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SUB SURFACE
Site Investigation Specialists,
Geotechnical & Environmental Consultants

GROUND INVESTIGATION REPORT

FOR
OLD MARKET STREET,
MANCHESTER,
M9 8HY

PREPARED FOR
ZAHID KHALID

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CONTENTS

1. INTRODUCTION	1.1	Site Location and Description
	1.2	Proposed Development and Purpose of the Ground Investigation
2. INVESTIGATION	2.1	Investigation Details
	2.2	Sub Surface Detail
3. SAMPLING, TESTING AND MONITORING	3.1	Sampling
	3.2	Field Testing
	3.3	Installations and Monitoring
	3.4	Laboratory Testing
4. APPRAISAL AND RECOMMENDATIONS	4.1	Comments on the Profile
	4.2	Foundations
	4.3	Floor Slab Construction
	4.4	Excavations and Groundwater
	4.5	Buried Concrete
	4.6	Contamination Considerations
	4.7	Ground Gas Considerations
	4.8	General
APPENDICES		Insitu Test results
		Laboratory Test results
		Contamination Analysis results
		Mini Borehole Record sheets
		Figures

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GROUND INVESTIGATION FOR OLD MARKET STREET, MANCHESTER, M9 8HY

CLIENT: ZAHID KHALID

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1. INTRODUCTION

This report has been prepared in accordance with an email, dated 28th May 2021, from the Client.

The brief was set out in our estimate, ref. E4960 and dated 8th May 2021, with amendments as the investigation proceeded and includes:

- 5 No. mini boreholes
- Insitu testing
- Geotechnical laboratory testing
- Contamination analysis
- Installation of standpipes followed by groundwater and ground gas monitoring
- Provision of an interpretative report on the above.

It should be noted that a Phase I Desk Study Report for this site, ref. A3274/19 and dated November 2019 has previously been issued by Earth, Environmental & Geotechnical Limited, which should be read in conjunction with this Phase II Ground Investigation Report.

1.1 Site Location and Description

The site is located off Old Market Street in the Blackley area of Manchester, as indicated on Figures 1 and 2. The approximate National Grid Reference for the centre of the site is 385642E 402922N.

The site is an irregular shape measuring some 52m by 18m, with a slight slope towards the south, and is bound to the north by Old Market Street, to the south east by Grant Close, and to the west by residential houses and gardens.

The site mainly surfaced with grass/soft cover apart from two small bituminous macadam car parking spaces on the southern boundary.

1.2 Proposed Development and Purpose of the Ground Investigation

We understand that it is proposed to construct a single residential bungalow with associated car parking and gardens as shown on Figure 3.

The purpose of the investigation was to determine the ground conditions at the positions of the exploratory holes, to assess the likelihood of a general pattern of strata being present below the site and to establish the load bearing characteristics of the strata deriving, if possible, an assessment of the suitability of appropriate founding techniques.

In addition contamination analysis and assessment was required in order to determine necessary precautions and/or remedial measures required for the proposed development and to ascertain the need for any further sampling and analyses.

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Ground gas monitoring and assessment was also required to determine necessary precautions and/or remedial measures.

2. INVESTIGATION

2.1 Investigation Details

Five mini boreholes were put down to depths of between 0.50m and 5.45m using a Dart Mini Sampling Rig fitted with windowless sample tubes of 84mm reducing to 54mm diameter at the positions determined and set out by Sub Surface North West Limited, as shown on Figure 4. The samples were subsequently logged in accordance with BS EN ISO 14688-1: 2018 and BS EN ISO 14689-1: 2018 and the resulting Mini Borehole Records are appended.

2.2 Sub Surface Detail

Details of the strata encountered in the ground investigation are given on the appended Mini Borehole Records. The exploratory holes found made ground overlying natural granular and cohesive strata. A general summary of the strata found is as follows:

2.2.1 Made Ground

Made ground was encountered in all of the exploratory holes to depths of between >0.50m and 4.00m and comprised mainly soft dark brown slightly gravelly slightly sandy clayey silt with low stone cobble content and some rootlets to between 0.60m and 0.90m, then soft dark brown slightly gravelly sandy silty clay with low stone cobble content and occasional rootlets generally to a depth of some 1.50m to 1.70m. The gravel sized component comprised mainly fine to coarse stone, brick and concrete with localised wood and ceramic.

In M4 a deeper zone of made ground was encountered down to a depth of 4.00m, with the clay stratum underlain at a depth of 3.00m by soft dark brown gravelly slightly sandy clayey silt with occasional lenses of sand and some rootlets. The gravel sized component comprised mainly fine to coarse brick, stone and coal.

M5 was terminated within the made ground at a depth of 0.50m.

