was based on the *mobile* groundwater condition in a *greenfield* scheme area

In these conditions it is considered that deterioration of buried concrete due to sulphate or acid attack is unlikely to occur. The preliminary design of buried concrete according to Table C2 of BRE Special Digest 1:2005 should be in accordance with Class DS-1 (AC-1) conditions assuming mobile groundwater.

## 8.0 Closure

A **Moderate** risk has been identified to site end-users from soil and dust inhalation, direct contact and ingestion of shallow site soils beneath the site due to the metals and PAHs exceedances recorded. A suitable thickness of clean and inert capping should be installed in all private gardens and areas of soft landscaping, detailed in a remediation strategy.

Construction workers should be provided with appropriate personal protection equipment (PPE) with consideration of the environmental testing results presented.

No gas protection measures will be required for the proposed residential development.

It is considered that shallow foundations will be possible to support the proposed development. Foundations will be required to be taken down below any Made Ground and be placed in the firm to stiff cohesive Glacial Till that exhibits an undrained shear strength in excess of 50kPa and cast at a minimum depth of 1.0m bgl. Assuming a 0.6m wide strip foundation at a depth of 1.0m bgl, an allowable bearing capacity of 75kPa is likely to be achievable (limited to less than 25mm settlement).

In accordance with the NHBC Standards (2022) ground bearing floor slabs may only be used where the depth of Made Ground is less than 600mm deep and properly compacted. Any unsuitable or soft soils should be excavated out and replaced with a granular fill, and the formation thoroughly proof rolled prior to casting. Where Made Ground is greater than 600mm thick, excavating and replacing the Made Ground to an engineering specification may enable a ground bearing solution, however approval from the warranty provider should be obtained in advance. Alternatively ground improvement such as vibro would enable a ground bearing solution. A suspended floor slab would be required in conjunction with a piled solution.

A Design Sulphate class of DS-1 and ACEC Class of AC-1 are deemed suitable for the proposed development for Made Ground and Glacial Till.

If you have any queries with regard to this letter report, please do not hesitate to contact us.

Yours sincerely,



J Lord
Senior Geo-Environmental Engineer
For and on behalf of
**Curtins Consulting Ltd**

| Author | Signature | Date |
|---|---|---|
| **J Lord**<br>BSc (Hons)<br>Senior Geo-Environmental Engineer |  | November 2022 |
| **Checked** | **Signature** | **Date** |
| **R Stringer**<br>BSc (Hons) CGeol EurGeol FGS<br>Principal Geotechnical Engineer |  | November 2022 |
| **Authorised** | **Signature** | **Date** |
| **R Stringer**<br>BSc (Hons) CGeol EurGeol FGS<br>Principal Geotechnical Engineer |  | November 2022 |

| Rev | Description | Issued by | Checked | Date |
|---|---|---|---|---|
| | | | | |
| | | | | |

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## References

1. Environmental Agency (2020) Land Contamination Risk Management (LCRM)
2. British Standards Institution (2011) Investigation of Potentially Contaminated Sites: Code of Practice (report no. BS10175:2011+A2:2017).
3. British Standards Institution BSI (2015+2000) Code of Practice for Site Investigations (report no. BS5930).
4. British Standards Institution (2006) Eurocode 7: Geotechnical Design (report no. BSEN1997).
5. British Standard (2016) Methods of test for soils for civil engineering purposes. General requirements and sample preparation (report no. BS1377-1).
6. NHBC Standards (2021) Chapter 4.2
7. BS 8002:1994 Code of Practice for Earth Retaining Structures
8. NHBC (2007) Guidance of Evaluation of Development Proposals on sites where methane and carbon dioxide are present. Report Edition No. 4

## Appendices

Appendix A1 – Drawings

Appendix A2 – Exploratory Hole Logs

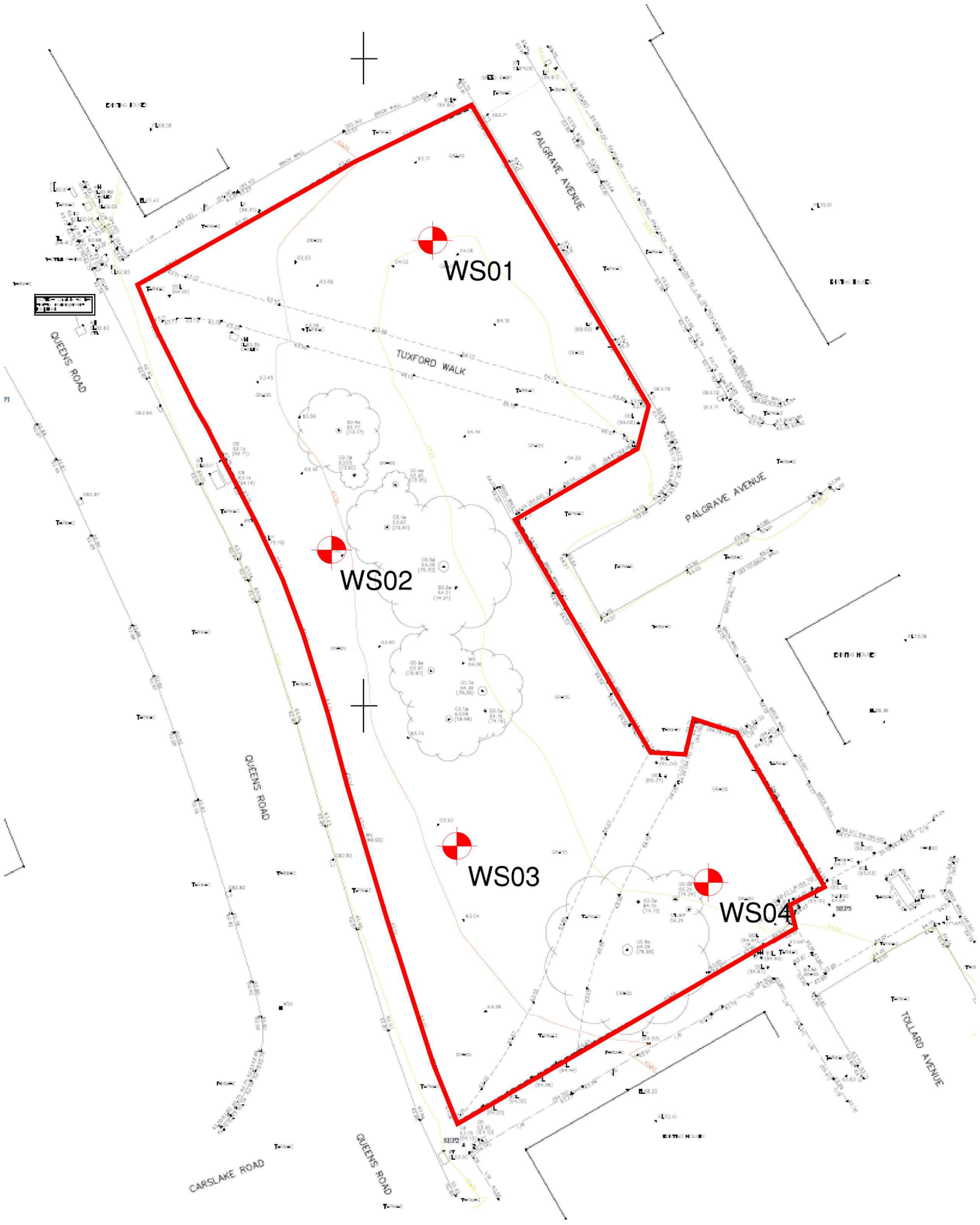
Appendix A3 – Geo-Environmental Laboratory Testing Results

Appendix A4 – Generic Assessment Criteria (GACs)

Appendix A5 – Geotechnical Laboratory Testing Results

Appendix A6 – Ground Gas Monitoring Results

# Appendix A1 – Drawings




## SITE INVESTIGATION

BOREHOLE LOCATIONS

| Rev: | Description: | Date: | By: | Chkd: |
|---|---|---|---|---|

curtins

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Birmingham - Bristol - Cardiff - Douglas - Edinburgh - Kendal - Leeds - Liverpool - London - Manchester - Nottingham

Status:

INFORMATION

Project:

**PALGRAVE AVENUE**

Drg Title:

**EXPLORATORY HOLE LOCATION PLAN**

| Scale: | Size: | First Issue: | Drawn: | Checked: |
|---|---|---|---|---|
| **NTS** | A3 | **16/08/2022** | **JL** | **RA** |

| Drg No: | Rev: |
|---|---|
| **077873-CUR-00-XX-DR-GE-80004** | **P02** |

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# Appendix A2 – Exploratory Hole Logs

# Borehole Log

Borehole No. **WS01**

Sheet 1 of 1

| | | | |
|---|---|---|---|
| Project Name: Palgrave Avenue | Project No. 077873.05 | Co-ords: - | Hole Type WS |
| Location: Palgrave Avenue, Monsall, M408JW | | Level: 64.00 | Scale 1:40 |
| Client: Guinness Partnership | | Dates: 09/08/2022 - 09/08/2022 | Logged By JL |

| Well | Water Strikes | Samples and In Situ Testing | | | Depth (m) | Level (m) | Legend | Stratum Description |
|---|---|---|---|---|---|---|---|---|
| | | Depth (m) | Type | Results | | | | |
| | | 0.45 | ES | | | | | MADE GROUND: Grass over dark brown slightly gravelly clayey SAND. Sand is fine to coarse. Gravel is fine to coarse angular to rounded of brick, concrete, ceramic, glass and sandstone |
| | | | | | | | | *From 0.50 to 0.55m bgl a layer of chicken wire* |
| | | | | | 1.00 | 63.00 | | Firm greyish brown slightly gravelly CLAY. Gravel is fine to medium subangular to subrounded of sandstone and coal |
| | | 1.20 | | N=8 (2,2/2,2,2,2) | | | | |
| | | 1.50 | D | | | | | |
| | | 2.00 | | N=16 (3,3/3,4,4,5) | | | | |
| | | | | | | | | *From 2.60m bgl the clay becomes stiff* |
| | | 3.00 | | N=20 (3,4/4,4,5,7) | | | | |
| | | 4.00 | | N=19 (3,3/5,5,4,5) | | | | |
| | | 5.00 | | N=23 (4,4/4,5,7,7) | | | | |
| | | | | | 5.45 | 58.55 | | End of borehole at 5.45 m |

Remarks

Service inspection pit hand excavated from GL to 1.20m. No groundwater encountered.

# Borehole Log

Borehole No.
**WS02**
Sheet 1 of 1

| | | | |
|---|---|---|---|
| Project Name: Palgrave Avenue | Project No. 077873.05 | Co-ords: - | Hole Type WS |
| Location: Palgrave Avenue, Monsall, M408JW | | Level: 63.34 | Scale 1:40 |
| Client: Guinness Partnership | | Dates: 09/08/2022 - 09/08/2022 | Logged By JL |

| Well | Water Strikes | Samples and In Situ Testing | | | Depth (m) | Level (m) | Legend | Stratum Description |
|---|---|---|---|---|---|---|---|---|
| | | Depth (m) | Type | Results | | | | |
| | | 0.50 | ES | | 0.55 | 62.79 | | MADE GROUND: Grass over dark brown slightly gravelly SAND, with frequent roots and rootlets. Sand is fine to coarse. Gravel is fine to coarse angular to subrounded of concrete, brick, plastic and sandstone |
| | | 1.20 | | N=10 (3,3/2,2,3,3) | | | | MADE GROUND: Grey gravelly SAND. Sand is medium to coarse. Gravel is fine to coarse angular to subangular of concrete and brick |
| | | 2.00 | | N=4 (3,0/0,1,1,2) | 2.45 | 60.89 | | Firm brown slightly gravelly very sandy CLAY. Gravel is fine to medium subangular to subrounded of sandstone and coal |
| | | 3.00 | | N=19 (4,5/4,5,5,5) | | | | *From 3.75m bgl the clay becomes stiff* |
| | | 3.50 | D | | | | | |
| | | 4.00 | | 50 (8,9/50 for 200mm) | 4.45 | 58.89 | | End of borehole at 4.45 m |

1 2 3 4 5 6 7 8

Remarks
Service inspection pit hand excavated from GL to 1.20m. No groundwater encountered.

AGS

# Borehole Log

Borehole No. **WS03**

Sheet 1 of 1

| | | | |
|---|---|---|---|
| Project Name: Palgrave Avenue | Project No. 077873.05 | Co-ords: - | Hole Type WS |
| Location: Palgrave Avenue, Monsall, M408JW | | Level: 63.60 | Scale 1:40 |
| Client: Guinness Partnership | | Dates: 09/08/2022 - 09/08/2022 | Logged By JL |

| Well | Water Strikes | Samples and In Situ Testing | | | Depth (m) | Level (m) | Legend | Stratum Description |
|---|---|---|---|---|---|---|---|---|
| | | Depth (m) | Type | Results | | | | |
| | | 0.60 | ES | | | | | MADE GROUND: Grass over dark brown gravelly SAND. Sand is fine to medium. Gravel fine to coarse angular to subrounded of sandstone, brick, metal and plastic |
| | | 1.20 | | N=21 (4,4/5,5,6,5) | 1.10 | 62.50 | | MADE GROUND: Grey sandy GRAVEL. Gravel is fine to coarse angular to subrounded of brick, concrete, sandstone and metal |
| | | 2.00 | | N=11 (2,2/2,3,3,3) | 1.80 | 61.80 | | Firm brown slightly sandy gravelly CLAY. Gravel is fine to coarse subangular to subrounded of sandstone and coal |
| | | | | | | | | *From 2.20m bgl the clay becomes firm to stiff* |
| | | 2.50 | D | | | | | |
| | | 3.00 | | N=25 (3,4/6,6,7,6) | | | | |
| | | | | | | | | *From 3.50m bgl the clay becomes stiff* |
| | | 4.00 | | N=28 (6,6/8,7,6,7) | | | | |
| | | 5.00 | | N=33 (4,4/7,7,8,11) | | | | |
| | | | | | 5.45 | 58.15 | | End of borehole at 5.45 m |

Remarks

Service inspection pit hand excavated from GL to 1.20m. No groundwater encountered.

# Borehole Log

Borehole No. **WS04**

Sheet 1 of 1

| | | | |
|---|---|---|---|
| Project Name: Palgrave Avenue | Project No. 077873.05 | Co-ords: - | Hole Type WS |
| Location: Palgrave Avenue, Monsall, M408JW | | Level: 64.15 | Scale 1:40 |
| Client: Guinness Partnership | | Dates: 09/08/2022 - 09/08/2022 | Logged By JL |

| Well | Water Strikes | Samples and In Situ Testing | | | Depth (m) | Level (m) | Legend | Stratum Description |
|---|---|---|---|---|---|---|---|---|
| | | Depth (m) | Type | Results | | | | |
| | | 0.40 | ES | | | | | MADE GROUND: Grass over dark brown gravelly SAND. Sand is fine to medium. Gravel fine to coarse angular to subrounded of sandstone, brick, metal and plastic |
| | | | | | 0.90 | 63.25 | | |
| | | 1.20 | | N=11 (2,2/3,2,3,3) | | | | MADE GROUND: Grey sandy GRAVEL. Gravel is fine to coarse angular to subrounded of brick, concrete, sandstone and metal |
| | | | | | 1.75 | 62.40 | | |
| | | 2.00 | D | | | | | Firm brown slightly gravelly CLAY. Gravel is fine to coarse subangular to subrounded of sandstone and coal |
| | | 2.00 | | N=16 (3,3/4,4,4,4) | | | | *From 2.20m bgl the clay becomes firm to stiff* |
| | | 3.00 | | N=18 (4,5/4,4,6,4) | | | | *From 3.20m bgl the clay becomes stiff* |
| | | 4.00 | | N=50 (6,9/50 for 275mm) | | | | |
| | | | | | 4.45 | 59.70 | | End of borehole at 4.45 m |

Remarks

Service inspection pit hand excavated from GL to 1.20m. No groundwater encountered.

# Appendix A3 – Geo-Environmental Laboratory Testing Results

envirolab
Units 7 & 8 Sandpits Business Park
Mottram Road, Hyde, Cheshire, SK14 3AR

# FINAL ANALYTICAL TEST REPORT
## SUPPLEMENT TO TEST REPORT 22/07886/1

**Amendments:** Request for Additional Analysis

**Envirolab Job Number:** 22/07886
**Issue Number:** 2 **Date:** 22 August, 2022

**Client:**
Curtins Consulting (Manchester)
Merchant Exchange
17-19 Whitworth Street
Manchester
UK
M1 5WG

**Project Manager:** Jonathan Lord
**Project Name:** P500 - Palgrave Avenue
**Project Ref:** 077873.002
**Order No:** EBMA3484
**Date Samples Received:** 11/08/22
**Date Instructions Received:** 12/08/22
**Date Analysis Completed:** 22/08/22

**Approved by:**

Danielle Brierley
Deputy Client Services Supervisor

**Envirolab Job Number: 22/07886**

**Client Project Name: P500 - Palgrave Avenue**

**Client Project Ref: 077873.002**

| Lab Sample ID | 22/07886/1 | 22/07886/2 | 22/07886/3 | 22/07886/4 | | | | Units | Limit of Detection | Method ref |
|---|---|---|---|---|---|---|---|---|---|---|
| Client Sample No | | | | | | | | | | |
| Client Sample ID | WS01 | WS02 | WS03 | WS04 | | | | | | |
| Depth to Top | 0.45 | 0.50 | 0.60 | 0.40 | | | | | | |
| Depth To Bottom | | | | | | | | | | |
| Date Sampled | 09-Aug-22 | 09-Aug-22 | 09-Aug-22 | 09-Aug-22 | | | | | | |
| Sample Type | Soil | Soil | Soil | Soil | | | | | | |
| Sample Matrix Code | 4AE | 4AE | 4ABE | 4AE | | | | | | |
| % Stones >10mm$_A$ | <0.1 | <0.1 | <0.1 | <0.1 | | | | % w/w | 0.1 | A-T-044 |
| pH$_D$ M# | 8.15 | 7.54 | 7.45 | 7.48 | | | | pH | 0.01 | A-T-031s |
| Sulphate (water sol 2:1)$_D$ M# | 0.02 | <0.01 | <0.01 | 0.04 | | | | g/l | 0.01 | A-T-026s |
| Cyanide (total)$_A$ M# | <1 | <1 | <1 | <1 | | | | mg/kg | 1 | A-T-042sTCN |
| Phenols - Total by HPLC$_A$ | <0.2 | <0.2 | <0.2 | <0.2 | | | | mg/kg | 0.2 | A-T-050s |
| Organic Matter$_D$ M# | 9.6 | 7.5 | 11.3 | 8.1 | | | | % w/w | 0.1 | A-T-032 OM |
| Arsenic$_D$ M# | 21 | 13 | 16 | 14 | | | | mg/kg | 1 | A-T-024s |
| Boron (water soluble)$_D$ | <1.0 | <1.0 | <1.0 | <1.0 | | | | mg/kg | 1 | A-T-027s |
| Cadmium$_D$ M# | 2.2 | 1.1 | 1.8 | 2.4 | | | | mg/kg | 0.5 | A-T-024s |
| Copper$_D$ M# | 132 | 60 | 92 | 55 | | | | mg/kg | 1 | A-T-024s |
| Chromium$_D$ M# | 24 | 17 | 25 | 22 | | | | mg/kg | 1 | A-T-024s |
| Chromium (hexavalent)$_D$ | <1 | <1 | <1 | <1 | | | | mg/kg | 1 | A-T-040s |
| Lead$_D$ M# | 191 | 181 | 297 | 873 | | | | mg/kg | 1 | A-T-024s |
| Mercury$_D$ | 1.02 | 0.84 | 1.75 | 1.40 | | | | mg/kg | 0.17 | A-T-024s |
| Nickel$_D$ M# | 33 | 15 | 23 | 23 | | | | mg/kg | 1 | A-T-024s |
| Selenium$_D$ M# | <1 | <1 | <1 | <1 | | | | mg/kg | 1 | A-T-024s |
| Zinc$_D$ M# | 460 | 106 | 227 | 205 | | | | mg/kg | 5 | A-T-024s |

**Envirolab Job Number: 22/07886**

**Client Project Name: P500 - Palgrave Avenue**

**Client Project Ref: 077873.002**

| Lab Sample ID | 22/07886/1 | 22/07886/2 | 22/07886/3 | 22/07886/4 | | | | Units | Limit of Detection | Method ref |
|---|---|---|---|---|---|---|---|---|---|---|
| Client Sample No | | | | | | | | | | |
| Client Sample ID | WS01 | WS02 | WS03 | WS04 | | | | | | |
| Depth to Top | 0.45 | 0.50 | 0.60 | 0.40 | | | | | | |
| Depth To Bottom | | | | | | | | | | |
| Date Sampled | 09-Aug-22 | 09-Aug-22 | 09-Aug-22 | 09-Aug-22 | | | | | | |
| Sample Type | Soil | Soil | Soil | Soil | | | | | | |
| Sample Matrix Code | 4AE | 4AE | 4ABE | 4AE | | | | | | |
| **Asbestos in Soil (inc. matrix)** | | | | | | | | | | |
| Asbestos in soil$_{D}^{\#}$ | Chrysotile | NAD | NAD | NAD | | | | | | A-T-045 |
| Asbestos Matrix (visual)$_{D}$ | - | - | - | - | | | | | | A-T-045 |
| Asbestos Matrix (microscope)$_{D}$ | Loose Fibres | - | - | - | | | | | | A-T-045 |
| Asbestos ACM - Suitable for Water Absorption Test?$_{D}$ | N/A | N/A | N/A | N/A | | | | | | A-T-045 |
| | | | | | | | | | | |
| **Asbestos in Soil Quantification % (Hand Picking & Weighing)** | | | | | | | | | | |
| Asbestos in soil % composition (hand picking and weighing)$_{D}$ | <0.001 | - | - | - | | | | % w/w | 0.001 | A-T-054 |

**Envirolab Job Number: 22/07886**

**Client Project Name: P500 - Palgrave Avenue**

**Client Project Ref: 077873.002**

| Lab Sample ID | 22/07886/1 | 22/07886/2 | 22/07886/3 | 22/07886/4 | | | | Units | Limit of Detection | Method ref |
|---|---|---|---|---|---|---|---|---|---|---|
| Client Sample No | | | | | | | | | | |
| Client Sample ID | WS01 | WS02 | WS03 | WS04 | | | | | | |
| Depth to Top | 0.45 | 0.50 | 0.60 | 0.40 | | | | | | |
| Depth To Bottom | | | | | | | | | | |
| Date Sampled | 09-Aug-22 | 09-Aug-22 | 09-Aug-22 | 09-Aug-22 | | | | | | |
| Sample Type | Soil | Soil | Soil | Soil | | | | | | |
| Sample Matrix Code | 4AE | 4AE | 4ABE | 4AE | | | | | | |
| **PAH-16MS** | | | | | | | | | | |
| Acenaphthene$_{A}^{M\#}$ | 1.63 | 0.13 | 0.19 | 0.14 | | | | mg/kg | 0.01 | A-T-019s |
| Acenaphthylene$_{A}^{M\#}$ | 0.06 | 0.03 | 0.05 | 0.03 | | | | mg/kg | 0.01 | A-T-019s |
| Anthracene$_{A}^{M\#}$ | 3.13 | 0.29 | 0.38 | 0.35 | | | | mg/kg | 0.02 | A-T-019s |
| Benzo(a)anthracene$_{A}^{M\#}$ | 6.85 | 1.00 | 1.23 | 1.25 | | | | mg/kg | 0.04 | A-T-019s |
| Benzo(a)pyrene$_{A}^{M\#}$ | 6.07 | 1.02 | 1.24 | 1.24 | | | | mg/kg | 0.04 | A-T-019s |
| Benzo(b)fluoranthene$_{A}^{M\#}$ | 6.18 | 1.12 | 1.37 | 1.29 | | | | mg/kg | 0.05 | A-T-019s |
| Benzo(ghi)perylene$_{A}^{M\#}$ | 3.09 | 0.63 | 0.74 | 0.66 | | | | mg/kg | 0.05 | A-T-019s |
| Benzo(k)fluoranthene$_{A}^{M\#}$ | 2.33 | 0.40 | 0.50 | 0.51 | | | | mg/kg | 0.07 | A-T-019s |
| Chrysene$_{A}^{M\#}$ | 7.16 | 1.08 | 1.39 | 1.34 | | | | mg/kg | 0.06 | A-T-019s |
| Dibenzo(ah)anthracene$_{A}^{M\#}$ | 1.01 | 0.18 | 0.20 | 0.20 | | | | mg/kg | 0.04 | A-T-019s |
| Fluoranthene$_{A}^{M\#}$ | 16.1 | 2.02 | 2.49 | 2.49 | | | | mg/kg | 0.08 | A-T-019s |
| Fluorene$_{A}^{M\#}$ | 1.28 | 0.09 | 0.14 | 0.10 | | | | mg/kg | 0.01 | A-T-019s |
| Indeno(123-cd)pyrene$_{A}^{M\#}$ | 4.14 | 0.78 | 0.92 | 0.85 | | | | mg/kg | 0.03 | A-T-019s |
| Naphthalene $_{A}^{M\#}$ | 0.47 | 0.03 | 0.10 | 0.09 | | | | mg/kg | 0.03 | A-T-019s |
| Phenanthrene$_{A}^{M\#}$ | 11.4 | 1.12 | 1.39 | 1.34 | | | | mg/kg | 0.03 | A-T-019s |
| Pyrene$_{A}^{M\#}$ | 14.3 | 1.88 | 2.31 | 2.29 | | | | mg/kg | 0.07 | A-T-019s |
| Total PAH-16MS$_{A}^{M\#}$ | 85.2 | 11.8 | 14.6 | 14.2 | | | | mg/kg | 0.01 | A-T-019s |