2.2.2 Drift Deposits

Natural drift deposits were encountered in M1, M2, M3 and M4 at depths of 1.60m, 1.70m, 1.50m, and 4.00m respectively. In M1 and M4 the natural strata comprised of loose becoming medium dense then dense in M1 and medium dense in M4 orangish brown slightly silty fine to medium sand. In M2 and M3 the natural strata comprised mainly soft low strength and very soft extremely low strength dark brown and brown slightly gravelly very sandy silty clay becoming medium strength below depths of between 3.00m and 3.15m and high strength below a depth of some 4.15m.

2.2.3 Groundwater

No groundwater was encountered in any of the exploratory holes although it should be noted that they were only left open for a short period of time and groundwater levels and rates of inflow may be subject to seasonal and/ or climatic variations.

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The standpipe installed in M1 was found to be dry during all of the monitoring visits. The standpipes installed in M2 and M3 were found to be dry during the first five monitoring visits, however the final visit found standing water depths of 2.30m and 1.70m respectively.

3. SAMPLING, TESTING AND MONITORING

3.1 Sampling

Continuous core, small disturbed and bulk disturbed samples were obtained for the strata encountered and were subjected to careful examination.

The samples will be retained for a period of one month after the issue of this report, for reference purposes, and then disposed of unless otherwise instructed.

3.2 Field Testing

Seventeen Standard Penetration Tests (SPTs) were performed in made ground and natural granular and cohesive strata, the results of which are recorded on the appended Standard Penetration Test Results Sheet with 'N' values and indicative relative density and shear strength, where appropriate, given on the appended Mini Borehole Records.

3.3 Installations and Monitoring

On completion of M1, M2 and M3 hdpe standpipes were installed to a depth of 4.00m The standpipes are slotted from 1.00m depth, have an internal diameter of 50mm and have removable quick release gas valves to enable both ground gas and groundwater monitoring and sampling to be undertaken. Details of the installations are given on the appended Mini Borehole Records.

Monitoring of the standpipes for ground gas and groundwater has been undertaken on six occasions using portable equipment. A Gas Data GFM 435 was used for monitoring methane, carbon dioxide, oxygen, gas flows and atmospheric pressure. The results of the monitoring are given on the appended Ground Gas and Groundwater Monitoring Results sheet.

3.4 Laboratory Testing

The following laboratory tests were carried out in accordance with BS.1377: 1990, where applicable, and the results are appended.

- Moisture content, plastic limit and liquid limit tests
- Soluble sulphate content and pH value tests (including pyritic ground testing).

Contamination analyses have been performed on three soil samples to determine: pH and concentrations of sulphate, sulphide, cyanide, arsenic, boron (soluble), cadmium, chromium, hexavalent chromium, copper, lead, mercury, molybdenum, nickel, selenium, zinc, speciated total petroleum hydrocarbons (TPHs), the speciated polynuclear aromatic hydrocarbons (PAHs) suite, the benzene/ ethylbenzene/ toluene/ xylene (BTEX) suite and phenols. In addition, the soil samples were subjected to an asbestos screen.

One soil sample was also analysed for a suite of volatile organic compounds (VOCs).

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The results of the contamination analyses are appended.

4. APPRAISAL AND RECOMMENDATIONS

4.1 Comments on the Profile

At the outset it should be appreciated that only a small proportion of the area to be developed has been investigated and consequently the recommendations made and opinions expressed in this report can only be applied to such conditions as were encountered in the exploratory holes.

The exploratory holes indicate a nature and degree of similarity to the extent that we consider them likely to be representative of the natural ground conditions. However, no guarantee can be given.

Due to the nature of made ground, localised variations in thickness and composition should be anticipated and hence interpolation or extrapolation from the exploratory holes to adjoining areas should only be undertaken with caution.

Details of the findings of the investigation are given on the appended Mini Borehole Records and a summary of the ground conditions is given in Section 2.2.

4.2 Foundations

We understand that it is proposed to construct a single residential bungalow with associated car parking and gardens as shown on Figure 3. However, at the time of writing this report no specific details regarding the proposed foundations and design loadings were available and consequently the recommendations given are in general terms only.

The ground investigation found made ground to depths of between >0.50m and 4.00m underlain in M1 and M4 by loose becoming medium dense then dense in M1 and medium dense in M4 orangish brown slightly silty fine to medium sand. In M2 and M3 the natural strata comprised mainly soft low strength and very soft extremely low strength dark brown and brown slightly gravelly very sandy silty clay becoming medium strength below depths of between 3.00m and 3.15m and high strength below a depth of some 4.15m.

We would not recommend founding in the made ground in its present condition because of its inherent variability in consistency and compaction, and in parts the nature of its constituents.

Providing there is sufficient load bearing capability we recommend that the proposed building is founded on strip footings for wall loads and pad foundations for column loads in the natural medium strength cohesive or medium dense granular strata.