**Envirolab Job Number: 22/07886**

**Client Project Name: P500 - Palgrave Avenue**

**Client Project Ref: 077873.002**

| Lab Sample ID | 22/07886/1 | 22/07886/2 | 22/07886/3 | 22/07886/4 | | | | Units | Limit of Detection | Method ref |
|---|---|---|---|---|---|---|---|---|---|---|
| Client Sample No | | | | | | | | | | |
| Client Sample ID | WS01 | WS02 | WS03 | WS04 | | | | | | |
| Depth to Top | 0.45 | 0.50 | 0.60 | 0.40 | | | | | | |
| Depth To Bottom | | | | | | | | | | |
| Date Sampled | 09-Aug-22 | 09-Aug-22 | 09-Aug-22 | 09-Aug-22 | | | | | | |
| Sample Type | Soil | Soil | Soil | Soil | | | | | | |
| Sample Matrix Code | 4AE | 4AE | 4ABE | 4AE | | | | | | |
| **TPH CWG with Clean Up** | | | | | | | | | | |
| Ali >C5-C6$_A^{\#}$ | <0.01 | <0.01 | <0.01 | <0.01 | | | | mg/kg | 0.01 | A-T-022s |
| Ali >C6-C8$_A^{\#}$ | <0.01 | <0.01 | <0.01 | <0.01 | | | | mg/kg | 0.01 | A-T-022s |
| Ali >C8-C10$_A$ | 1 | <1 | <1 | 2 | | | | mg/kg | 1 | A-T-055s |
| Ali >C10-C12$_A^{M\#}$ | 2 | <1 | <1 | 2 | | | | mg/kg | 1 | A-T-055s |
| Ali >C12-C16$_A^{M\#}$ | 7 | 2 | 2 | 4 | | | | mg/kg | 1 | A-T-055s |
| Ali >C16-C21$_A^{M\#}$ | 9 | 4 | 5 | 5 | | | | mg/kg | 1 | A-T-055s |
| Ali >C21-C35$_A^{M\#}$ | 55 | 68 | 112 | 62 | | | | mg/kg | 1 | A-T-055s |
| Total Aliphatics$_A$ | 66 | 67 | 103 | 71 | | | | mg/kg | 1 | Calc-As Recd |
| Aro >C5-C7$_A^{\#}$ | <0.01 | <0.01 | <0.01 | <0.01 | | | | mg/kg | 0.01 | A-T-022s |
| Aro >C7-C8$_A^{\#}$ | <0.01 | <0.01 | <0.01 | <0.01 | | | | mg/kg | 0.01 | A-T-022s |
| Aro >C8-C10$_A$ | 1 | 1 | 1 | 2 | | | | mg/kg | 1 | A-T-055s |
| Aro >C10-C12$_A$ | 5 | 2 | 2 | 4 | | | | mg/kg | 1 | A-T-055s |
| Aro >C12-C16$_A$ | 39 | 9 | 10 | 28 | | | | mg/kg | 1 | A-T-055s |
| Aro >C16-C21$_A^{M\#}$ | 179 | 16 | 37 | 46 | | | | mg/kg | 1 | A-T-055s |
| Aro >C21-C35$_A^{M\#}$ | 524 | 44 | 101 | 87 | | | | mg/kg | 1 | A-T-055s |
| Total Aromatics$_A$ | 664 | 65 | 131 | 156 | | | | mg/kg | 1 | Calc-As Recd |
| TPH (Ali & Aro >C5-C35)$_A$ | 730 | 132 | 234 | 227 | | | | mg/kg | 1 | Calc-As Recd |
| BTEX - Benzene$_A^{\#}$ | <0.01 | <0.01 | <0.01 | <0.01 | | | | mg/kg | 0.01 | A-T-022s |
| BTEX - Toluene$_A^{\#}$ | <0.01 | <0.01 | <0.01 | <0.01 | | | | mg/kg | 0.01 | A-T-022s |
| BTEX - Ethyl Benzene$_A^{\#}$ | <0.01 | <0.01 | <0.01 | <0.01 | | | | mg/kg | 0.01 | A-T-022s |
| BTEX - m & p Xylene$_A^{\#}$ | <0.01 | <0.01 | <0.01 | <0.01 | | | | mg/kg | 0.01 | A-T-022s |
| BTEX - o Xylene$_A^{\#}$ | <0.01 | <0.01 | <0.01 | <0.01 | | | | mg/kg | 0.01 | A-T-022s |
| MTBE$_A^{\#}$ | <0.01 | <0.01 | <0.01 | <0.01 | | | | mg/kg | 0.01 | A-T-022s |

## REPORT NOTES

**General**

This report shall not be reproduced, except in full, without written approval from Envirolab.
The results reported herein relate only to the material supplied to the laboratory.
The residue of any samples contained within this report, and any received with the same delivery, will be disposed of six weeks after initial scheduling. For samples tested for Asbestos we will retain a portion of the dried sample for a minimum of six months after the initial Asbestos testing is completed.
Analytical results reflect the quality of the sample at the time of analysis only.
Opinions and interpretations expressed are outside the scope of our accreditation.
If results are in italic font they are associated with an AQC failure, these are not accredited and are unreliable.
A deviating samples report is appended and will indicate if samples or tests have been found to be deviating. Any test results affected may not be an accurate record of the concentration at the time of sampling and, as a result, may be invalid.
The Client Sample No, Client Sample ID, Depth to Top, Depth to Bottom and Date Sampled were all provided by the client.

**Soil chemical analysis:**

All results are reported as dry weight (<40°C).
For samples with Matrix Codes 1 - 6 natural stones, brick and concrete fragments >10mm and any extraneous material (visible glass, metal or twigs) are removed and excluded from the sample prior to analysis and reported results corrected to a whole sample basis. This is reported as '% stones >10mm'.
For samples with Matrix Code 7 the whole sample is dried and crushed prior to analysis and this supersedes any “A” subscripts
All analysis is performed on the sample as received for soil samples which are positive for asbestos or the client has informed asbestos may be present and/or if they are from outside the European Union and this supersedes any "D" subscripts.

**TPH analysis of water by method A-T-007:**

Free and visible oils are excluded from the sample used for analysis so that the reported result represents the dissolved phase only.

**Electrical Conductivity of water by Method A-T-037:**

Results greater than 12900µS/cm @ 25°C / 11550µS/cm @ 20°C fall outside the calibration range and as such are unaccredited.

**Asbestos:**

Asbestos in soil analysis is performed on a dried aliquot of the submitted sample and cannot guarantee to identify asbestos if only present in small numbers as discrete fibres/fragments in the original sample.
Stones etc. are not removed from the sample prior to analysis.
Quantification of asbestos is a 3 stage process including visual identification, hand picking and weighing and fibre counting by sedimentation/phase contrast optical microscopy if required. If asbestos is identified as being present but is not in a form that is suitable for analysis by hand picking and weighing (normally if the asbestos is present as free fibres) quantification by sedimentation is performed. Where ACMs are found a percentage asbestos is assigned to each with reference to 'HSG264, Asbestos: The survey guide' and the calculated asbestos content is expressed as a percentage of the dried soil sample aliquot used.

**Predominant Matrix Codes:**

1 = SAND, 2 = LOAM, 3 = CLAY, 4 = LOAM/SAND, 5 = SAND/CLAY, 6 = CLAY/LOAM, 7 = OTHER, 8 = Asbestos bulk ID sample, 9 = INCINERATOR ASH.
Samples with Matrix Code 7 & 8 are not predominantly a SAND/LOAM/CLAY mix and are not covered by our BSEN 17025 or MCERTS accreditations, with the exception of bulk asbestos which are BSEN 17025 accredited.

**Secondary Matrix Codes:**

A = contains stones, B = contains construction rubble, C = contains visible hydrocarbons, D = contains glass/metal,
E = contains roots/twigs.

**Key:**

IS indicates Insufficient Sample for analysis.
US indicates Unsuitable Sample for analysis.
NDP indicates No Determination Possible.
NAD indicates No Asbestos Detected.
N/A indicates Not Applicable.
Superscript # indicates method accredited to ISO 17025.
Superscript "M" indicates method accredited to MCERTS.
Subscript "A" indicates analysis performed on the sample as received.
Subscript "D" indicates analysis performed on the dried sample, crushed to pass a 2mm sieve
Subscript "^" indicates analysis has dependant options against results. Testing dependant on results appear in the comments area of your sample receipt.
EPH CWG results have humics mathematically subtracted through instrument calculation
TPH results "with Cleanup" indicates results cleaned up with Silica during extraction

**EPH CWG GCxGC ID from TPH CWG**

Where we have identified humic substances in any ID's from TPH CWG with Clean Up please note that the concentration of these humic substances is not included in the quantified results and are included in the ID for information.

Please contact us if you need any further information.

v2

# Envirolab Deviating Samples Report

Units 7&8 Sandpits Business Park, Mottram Road, Hyde, SK14 3AR
Tel. 0161 368 4921 email. ask@envlab.co.uk

**Client:** Curtins Consulting (Manchester), Merchant Exchange, 17-19 Whitworth Street , Manchester, UK, M1 5WG

**Project:** P500 - Palgrave Avenue

**Clients Project No:** 077873.002

**Project No:** 22/07886

**Date Received:** 12/08/2022 (am)

**Cool Box Temperatures (°C):** 19.7

NO DEVIATIONS IDENTIFIED with respect to sampling dates or containers received.

Note: If, at any point before reaching the laboratory, the temperature of the samples has breached those set in published standards, e.g. BS-EN 5667-3 (for water samples 5 ± 3°C), ISO 18400-105:2017, then the concentration of any affected analytes may differ from that at the time of sampling.

# Envirolab Analysis Dates

| Lab Sample ID | 22/07886/1 | 22/07886/2 | 22/07886/3 | 22/07886/4 |
|---|---|---|---|---|
| Client Sample No | | | | |
| Client Sample ID/Depth | WS01 0.45m | WS02 0.50m | WS03 0.60m | WS04 0.40m |
| Date Sampled | 09/08/22 | 09/08/22 | 09/08/22 | 09/08/22 |
| A-T-019s | 18/08/2022 | 18/08/2022 | 18/08/2022 | 18/08/2022 |
| A-T-022s | 18/08/2022 | 18/08/2022 | 18/08/2022 | 18/08/2022 |
| A-T-024s | 18/08/2022 | 18/08/2022 | 18/08/2022 | 18/08/2022 |
| A-T-026s | 18/08/2022 | 18/08/2022 | 18/08/2022 | 18/08/2022 |
| A-T-027s | 17/08/2022 | 17/08/2022 | 17/08/2022 | 17/08/2022 |
| A-T-031s | 18/08/2022 | 18/08/2022 | 18/08/2022 | 18/08/2022 |
| A-T-032 OM | 17/08/2022 | 17/08/2022 | 17/08/2022 | 17/08/2022 |
| A-T-040s | 18/08/2022 | 18/08/2022 | 18/08/2022 | 18/08/2022 |
| A-T-042sTCN | 19/08/2022 | 19/08/2022 | 19/08/2022 | 19/08/2022 |
| A-T-044 | 17/08/2022 | 17/08/2022 | 17/08/2022 | 17/08/2022 |
| A-T-045 | 15/08/2022 | 15/08/2022 | 15/08/2022 | 15/08/2022 |
| A-T-050s | 16/08/2022 | 16/08/2022 | 16/08/2022 | 16/08/2022 |
| A-T-054 | 22/08/2022 | | | |
| A-T-055s | 18/08/2022 | 18/08/2022 | 18/08/2022 | 18/08/2022 |
| Calc-As Recd | 18/08/2022 | 18/08/2022 | 18/08/2022 | 18/08/2022 |

The above dates are the analysis completion dates, please note that these are not necessarily the date that the analysis was weighed/extracted.

**End of Report**

# Appendix A4 – Generic Assessment Criteria (GACs)

# Adopted Soil Generic Assessment Criteria
## Sandy loam with 6% SOM

curtins

| Contaminants | Residential with home grown produce | Residential without home grown produce | Allotments | Commercial | Public open space near residential housing $POS_{resi}$ | Public park $POS_{park}$ |
|---|---|---|---|---|---|---|
| ***Metals*** | | | | | | |
| Beryllium | *1.7* | *1.7* | *35* | *12* | *2.2* | *63* |
| Boron | *290* | *11,000* | *45* | *240,000* | *21,000* | *46,000* |
| Cadmium | **10**[13] 22 | **85**[13] 150 | **1.8** 3.9 | **230** 410 | *120* 220 | *560* 880 |
| Chromium III | *910* | *910* | *18,000* | *8,600* | *1,500* | *33,000* |
| Chromium VI | *6* 21 | *6* 21 | *1.8* 170 | *33* 49 | *7.7* 21 | *220* 250 |
| Lead | 200 | 310 | 80 | 2,300 | 630 | 1,300 |
| Mercury *(elemental)* | **1** | **1** | **26** | **26** | *16* | **26**[8] [*30*] |
| *Mercury (inorganic)* | **170** | **240** | **80** | **3600** | *120* | *240* |
| Nickel | *130*[10] | *180*[10] | *53*[11] | *980*[10] | *230* | *800* |
| Vanadium | *410* | *1200* | *91* | *9000* | *2000* | *5000* |
| Copper | *2400* | *7100* | *520* | *68000* | *12000* | *44000* |
| Zinc | *3700* | *40000* | *620* | *730000* | *81000* | *170000* |
| ***Semi-Metals and non-metals*** | | | | | | |
| Arsenic | **32**[12] 37 | **35**[12] 40 | **43**[12] 49 | **640**[12] 640 | *79* 79 | *170* 170 |
| Antimony | | ***550*** | | ***7500*** | ***1500*** | ***3300*** |
| Selenium | **350** | **600** | **120** | **13000** | *1100* | *1800* |
| ***Inorganic chemicals*** | | | | | | |
| Cyanide | 34 | 34 | 34 | 34 | 34 | 34 |
| ***Organic contaminants*** | | | | | | |
| *Aliphatic risk banded hydrocarbons - TPHCWG method* | | | | | | |
| $EC_{>5}$ - $EC_6$ | *160* | *160* | *3900* | *12000* | *600000* | *180000* |
| $EC_{>6}$ - $EC_8$ | *530* | *530* | *13000* | *40000* | *620000* | *320000* |
| $EC_{>8}$ - $EC_{10}$ | *150* | *150* | *1700* | *11000* | *13000* | *21000* |
| $EC_{10}$-$EC_{12}$ | *760* | *770* | *7300* | *47000* | *13000* | *24000* |
| $EC_{12}$-$EC_{16}$ | *4300* | *4400* | *13000* | *90000* | *13000* | *26000* |
| $EC_{>16}$ - $EC_{35}$ | *110000* | *110000* | *270000* | *1800000* | *250000* | *490000* |
| $EC>_{35}$ - $EC_{44}$ | *110000* | *110000* | *270000* | *1800000* | *250000* | *490000* |
| *Aromatic risk banded hydrocarbons - TPHCWG method* | | | | | | |
| $EC>_5$ - $EC_7$ | *300* | *1400* | *57* | *86000* | *56000* | *92000* |
| $EC>_7$ - $EC_8$ | *660* | *3900* | *120* | *180000* | *56000* | *100000* |
| $EC_{>8}$ - $EC_{10}$ | *190* | *270* | *51* | *17000* | *5000* | *9300* |
| $EC_{10}$ - $EC_{12}$ | *380* | *1200* | *74* | *34000* | *5000* | *10000* |
| $EC_{12}$ - $EC_{16}$ | *660* | *2500* | *130* | *38000* | *5000* | *10000* |
| $EC_{>16}$ - $EC_{21}$ | *930* | *1900* | *260* | *28000* | *3800* | *7800* |
| $EC_{>21}$ - $EC_{35}$ | *1700* | *1900* | *1600* | *28000* | *3800* | *7900* |
| $EC>_{35}$ - $EC_{44}$ | *1700* | *1900* | *1600* | *28000* | *3800* | *7900* |
| | | | | | | |
| Aliph + Arom EC >44-70 | *1900* | *1900* | *3000* | *28000* | 3800 | 7900 |
| *Aromatic* | | | | | | |
| Benzene | **0.33** 0.87 | **1.0** 3.3 | **0.07** 0.18 | **95** 98 | *73* 140 | *110* 230 |
| Ethyl benzene | **350** | **840** | **90** | **2800**[8] [66000] | **2800**[8] [*25000*] | **2800**[8] [*27000*] |
| Toluene | **610** | **2700** | **120** | **4400**[8] [190000] | **4400**[8] [*56000*] | **4400**[8] [*100000*] |
| Xylene[9] | **230** | **290** | **160** | **2600**[8] [32000] | **2600**[8] [*43000*] | **2600**[8] [*31000*] |
| Phenol | **420** | **520** | **280** | **3200**[14] (38000) | **3200**[14] (*10000*) | **3200**[14] (*9300*) |
| *Polycyclic Aromatic Hydrocarbons (PAH)* | | | | | | |
| Naphthalene | *13* | *13* | *24* | *1100* | *4900* | *3000* |
| Acenaphthylene | *920* | *6000* | *160* | *100000* | *15000* | *30000* |
| Acenaphthene | *1100* | *6000* | *200* | *100000* | *15000* | *30000* |
| Fluorene | *860* | *4500* | *160* | *71000* | *9900* | *20000* |
| Phenanthrene | *440* | *1500* | *90* | *23000* | *3100* | *6300* |
| Anthracene | *11000* | *37000* | *2200* | *540000* | *74000* | *150000* |
| Fluoranthene | *890* | *1600* | *290* | *23000* | *3100* | *6400* |
| Pyrene | *2000* | *3800* | *620* | *54000* | *7400* | *15000* |
| Benz(a)anthracene | *13* | *15* | *13* | *180* | *29* | *62* |
| Chrysene | *27* | *32* | *19* | *350* | *57* | *120* |
| Benzo(b)fluoranthene | *3.7* | *4.0* | *3.9* | *45* | *7.2* | *16.0* |
| Benzo(k)fluoranthene | *100* | *110* | *130* | *1200* | *190* | *440* |
| Benzo(a)pyrene | *3.0* 5.0 | *3.2* 5.3 | *3.5* 5.7 | *36* 77 | *5.7* 10 | *13* 21 |
| Indeno(123cd)pyrene | *41* | *46* | *39* | *510* | *82* | *180* |
| Dibenzo(ah)anthracene | *0.3* | *0.32* | *0.43* | *3.6* | *0.58* | *1.4* |
| Benzo(ghi)perylene | *350* | *360* | *640* | *4000* | *640* | *1600* |
| ***Chlorinated Aliphatic Hydrocarbons*** | | | | | | |
| Vinyl chloride | *0.0014* | *0.0015* | *0.0018* | *0.12* | *3.5* | *5.4* |
| Trichloroethene (TCE) | *0.075* | *0.08* | *0.21* | *5.7* | *120* | *120* |
| 1,1,1,2 Tetrachlorethane | *6.4* | *8.2* | *4.4* | *560* | *1400* | *2100* |
| Tetrachlorethene (PCE) | *0.90* | *0.92* | *3.6* | *95* | *1400* | *1500* |
| 1,1,1 Trichlorethane | *39* | *40* | *240* | *3000* | *140000* | *100000* |

**Notes**

1. All values above are in mg/kg
2. **Numbers in bold are SGVs or GAC that are derived based on SGV report input parameters**, *numbers in italics are S4ULs*, ***numbers in bold-italics are based on EIC/AGS/CL:AIRE numbers & input parameters*** and underlined numbers are C4SLs
3. Soil organic matter (SOM) is assumed to be 6% - DEFAULT VALUE
4. Soil type is assumed to be sandy loam - DEFAULT SOIL TYPE
5. For residential, the building type is conservatively assumed to be a small terrace house where the development includes bungalows change to more conservative bungalow setting in computer model
6. For commercial, the building type is conservatively assumed to be a pre 1970s office building, where the proposed development comprises houses, flat with living spaces changes setting in model accordingly
7. For classrooms consider increasing the dust loading fator in the 'Soil and Building Data' of the CLEA 1.04 model from 50 to 100µg $m^{-3}$
8. Based on vapour saturation limt as suggested by EA / [ ] model value
9. Lowest of o-, m- and p-xylene
10. Based on comparison of inhalation exposure with inhalation TDI
11. Based on comparison of oral, dermal, and inhalation exposure with the oral TDI
12. Based on a comparison of oral and dermal soil exposure with oral Index Dose only
13. Averaged over and based on lifetime exposure
14. Based on critical concentration for skin irritation in humans arising from contact with phenol in aqueous solution (number in brackets based on health effects following long term exposure for illustration)
15. NA: Not applicable

# Adopted Soil Generic Assessment Criteria
## Sandy loam with 2.5% SOM

curtins

| Contaminants | Residential with home grown produce | Residential without home grown produce | Allotments | Commercial | Public open space near residential housing $POS_{resi}$ | Public park $POS_{park}$ |
|---|---|---|---|---|---|---|
| ***Metals*** | | | | | | |
| Beryllium | *1.7* | *1.7* | *35* | *12* | *2.2* | *63* |
| Boron | *290* | *11,000* | *45* | *240,000* | *21,000* | *46,000* |
| Cadmium | **10**[13] 22 | **85**[13] 150 | **1.8** 3.9 | **230** 410 | *120* 220 | *560* 880 |
| Chromium III | *910* | *910* | *18,000* | *8,600* | *1,500* | *33,000* |
| Chromium VI | *6* 21 | *6* 21 | *1.8* 170 | *33* 49 | *7.7* 21 | *220* 250 |
| Lead | 200 | 310 | 80 | 2,300 | 630 | 1,300 |
| Mercury *(elemental)* | **1** | **1** | **26** | **26** | *16* | **26**[8] [*30*] |
| *Mercury (inorganic)* | **170** | **240** | **80** | **3600** | *120* | *240* |
| Nickel | *130*[10] | *180*[10] | *53*[11] | *980*[10] | *230* | *800* |
| Vanadium | *410* | *1200* | *91* | *9000* | *2000* | *5000* |
| Copper | *2400* | *7100* | *520* | *68000* | *12000* | *44000* |
| Zinc | *3700* | *40000* | *620* | *730000* | *81000* | *170000* |
| ***Semi-Metals and non-metals*** | | | | | | |
| Arsenic | **32**[12] 37 | **35**[12] 40 | **43**[12] 49 | **640**[12] 640 | *79* 79 | *170* 170 |
| Antimony | | ***550*** | | ***7500*** | ***1500*** | ***3300*** |
| Selenium | **350** | **600** | **120** | **13000** | *1100* | *1800* |
| ***Inorganic chemicals*** | | | | | | |
| Cyanide | 34 | 34 | 34 | 34 | 34 | 34 |
| ***Organic contaminants*** | | | | | | |
| *Aliphatic risk banded hydrocarbons - TPHCWG method* | | | | | | |
| $EC_{>5}$ - $EC_6$ | *78* | *78* | *1700* | *5900* | *590000* | *130000* |
| $EC_{>6}$ - $EC_8$ | *230* | *230* | *5600* | *17000* | *610000* | *220000* |
| $EC_{>8}$ - $EC_{10}$ | *65* | *65* | *770* | *4800* | *13000* | *18000* |
| $EC_{10}$-$EC_{12}$ | *330* | *330* | *4400* | *23000* | *13000* | *23000* |
| $EC_{12}$-$EC_{16}$ | *2400* | *2400* | *13000* | *82000* | *13000* | *25000* |
| $EC_{>16}$ - $EC_{35}$ | *92000* | *92000* | *270000* | *1700000* | *250000* | *480000* |
| $EC>_{35}$ - $EC_{44}$ | *92000* | *92000* | *270000* | *1700000* | *250000* | *480000* |
| *Aromatic risk banded hydrocarbons - TPHCWG method* | | | | | | |
| $EC>_5$ - $EC_7$ | *140* | *690* | *27* | *46000* | *56000* | *84000* |
| $EC>_7$ - $EC_8$ | *290* | *1800* | *51* | *110000* | *56000* | *95000* |
| $EC_{>8}$ - $EC_{10}$ | *83* | *110* | *21* | *8100* | *5000* | *8500* |
| $EC_{10}$ - $EC_{12}$ | *180* | *590* | *31* | *28000* | *5000* | *9700* |
| $EC_{12}$ - $EC_{16}$ | *330* | *2300* | *57* | *37000* | *5100* | *10000* |
| $EC_{>16}$ - $EC_{21}$ | *540* | *1900* | *110* | *28000* | *3800* | *7700* |
| $EC_{>21}$ - $EC_{35}$ | *1500* | *1900* | *820* | *28000* | *3800* | *7800* |
| $EC>_{35}$ - $EC_{44}$ | *1500* | *1900* | *820* | *28000* | *3800* | *7800* |
| | | | | | | |
| Aliph + Arom EC >44-70 | *1800* | *1900* | *2100* | *28000* | 3800 | 7800 |
| *Aromatic* | | | | | | |
| Benzene | **0.16** | **0.49** | **0.035** | **50** | *72* | *100* |
| Ethyl benzene | **150** | **380** | **39** | **1200**[8] [35000] | **1200**[8] [*24000*] | **1200**[8] [*22000*] |
| Toluene | **270** | **1300** | **51** | **1900**[8] [110000] | **1900**[8] [*56000*] | **1900**[8] [*95000*] |
| Xylene[9] | **98** | **120** | **70** | **1200**[8] [14000] | **1200**[8] [*42000*] | **1200**[8] [*23000*] |
| Phenol | **290** | **420** | **140** | **1500**[14] (35000) | **1500**[14] (*10000*) | **1500**[14] (*8300*) |
| *Polycyclic Aromatic Hydrocarbons (PAH)* | | | | | | |
| Naphthalene | *5.6* | *5.6* | *10* | *460* | *4900* | *1900* |
| Acenaphthylene | *420* | *4600* | *69* | *97000* | *15000* | *30000* |
| Acenaphthene | *510* | *4700* | *85* | *97000* | *15000* | *30000* |
| Fluorene | *400* | *3800* | *67* | *68000* | *9900* | *20000* |
| Phenanthrene | *220* | *1500* | *38* | *22000* | *3100* | *6200* |
| Anthracene | *5400* | *35000* | *950* | *540000* | *74000* | *150000* |
| Fluoranthene | *560* | *1600* | *130* | *23000* | *3100* | *6300* |
| Pyrene | *1200* | *3800* | *270* | *54000* | *7400* | *15000* |
| Benz(a)anthracene | *11* | *14* | *6.5* | *170* | *29* | *56* |
| Chrysene | *22* | *31* | *9.4* | *350* | *57* | *110* |
| Benzo(b)fluoranthene | *3.3* | *4.0* | *2.1* | *44* | *7.2* | *15* |
| Benzo(k)fluoranthene | *93* | *110* | *75* | *1200* | *190* | *410* |
| Benzo(a)pyrene | *2.7* | *3.2* | *2* | *35* | *5.7* | *12* |
| Indeno(123cd)pyrene | *36* | *46* | *21* | *510* | *82* | *170* |
| Dibenzo(ah)anthracene | *0.28* | *0.32* | *0.27* | *3.6* | *0.57* | *1.3* |
| Benzo(ghi)perylene | *340* | *360* | *470* | *4000* | *640* | *1500* |
| ***Chlorinated Aliphatic Hydrocarbons*** | | | | | | |
| Vinyl chloride | *0.00087* | *0.001* | *0.001* | *0.077* | *3.5* | *5* |
| Trichloroethene (TCE) | *0.034* | *0.036* | *0.091* | *2.6* | *120* | *91* |
| 1,1,1,2 Tetrachlorethane | *2.8* | *3.5* | *1.9* | *250* | *1400* | *1800* |
| Tetrachlorethene (PCE) | *0.39* | *0.4* | *1.5* | *42* | *1400* | *1100* |
| 1,1,1 Trichlorethane | *18* | *18* | *110* | *1300* | *140000* | *76000* |

**Notes**

1. All values above are in mg/kg
2. **Numbers in bold are SGVs or GAC that are derived based on SGV report input parameters**, *numbers in italics are S4ULs*, ***numbers in bold-italics are based on EIC/AGS/CL:AIRE numbers & input parameters*** and underlined numbers are C4SLs
3. Soil organic matter (SOM) is assumed to be 2.5% - DEFAULT VALUE
4. Soil type is assumed to be sandy loam - DEFAULT SOIL TYPE
5. For residential, the building type is conservatively assumed to be a small terrace house where the development includes bungalows change to more conservative bungalow setting in computer model
6. For commercial, the building type is conservatively assumed to be a pre 1970s office building, where the proposed development comprises houses, flat with living spaces changes setting in model accordingly
7. For classrooms consider increasing the dust loading fator in the 'Soil and Building Data' of the CLEA 1.04 model from 50 to 100µg $m^{-3}$
8. Based on vapour saturation limt as suggested by EA / [ ] model value
9. Lowest of o-, m- and p-xylene
10. Based on comparison of inhalation exposure with inhalation TDI
11. Based on comparison of oral, dermal, and inhalation exposure with the oral TDI
12. Based on a comparison of oral and dermal soil exposure with oral Index Dose only
13. Averaged over and based on lifetime exposure
14. Based on critical concentration for skin irritation in humans arising from contact with phenol in aqueous solution (number in brackets based on health effects following long term exposure for illustration)
15. NA: Not applicable

# Adopted Soil Generic Assessment Criteria
## Sandy loam with 1% SOM

curtins

| Contaminants | Residential with home grown produce | Residential without home grown produce | Allotments | Commercial | Public open space near residential housing $POS_{resi}$ | Public park $POS_{park}$ |
|---|---|---|---|---|---|---|
| ***Metals*** | | | | | | |
| Beryllium | *1.7* | *1.7* | *35* | *12* | *2.2* | *63* |
| Boron | *290* | *11,000* | *45* | *240,000* | *21,000* | *46,000* |
| Cadmium | **10**[13] 22 | **85**[13] 150 | **1.8** 3.9 | **230** 410 | *120* 220 | *560* 880 |
| Chromium III | *910* | *910* | *18,000* | *8,600* | *1,500* | *33,000* |
| Chromium VI | *6* 21 | *6* 21 | *1.8* 170 | *33* 49 | *7.7* 21 | *220* 250 |
| Lead | 200 | 310 | 80 | 2,300 | 630 | 1,300 |
| Mercury *(elemental)* | **1** | **1** | **26** | **26** | *16* | **26**[8] *[30]* |
| *Mercury (inorganic)* | **170** | **240** | **80** | **3600** | *120* | *240* |
| Nickel | *130*[10] | *180*[10] | *53*[11] | *980*[10] | *230* | *800* |
| Vanadium | *410* | *1200* | *91* | *9000* | *2000* | *5000* |
| Copper | *2400* | *7100* | *520* | *68000* | *12000* | *44000* |
| Zinc | *3700* | *40000* | *620* | *730000* | *81000* | *170000* |
| ***Semi-Metals and non-metals*** | | | | | | |
| Arsenic | **32**[12] 37 | **35**[12] 40 | **43**[12] 49 | **640**[12] 640 | *79* 79 | *170* 170 |
| Antimony | | ***550*** | | ***7500*** | ***1500*** | ***3300*** |
| Selenium | **350** | **600** | **120** | **13000** | *1100* | *1800* |
| ***Inorganic chemicals*** | | | | | | |
| Cyanide | 34 | 34 | 34 | 34 | 34 | 34 |
| ***Organic contaminants*** | | | | | | |
| *Aliphatic risk banded hydrocarbons - TPHCWG method* | | | | | | |
| $EC_{>5}$ - $EC_6$ | *42* | *42* | *730* | *3200* | *570000* | *95000* |
| $EC_{>6}$ - $EC_8$ | *100* | *100* | *2300* | *7800* | *600000* | *150000* |
| $EC_{>8}$ - $EC_{10}$ | *27* | *27* | *320* | *2000* | *13000* | *14000* |
| $EC_{10}$-$EC_{12}$ | *130* | *130* | *2200* | *9700* | *13000* | *21000* |
| $EC_{12}$-$EC_{16}$ | *1100* | *1100* | *11000* | *59000* | *13000* | *25000* |
| $EC_{>16}$ - $EC_{35}$ | *65000* | *65000* | *260000* | *1600000* | *250000* | *450000* |
| $EC>_{35}$ - $EC_{44}$ | *65000* | *65000* | *260000* | *1600000* | *250000* | *450000* |
| *Aromatic risk banded hydrocarbons - TPHCWG method* | | | | | | |
| $EC>_5$ - $EC_7$ | *70* | *370* | *13* | *26000* | *56000* | *76000* |
| $EC>_7$ - $EC_8$ | *130* | *860* | *22* | *56000* | *56000* | *87000* |
| $EC_{>8}$ - $EC_{10}$ | *34* | *47* | *8.6* | *3500* | *5000* | *7200* |
| $EC_{10}$ - $EC_{12}$ | *74* | *250* | *13* | *16000* | *5000* | *9200* |
| $EC_{12}$ - $EC_{16}$ | *140* | *1800* | *23* | *36000* | *5100* | *10000* |
| $EC_{>16}$ - $EC_{21}$ | *260* | *1900* | *46* | *28000* | *3800* | *7600* |
| $EC_{>21}$ - $EC_{35}$ | *1100* | *1900* | *370* | *28000* | *3800* | *7800* |
| $EC>_{35}$ - $EC_{44}$ | *1100* | *1900* | *370* | *28000* | *3800* | *7800* |
| | | | | | | |
| Aliph + Arom EC >44-70 | *1600* | *1900* | *1200* | *28000* | 3800 | 7800 |
| *Aromatic* | | | | | | |
| Benzene | **0.08** | **0.3** | **0.017** | **28** | *72* | *90* |
| Ethyl benzene | **65** | **170** | **16** | **520**[8] [17000] | **520**[8] *[24000]* | **520**[8] *[17000]* |
| Toluene | **120** | **610** | **22** | **860**[8] [59000] | **860**[8] *[56000]* | **860**[8] *[87000]* |
| Xylene[9] | **41** | **53** | **28** | **480**[8] [69000] | **480**[8] *[41000]* | **480**[8] *[17000]* |
| Phenol | **180** | **310** | **66** | **760**[14] (31000) | **760**[14] *(10000)* | **760**[14] *(7600)* |
| *Polycyclic Aromatic Hydrocarbons (PAH)* | | | | | | |
| Naphthalene | *2.3* | *2.3* | *4.1* | *190* | *4900* | *1200* |
| Acenaphthylene | *170* | *2900* | *28* | *83000* | *15000* | *29000* |
| Acenaphthene | *210* | *3000* | *34* | *84000* | *15000* | *29000* |
| Fluorene | *170* | *2800* | *27* | *63000* | *9900* | *20000* |
| Phenanthrene | *95* | *1300* | *15* | *22000* | *3100* | *6200* |
| Anthracene | *2400* | *31000* | *380* | *520000* | *74000* | *150000* |
| Fluoranthene | *280* | *1500* | *52* | *23000* | *3100* | *6300* |
| Pyrene | *620* | *3700* | *110* | *54000* | *7400* | *15000* |
| Benz(a)anthracene | *7.2* | *11* | *2.9* | *170* | *29* | *49* |
| Chrysene | *15* | *30* | *4.1* | *350* | *57* | *93* |
| Benzo(b)fluoranthene | *2.6* | *3.9* | *0.99* | *44* | *7.1* | *13* |
| Benzo(k)fluoranthene | *77* | *110* | *37* | *1200* | *190* | *370* |
| Benzo(a)pyrene | *2.2* | *3.2* | *0.97* | *35* | *5.7* | *11* |
| Indeno(123cd)pyrene | *27* | *45* | *9.5* | *500* | *82* | *150* |
| Dibenzo(ah)anthracene | *0.24* | *0.31* | *0.14* | *3.5* | *0.57* | *1.1* |
| Benzo(ghi)perylene | *320* | *360* | *290* | *3900* | *640* | *1400* |
| ***Chlorinated Aliphatic Hydrocarbons*** | | | | | | |
| Vinyl chloride | *0.00064* | *0.00077* | *0.00055* | *0.059* | *3.5* | *4.8* |
| Trichloroethene (TCE) | *0.016* | *0.017* | *0.041* | *1.2* | *120* | *70* |
| 1,1,1,2 Tetrachlorethane | *1.2* | *1.5* | *0.79* | *110* | *1400* | *1500* |
| Tetrachlorethene (PCE) | *0.18* | *0.18* | *0.65* | *19* | *1400* | *810* |
| 1,1,1 Trichlorethane | *8.8* | *9* | *48* | *660* | *140000* | *57000* |

**Notes**

1. All values above are in mg/kg
2. **Numbers in bold are SGVs or GAC that are derived based on SGV report input parameters**, *numbers in italics are S4ULs*, ***numbers in bold-italics are based on EIC/AGS/CL:AIRE numbers & input parameters*** and underlined numbers are C4SLs
3. Soil organic matter (SOM) is assumed to be 1% - DEFAULT VALUE
4. Soil type is assumed to be sandy loam - DEFAULT SOIL TYPE
5. For residential, the building type is conservatively assumed to be a small terrace house where the development includes bungalows change to more conservative bungalow setting in computer model
6. For commercial, the building type is conservatively assumed to be a pre 1970s office building, where the proposed development comprises houses, flat with living spaces changes setting in model accordingly
7. For classrooms consider increasing the dust loading fator in the 'Soil and Building Data' of the CLEA 1.04 model from 50 to 100µg $m^{-3}$
8. Based on vapour saturation limt as suggested by EA / [ ] model value
9. Lowest of o-, m- and p-xylene
10. Based on comparison of inhalation exposure with inhalation TDI
11. Based on comparison of oral, dermal, and inhalation exposure with the oral TDI
12. Based on a comparison of oral and dermal soil exposure with oral Index Dose only
13. Averaged over and based on lifetime exposure
14. Based on critical concentration for skin irritation in humans arising from contact with phenol in aqueous solution (number in brackets based on health effects following long term exposure for illustration)
15. NA: Not applicable

# Appendix A5 – Geotechnical Laboratory Testing Results

**Jonathan Lord**
Curtins
17-19 Whitworth Street West
Manchester
M1 5WG

**e:** jonathan.lord@curtins.com

i2 Analytical Ltd.
7 Woodshots Meadow,
Croxley Green
Business Park,
Watford,
Herts,
WD18 8YS

**t:** 01923 225404
**f:** 01923 237404
**e:** reception@i2analytical.com

# Analytical Report Number : 22-80528

| | | | |
|---|---|---|---|
| **Project / Site name:** | P500 Palgrave Avenue | **Samples received on:** | 22/08/2022 |
| **Your job number:** | B077873 | **Samples instructed on/ Analysis started on:** | 26/08/2022 |
| **Your order number:** | EBMA 3525 | **Analysis completed by:** | 08/09/2022 |
| **Report Issue Number:** | 1 | **Report issued on:** | 09/09/2022 |
| **Samples Analysed:** | 3 soil samples | | |

**Signed:**

Joanna Wawrzeczko
Reporting Specialist
**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 |

Excel copies of reports are only valid when accompanied by this PDF certificate.

Any assessments of compliance with specifications are based on actual analytical results with no contribution from uncertainty of measurement.
Application of uncertainty of measurement would provide a range within which the true result lies.
An estimate of measurement uncertainty can be provided on request.

This certificate should not be reproduced, except in full, without the express permission of the laboratory.
The results included within the report are representative of the samples submitted for analysis.

**Analytical Report Number: 22-80528**
**Project / Site name: P500 Palgrave Avenue**
**Your Order No: EBMA 3525**

| **Lab Sample Number** | | | | 2404129 | 2404130 | 2404131 |
|---|---|---|---|---|---|---|
| **Sample Reference** | | | | WS01 | WS02 | WS04 |
| **Sample Number** | | | | None Supplied | None Supplied | None Supplied |
| **Depth (m)** | | | | 1.50 | 3.50 | 2.00 |
| **Date Sampled** | | | | 09/08/2022 | 09/08/2022 | 09/08/2022 |
| **Time Taken** | | | | 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 |
| Moisture Content | % | 0.01 | NONE | 13 | 13 | 12 |
| Total mass of sample received | kg | 0.001 | NONE | 0.4 | 0.4 | 0.4 |
| **General Inorganics** | | | | | | |
| pH - Automated | pH Units | N/A | MCERTS | 7.5 | 8.5 | 8.4 |
| Total Sulphate as SO4 | % | 0.005 | MCERTS | 0.031 | 0.056 | 0.024 |
| Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent) | g/l | 0.00125 | MCERTS | 0.05 | 0.17 | 0.056 |
| Water Soluble Chloride (2:1) (leachate equivalent) | mg/l | 0.5 | MCERTS | 1.6 | 15 | 6.7 |
| Total Sulphur | % | 0.005 | MCERTS | 0.017 | 0.023 | 0.012 |
| Water Soluble Nitrate (2:1) as N (leachate equivalent) | mg/l | 2 | NONE | < 2.0 | < 2.0 | < 2.0 |
| **Heavy Metals / Metalloids** | | | | | | |
| Magnesium (water soluble) | mg/kg | 5 | NONE | 18 | 52 | 18 |
| Magnesium (leachate equivalent) | mg/l | 2.5 | NONE | 8.8 | 26 | 9.2 |

U/S = Unsuitable Sample  I/S = Insufficient Sample

This certificate should not be reproduced, except in full, without the express permission of the laboratory.
The results included within the report relate only to the sample(s) submitted for testing.

**Analytical Report Number : 22-80528**
**Project / Site name: P500 Palgrave Avenue**

* 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 * |
|---|---|---|---|---|
| 2404129 | WS01 | None Supplied | 1.5 | Brown clay and loam. |
| 2404130 | WS02 | None Supplied | 3.5 | Brown clay and loam. |
| 2404131 | WS04 | None Supplied | 2 | Brown clay and loam. |

**Analytical Report Number : 22-80528**
**Project / Site name: P500 Palgrave Avenue**

**Water matrix abbreviations:**
**Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters (PrW) Final Sewage Effluent (FSE) Landfill Leachate (LL)**

| Analytical Test Name | Analytical Method Description | Analytical Method Reference | Method number | Wet / Dry Analysis | Accreditation Status |
|---|---|---|---|---|---|
| Sulphate, water soluble, in soil (16hr extraction) | Determination of water soluble sulphate by ICP-OES. Results reported directly (leachate equivalent) and corrected for extraction ratio (soil equivalent). | In house method. | L038-PL | D | MCERTS |
| Magnesium, water soluble, in soil | Determination of water soluble magnesium by extraction with water followed by ICP-OES. | In-house method based on TRL 447 | L038-PL | D | NONE |
| Moisture Content | Moisture content, determined gravimetrically. (30 oC) | In house method. | L019-UK/PL | W | NONE |
| pH in soil (automated) | Determination of pH in soil by addition of water followed by automated electrometric measurement. | In house method. | L099-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 |
| Total Sulphate in soil as % | Determination of total sulphate in soil by extraction with 10% HCl followed by ICP-OES. | In house method. | L038-PL | D | MCERTS |
| Total Sulphur in soil as % | Determination of total sulphur in soil by extraction with aqua-regia, potassium bromide/bromate followed by ICP-OES. | In house method. | L038-PL | D | MCERTS |
| Water Soluble Nitrate (2:1) as N in soil | Determination of nitrate by reaction with sodium salicylate and colorimetry. | In-house method based on Examination of Water and Wastewatern & Polish Standard Method PN-82/C-04579.08, 2:1 extraction. | L078-PL | W | NONE |
| Chloride, water soluble, in soil | Determination of Chloride colorimetrically by discrete analyser. | In house method. | L082-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.**

**Unless otherwise indicated, site information, order number, project number, sampling date, time, sample reference and depth are provided by the client. The instructed on date indicates the date on which this information was provided to the laboratory.**

# TEST CERTIFICATE

**DETERMINATION OF LIQUID AND PLASTIC LIMITS**
Tested in Accordance with:BS 1377-2:1990:Clause 4.3 and 5

i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB

UKAS TESTING 4041

Environmental Science

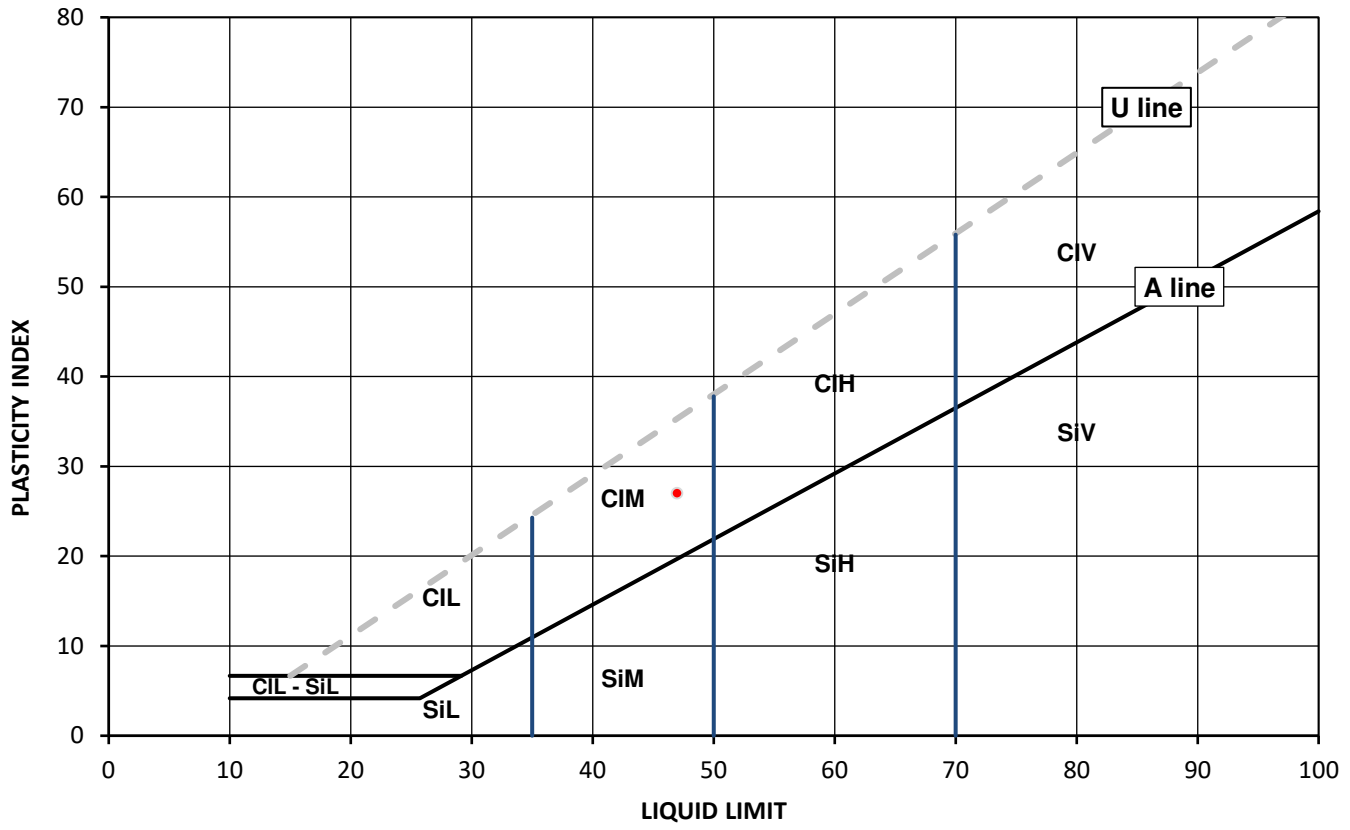
| | | | |
|---|---|---|---|
| Client: | Curtins | Client Reference: | B077873 |
| Client Address: | 17-19 Whitworth Street West, Manchester, M1 5WG | Job Number: | 22-80527 |
| | | Date Sampled: | 09/08/2022 |
| | | Date Received: | 22/08/2022 |
| Contact: | Jonathan Lord | Date Tested: | 05/09/2022 |
| Site Address: | P500 Palgrave Avenue | Sampled By: | Not Given |

*Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland*

**Test Results:**

| | | | |
|---|---|---|---|
| Laboratory Reference: | 2404126 | Depth Top [m]: | 1.50 |
| Hole No.: | WS01 | Depth Base [m]: | Not Given |
| Sample Reference: | Not Given | Sample Type: | D |
| Sample Description: | Brownish grey slightly sandy CLAY | | |
| Sample Preparation: | Tested in natural condition | | |

| As Received Water Content [ W ] % | Liquid Limit [ WL ] % | Plastic Limit [ Wp ] % | Plasticity Index [ Ip ] % | % Passing 425µm BS Test Sieve |
|---|---|---|---|---|
| 17 | 47 | 20 | 27 | 100 |




Legend, based on BS EN ISO 14688 2:2018 Geotechnical investigation and testing – Identification and classification of soil

| | | Plasticity | | Liquid Limit |
|---|---|---|---|---|
| Cl | Clay | L | Low | below 35 |
| Si | Silt | M | Medium | 35 to 50 |
| | | H | High | 50 to 70 |
| | | V | Very high | exceeding 70 |
| | | O | Organic | append to classification for organic material ( eg ClHO ) |

Note: Water Content by BS 1377-2: 1990: Clause 3.2

Remarks:

Opinions and interpretations expressed herein are outside of the scope of the UKAS Accreditation. This report may not be reproduced other than in full without the prior written approval of the issuing laboratory. The results included within the report relate only to the sample(s) submitted for testing.

**Signed:** Monika Siewior

Monika Siewior
Reporting Specialist
**for and on behalf of i2 Analytical Ltd**



**Date Reported:** 12/09/2022

**GF 236.12**

# TEST CERTIFICATE

**DETERMINATION OF LIQUID AND PLASTIC LIMITS**
Tested in Accordance with:BS 1377-2:1990:Clause 4.3 and 5

i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB

UKAS TESTING 4041

Environmental Science

| | | | |
|---|---|---|---|
| Client: | Curtins | Client Reference: | B077873 |
| Client Address: | 17-19 Whitworth Street West, Manchester, M1 5WG | Job Number: | 22-80527 |
| | | Date Sampled: | 09/08/2022 |
| | | Date Received: | 22/08/2022 |
| Contact: | Jonathan Lord | Date Tested: | 05/09/2022 |
| Site Address: | P500 Palgrave Avenue | Sampled By: | Not Given |

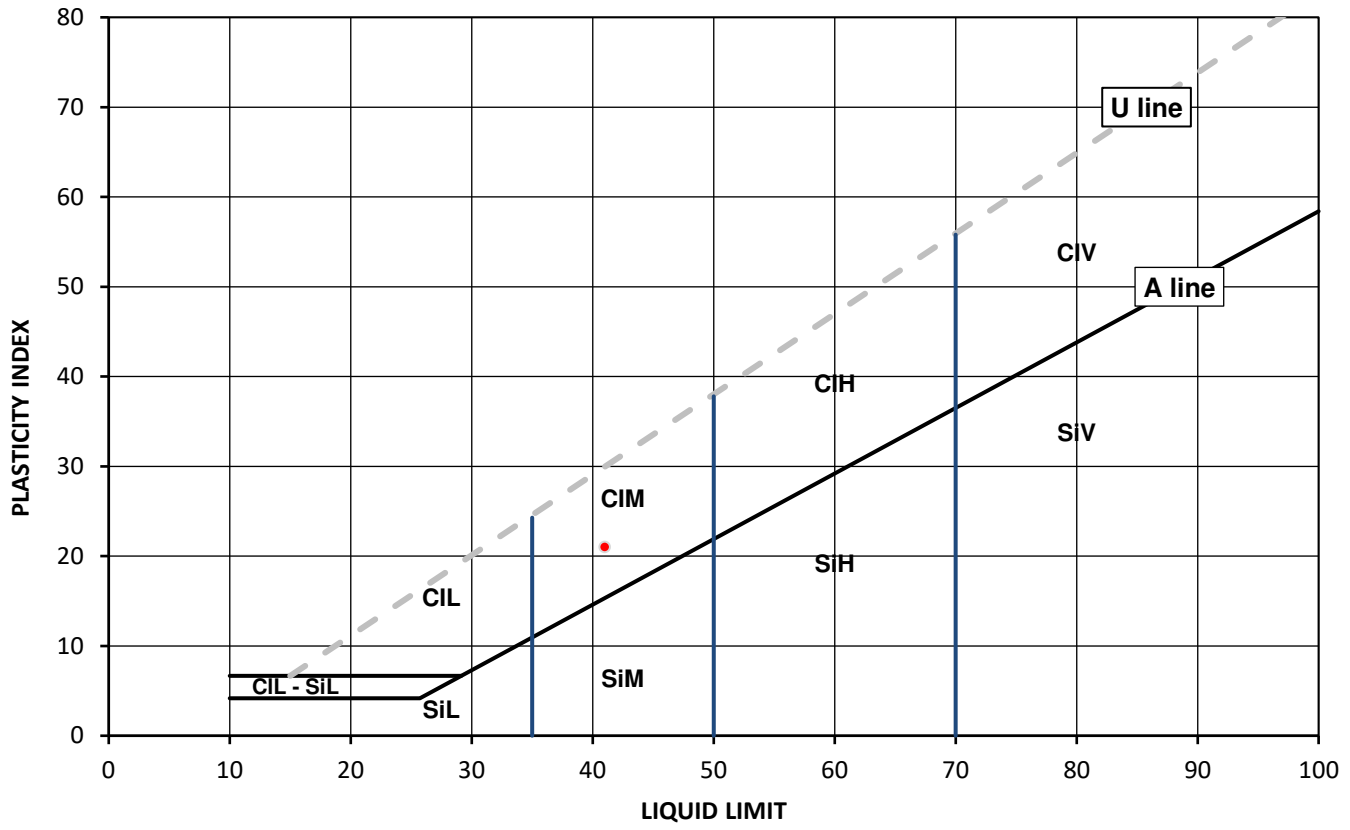
*Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland*

**Test Results:**

| | | | |
|---|---|---|---|
| Laboratory Reference: | 2404127 | Depth Top [m]: | 3.50 |
| Hole No.: | WS02 | Depth Base [m]: | Not Given |
| Sample Reference: | Not Given | Sample Type: | D |
| Sample Description: | Brown sandy CLAY | | |

Sample Preparation: Tested in natural condition

| As Received Water Content [ W ] % | Liquid Limit [ WL ] % | Plastic Limit [ Wp ] % | Plasticity Index [ Ip ] % | % Passing 425µm BS Test Sieve |
|---|---|---|---|---|
| 19 | 41 | 20 | 21 | 100 |




Legend, based on BS EN ISO 14688 2:2018 Geotechnical investigation and testing – Identification and classification of soil

| | | Plasticity | | Liquid Limit |
|---|---|---|---|---|
| Cl | Clay | L | Low | below 35 |
| Si | Silt | M | Medium | 35 to 50 |
| | | H | High | 50 to 70 |
| | | V | Very high | exceeding 70 |
| | | O | Organic | append to classification for organic material ( eg ClHO ) |

Note: Water Content by BS 1377-2: 1990: Clause 3.2

Remarks:

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**Signed:** Monika Siewior

Monika Siewior
Reporting Specialist
**for and on behalf of i2 Analytical Ltd**



**Date Reported:** 12/09/2022

**GF 236.12**

# TEST CERTIFICATE

**DETERMINATION OF LIQUID AND PLASTIC LIMITS**
Tested in Accordance with:BS 1377-2:1990:Clause 4.3 and 5

i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB

UKAS TESTING 4041

Environmental Science

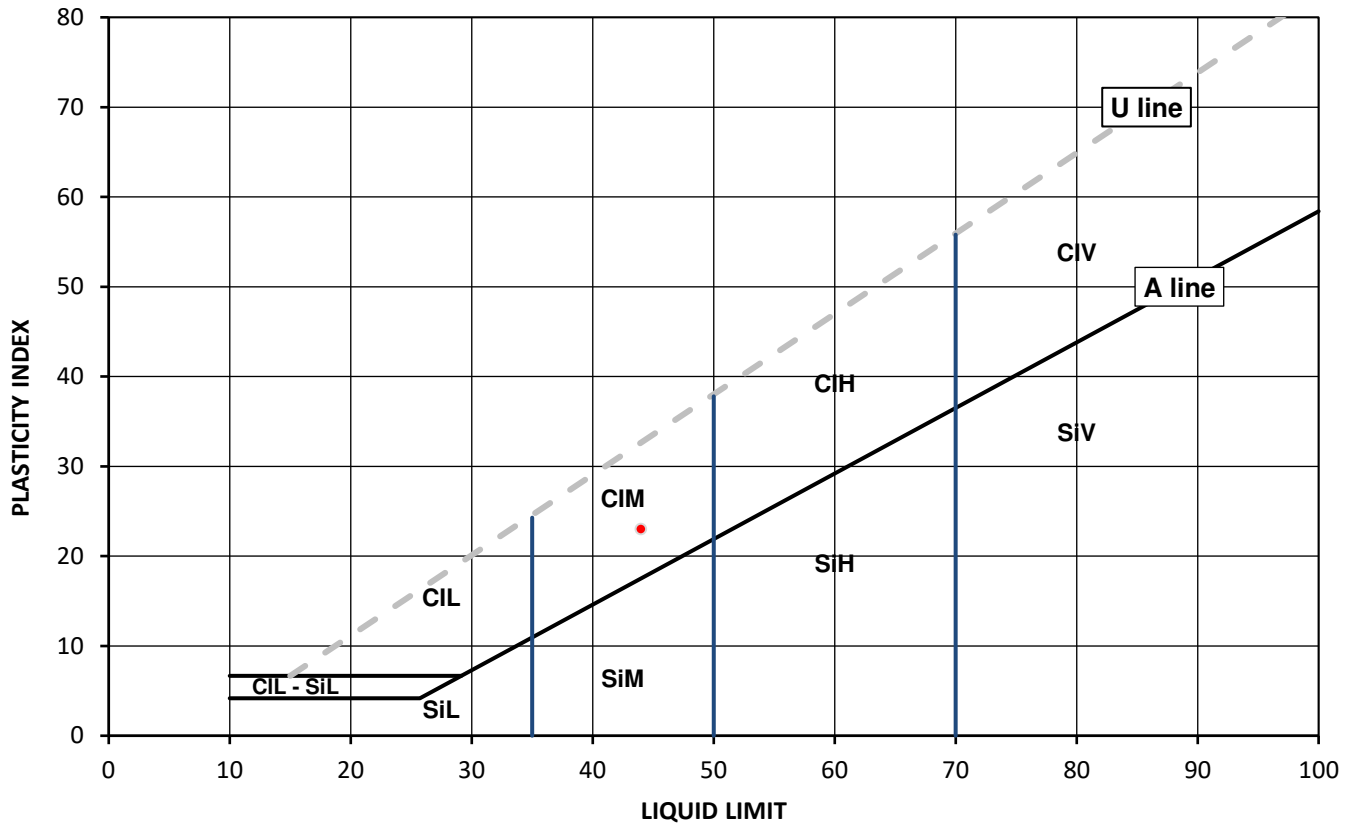
| | | | |
|---|---|---|---|
| Client: | Curtins | Client Reference: | B077873 |
| Client Address: | 17-19 Whitworth Street West, Manchester, M1 5WG | Job Number: | 22-80527 |
| | | Date Sampled: | 09/08/2022 |
| | | Date Received: | 22/08/2022 |
| Contact: | Jonathan Lord | Date Tested: | 05/09/2022 |
| Site Address: | P500 Palgrave Avenue | Sampled By: | Not Given |

*Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland*

**Test Results:**

| | | | |
|---|---|---|---|
| Laboratory Reference: | 2404128 | Depth Top [m]: | 2.00 |
| Hole No.: | WS04 | Depth Base [m]: | Not Given |
| Sample Reference: | Not Given | Sample Type: | D |
| Sample Description: | Brownish grey slightly gravelly sandy CLAY | | |
| Sample Preparation: | Tested after >425um removed by hand | | |

| As Received Water Content [ W ] % | Liquid Limit [ WL ] % | Plastic Limit [ Wp ] % | Plasticity Index [ Ip ] % | % Passing 425µm BS Test Sieve |
|---|---|---|---|---|
| 17 | 44 | 21 | 23 | 99 |




Legend, based on BS EN ISO 14688 2:2018 Geotechnical investigation and testing – Identification and classification of soil

| | | Plasticity | | Liquid Limit |
|---|---|---|---|---|
| Cl | Clay | L | Low | below 35 |
| Si | Silt | M | Medium | 35 to 50 |
| | | H | High | 50 to 70 |
| | | V | Very high | exceeding 70 |
| | | O | Organic | append to classification for organic material ( eg ClHO ) |

Note: Water Content by BS 1377-2: 1990: Clause 3.2

Remarks:

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**Signed:** Monika Siewior

Monika Siewior
Reporting Specialist
**for and on behalf of i2 Analytical Ltd**



**Date Reported:** 12/09/2022

**GF 236.12**

# SUMMARY REPORT

## SUMMARY OF CLASSIFICATION TEST RESULTS

Tested in Accordance with:

Water Content by BS 1377-2:1990: Clause 3.2; Atterberg by BS 1377-2: 1990: Clause 4.3 (4 Point Test), Clause 4.4 (1 Point Test) and 5; PD by BS 1377-2: 1990: Clause 8.2

i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB

4041

Client: Curtins

Client Address: 17-19 Whitworth Street West, Manchester, M1 5WG

Contact: Jonathan Lord

Site Address: P500 Palgrave Avenue

Client Reference: B077873
Job Number: 22-80527
Date Sampled: 09/08/2022
Date Received: 22/08/2022
Date Tested: 05/09/2022
Sampled By: Not Given

*Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland*

### Test results

| Laboratory Reference | Hole No. | Sample | | | | Description | Remarks | Water Content BS 1377-2 [ W ] | Water Content BS EN ISO 17892-2 [ W ] | Atterberg | | | | Density | | | Total Porosity# | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Reference | Depth Top | Depth Base | Type | | | | | % Passing 425um | WL | Wp | Ip | bulk | dry | PD | | | |
| | | | m | m | | | | % | % | % | % | % | % | Mg/m3 | Mg/m3 | Mg/m3 | % | | |
| 2404126 | WS01 | Not Given | 1.50 | Not Given | D | Brownish grey slightly sandy CLAY | Atterberg 4 Point | 17 | | 100 | 47 | 20 | 27 | | | | | | |
| 2404127 | WS02 | Not Given | 3.50 | Not Given | D | Brown sandy CLAY | Atterberg 4 Point | 19 | | 100 | 41 | 20 | 21 | | | | | | |
| 2404128 | WS04 | Not Given | 2.00 | Not Given | D | Brownish grey slightly gravelly sandy CLAY | Atterberg 4 Point | 17 | | 99 | 44 | 21 | 23 | | | | | | |
| | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |
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| | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |

Note: # Non accredited; NP - Non plastic

Comments:

Opinions and interpretations expressed herein are outside of the scope of the UKAS Accreditation. This report may not be reproduced other than in full without the prior written approval of the issuing laboratory. The results included within the report relate only to the sample(s) submitted for testing.

**Signed:**

Monika Siewior
Reporting Specialist
**for and on behalf of i2 Analytical Ltd**



**Date Reported:** 12/09/2022

**GF 238.14**

# SUMMARY REPORT

## DETERMINATION OF WATER CONTENT

Tested in Accordance with: BS 1377-2: 1990: Clause 3.2

i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB

4041

Client: Curtins

Client Address: 17-19 Whitworth Street West, Manchester, M1 5WG

Contact: Jonathan Lord

Site Address: P500 Palgrave Avenue

Client Reference: B077873
Job Number: 22-80527
Date Sampled: 09/08/2022
Date Received: 22/08/2022
Date Tested: 05/09/2022
Sampled By: Not Given

*Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland*

### Test results

| Laboratory Reference | Hole No. | Sample | | | | Description | Remarks | WC | Sample preparation / Oven temperature at the time of testing | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Reference | Depth Top m | Depth Base m | Type | | | % | | | | |
| 2404126 | WS01 | Not Given | 1.50 | Not Given | D | Brownish grey slightly sandy CLAY | | 17 | Sample was quartered, oven dried at 109 °C | | | |
| 2404127 | WS02 | Not Given | 3.50 | Not Given | D | Brown sandy CLAY | | 19 | Sample was quartered, oven dried at 109 °C | | | |
| 2404128 | WS04 | Not Given | 2.00 | Not Given | D | Brownish grey slightly gravelly sandy CLAY | | 17 | Sample was quartered, oven dried at 109 °C | | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |

Comments:

Opinions and interpretations expressed herein are outside of the scope of the UKAS Accreditation. This report may not be reproduced other than in full without the prior written approval of the issuing laboratory. The results included within the report relate only to the sample(s) submitted for testing.

**Signed:**

Monika Siewior
Reporting Specialist
**for and on behalf of i2 Analytical Ltd**



**Date Reported:** 12/09/2022

# Appendix A6 – Ground Gas Monitoring Results

**Curtins**
Merchant Exchange, 17-19 Whitworth Street West, Manchester, M1 5WG
Tel: 0161 236 2394
Fax: 0161 228 7902

# GAS MONITORING LOG SHEET

| | | | |
|---|---|---|---|
| **Project:** | Palgrave Avenue, P500 | **Date:** | 24/08/2022 |
| **Job Number:** | B077873 | **Visit:** | 1 |
| **Client:** | Guiness Partnership | **Weather:** | Overcast |
| **Barometric State:** | Steady | **Ground Conditions:** | Dry |

| Borehole Reference | Barometric Pressure mb | Flow l/hr | | Methane % | | Carbon Dioxide % | | Oxygen % | Hydrogen Sulphide ppm | Carbon Monoxide ppm | Water Level m bgl | Borehole Base m bgl | PID | Note |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Max | SS | Max | SS | Max | SS | | | | | | | |
| WS02 | 1005 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 20.8 | 0 | 0 | Dry | 1.68 | 1.00 | |
| WS04 | 1005 | 0.0 | 0.0 | 0.0 | 0.0 | 1.6 | 1.6 | 19.4 | 0 | 0 | Dry | 3.92 | 1.00 | |
| MAX | | 0.0 | 0.0 | 0.0 | 0.0 | 1.6 | 1.6 | 20.8 | 0 | 0 | | | | |

**Notes**

**Logged by** **RBJ**

**1** Could not open install.

*1% gas volume = 10,000 ppm*
*Flow rate, methane and carbon dioxide reported as 'maximum' (max) and 'steady state' (SS) readings.*
*All other gases recorded at 'steady state' unless otherwise stated*

**Curtins**
Merchant Exchange, 17-19 Whitworth Street West, Manchester, M1 5WG
Tel: 0161 236 2394
Fax: 0161 228 7902

# GAS MONITORING LOG SHEET

| | | | |
|---|---|---|---|
| **Project:** | Palgrave Avenue, P500 | **Date:** | 01/09/2022 |
| **Job Number:** | B077873 | **Visit:** | 2 |
| **Client:** | Guiness Partnership | **Weather:** | Sunny |
| **Barometric State:** | Steady | **Ground Conditions:** | Dry |

| Borehole Reference | Barometric Pressure mb | Flow l/hr | | Methane % | | Carbon Dioxide % | | Oxygen % | Hydrogen Sulphide ppm | Carbon Monoxide ppm | Water Level m bgl | Borehole Base m bgl | PID | Note |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Max | SS | Max | SS | Max | SS | | | | | | | |
| WS02 | 1015 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 20.60 | 0 | 0 | Dry | 1.65 | 1.00 | |
| WS04 | 1015 | 0.0 | 0.0 | 0.0 | 0.0 | 1.6 | 1.6 | 19.20 | 0 | 0 | Dry | 3.92 | 1.00 | 1 |
| MAX | | 0.0 | 0.0 | 0.0 | 0.0 | 1.6 | 1.6 | 20.6 | 0 | 0 | | | | |

**Notes**

1 Gas tap left open on bung, results may be innacurate

**Logged by**

JP

*1% gas volume = 10,000 ppm*
*Flow rate, methane and carbon dioxide reported as 'maximum' (max) and 'steady state' (SS) readings.*
*All other gases recorded at 'steady state' unless otherwise stated*

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# GAS MONITORING LOG SHEET

| | | | |
|---|---|---|---|
| **Project:** | Palgrave Avenue, P500 | **Date:** | 21/09/22 |
| **Job Number:** | B077873 | **Visit:** | 3 |
| **Client:** | Guiness Partnership | **Weather:** | Sunny |
| **Barometric State:** | Steady | **Ground Conditions:** | Dry |

| Borehole Reference | Barometric Pressure mb | Flow l/hr | | Methane % | | Carbon Dioxide % | | Oxygen % | Hydrogen Sulphide ppm | Carbon Monoxide ppm | Water Level m bgl | Borehole Base m bgl | | Note |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Max | SS | Max | SS | Max | SS | | | | | | | |
| WS02 | 1015 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.1 | 20.5 | 0 | 0 | Dry | 1.63 | 1.00 | |
| WS04 | 1015 | 0.0 | 0.0 | 0.0 | 0.0 | 1.8 | 1.8 | 19.0 | 0 | 0 | Dry | 3.92 | 1.00 | |
| MAX | | 0.0 | 0.0 | 0.0 | 0.0 | 1.8 | 1.8 | 20.5 | 0 | 0 | | | | |

**Notes**

**Logged by**

JP

*1% gas volume = 10,000 ppm*
*Flow rate, methane and carbon dioxide reported as 'maximum' (max) and 'steady state' (SS) readings.*
*All other gases recorded at 'steady state' unless otherwise stated*

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# GAS MONITORING LOG SHEET

| | | | |
|---|---|---|---|
| **Project:** | Palgrave Avenue, P500 | **Date:** | 28/09/22 |
| **Job Number:** | B077873 | **Visit:** | 4 |
| **Client:** | Guiness Partnership | **Weather:** | Sunny |
| **Barometric State:** | Falling | **Ground Conditions:** | Wet |

| Borehole Reference | Barometric Pressure mb | Flow l/hr | | Methane % | | Carbon Dioxide % | | Oxygen % | Hydrogen Sulphide ppm | Carbon Monoxide ppm | Water Level m bgl | Borehole Base m bgl | PID | Note |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Max | SS | Max | SS | Max | SS | | | | | | | |
| WS02 | 1002 | 0.0 | 0.0 | 0.0 | 0.0 | 0.3 | 0.3 | 20.4 | 0 | 0 | Dry | 1.63 | 1.00 | |
| WS04 | 1001 | 0.0 | 0.0 | 0.0 | 0.0 | 1.8 | 1.8 | 19.1 | 0 | 0 | Dry | 3.92 | 1.00 | |
| MAX | | 0.0 | 0.0 | 0.0 | 0.0 | 1.8 | 1.8 | 20.4 | 0 | 0 | | | | |

**Notes**

**Logged by**

TW

*1% gas volume = 10,000 ppm*
*Flow rate, methane and carbon dioxide reported as 'maximum' (max) and 'steady state' (SS) readings.*
*All other gases recorded at 'steady state' unless otherwise stated*

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# GAS MONITORING LOG SHEET

| | | | |
|---|---|---|---|
| **Project:** | Palgrave Avenue, P500 | **Date:** | 14/10/22 |
| **Job Number:** | B077873 | **Visit:** | 5 |
| **Client:** | Guiness Partnership | **Weather:** | Sunny |
| **Barometric State:** | Steady | **Ground Conditions:** | Damp |

| Borehole Reference | Barometric Pressure mb | Flow l/hr | | Methane % | | Carbon Dioxide % | | Oxygen % | Hydrogen Sulphide ppm | Carbon Monoxide ppm | Water Level m bgl | Borehole Base m bgl | Note |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Max | SS | Max | SS | Max | SS | | | | | | |
| WS02 | 999 | 3.2 | 0.0 | 0.0 | 0.0 | 0.5 | 0.5 | 19.6 | 0 | 0 | Dry | 1.63 | |
| WS04 | 999 | 0.0 | 0.0 | 0.0 | 0.0 | 2.1 | 2.1 | 18.3 | 0 | 0 | Dry | 3.93 | |
| MAX | | 3.2 | 0.0 | 0.0 | 0.0 | 2.1 | 2.1 | 19.6 | 0 | 0 | | | |

**Notes**

**Logged by** JP

*1% gas volume = 10,000 ppm*
*Flow rate, methane and carbon dioxide reported as 'maximum' (max) and 'steady state' (SS) readings.*
*All other gases recorded at 'steady state' unless otherwise stated*

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# GAS MONITORING LOG SHEET

| | | | |
|---|---|---|---|
| **Project:** | Palgrave Avenue, P500 | **Date:** | 28/10/22 |
| **Job Number:** | B077873 | **Visit:** | 6 |
| **Client:** | Guiness Partnership | **Weather:** | Sunny and overcast |
| **Barometric State:** | Steady | **Ground Conditions:** | Damp |

| Borehole Reference | Barometric Pressure mb | Flow l/hr | | Methane % | | Carbon Dioxide % | | Oxygen % | Hydrogen Sulphide ppm | Carbon Monoxide ppm | Water Level m bgl | Borehole Base m bgl | Note |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Max | SS | Max | SS | Max | SS | | | | | | |
| WS02 | 1003 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.1 | 20.1 | 0 | 0 | Dry | 3.74 | |
| WS04 | 1003 | 0.0 | 0.0 | 0.0 | 0.0 | 2.1 | 2.1 | 18.7 | 0 | 0 | Dry | 2.53 | |
| MAX | | 0.0 | 0.0 | 0.0 | 0.0 | 2.1 | 2.1 | 20.1 | 0 | 0 | | | |

**Notes**

**Logged by**

JP

*1% gas volume = 10,000 ppm*
*Flow rate, methane and carbon dioxide reported as 'maximum' (max) and 'steady state' (SS) readings.*
*All other gases recorded at 'steady state' unless otherwise stated*