Atterberg limit tests undertaken on the cohesive strata were inconclusive due to the very sandy nature of the material. We recommend that the clay strata are assumed to have a medium susceptibility to shrinkage and swelling with varying moisture content. Given the above foundations should be taken down to a minimum 0.90m below finished ground level to avoid the zone which is subject to seasonal moisture content variation and frost action. If buildings are to be constructed adjacent to existing trees, trees are to be removed and/or trees are to be planted then the guidelines given in the National House Building Council (NHBC) Standards Chapter 4.2, 'Building Near Trees', should be followed for clays of medium shrinkage and swelling potential.

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It should be noted that in the mini boreholes the natural strata was encountered at a depth of in excess of 0.90m and we recommend foundations should be taken down to a minimum 0.10m below the base of the made ground unless the NHBC guidelines indicate a greater depth.

In view of the depth of foundations required it is anticipated that trench fill will be used to bring levels back up to the surface. Largely dependent upon the cost of disposal of arisings, we anticipate that trench fill would normally be economically viable providing foundation depths do not exceed about 2.50 to 3.00m.

Taking the results of the field tests we have determined the safe bearing capacity of the natural strata, as follows:

TABLE 1 SAFE BEARING CAPACITY

Expl Hole No.	Depth (m)	SPT 'N' Value	Shear Strength (kN/m^2)	Safe Bearing Pressure (kN/m^2)		Recommended Minimum Foundation Depth (m)
				Strip Footing	Square Pad	
M1	2.15	20	-	225*	225*	1.70
	3.15	30	-	355*	355*	
	4.15	35	-	420*	420*	
M2	2.15	9	36	65	80	1.80
	3.15	12	48	90	105	
	4.15	20	80	150	180	
M3	3.15	15	60	110	135	3.00
	4.15	19	76	140	170	

* For footings on granular strata, the safe bearing capacity given is based upon a footing width of less than 1.50m. For wider footings a reduction would be necessary.

Appreciable variations in safe bearing capacity are indicated in Table 1 and as a consequence of this, and the need to utilise a generally applicable safe bearing pressure to enable designs to be reasonably formulated, we recommend that values of 65 kN/m^2 for strip footings and 80 kN/m^2 for square pads should not be exceeded for the recommended minimum foundation depth given.

It should be noted that we have recommended that the footing should be taken down to a depth of 3.00m in the area of M3 to avoid overstressing the extremely low strength clay encountered from 1.50m to 3.00m.

All formation levels should be carefully inspected by an experienced and qualified engineer to confirm the appropriateness of the design figures used with any soft, loose, or rubbly zones removed and replaced with lean mix concrete. The formation should then be blinded with lean mix concrete as soon as possible after exposure, if there is to be a delay before construction, to prevent water softening or disturbance.

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It should be noted that the safe bearing pressures given for the cohesive strata do not take into consideration settlement. Settlement is dependent upon loading intensity, the width of the foundation and the coefficient of volume compressibility (Mv) of the compressible strata. When details of the foundations are formulated we recommend that total and differential settlements are assessed to ensure that they are within acceptable limits.

Should granular and cohesive strata be present at the proposed formation level we recommend that foundation excavations should be locally deepened in order that the formation is entirely within similar strata. If this is not possible we recommend that reinforcement in foundations is provided to give adequate strength to bridge or cantilever over areas of significantly differing rates of settlement and to induce an increase in the settlement where relatively low settlements are expected.

It should be noted that if the deeper made ground encountered in M4 encroaches on the building footprint then shallow foundations may not be viable and alternative foundations may need to be considered. These might include ground improvement by vibroflotation with shallow reinforced foundations or piled foundations.

When considering whether to use vibroflotation or piles consideration should be given to the carbon footprint. It has been shown in 2021 that by using vibroflotation, as opposed to using standard concrete piles with steel reinforcement, there is an about 92% reduction in the carbon footprint.

The most common form of the vibroflotation treatment technique is vibro replacement whereby dense stone columns are formed through the full depth of any made ground that is present and variable near surface strata, utilising the passive resistance of cohesive soils and compacting granular soils to improve the bearing capacity and minimise differential settlements of the composite mass of near surface materials and compacted stone columns.

Due to the varying types, sizes and power of vibroflotation machines currently in use, the advice of a Specialist Contractor should be sought to ascertain the feasibility of applying the particular technique, the allowable bearing capacity and expected differential settlements each machine will achieve and in formulating the most economic scheme.

Care must be taken when undertaking vibroflotation ground treatment to prevent vibrations being transmitted to adjacent/ nearby buildings, structures, services and/or slopes/ retaining walls as they may be detrimentally affected. Consequently, we recommend that any tendering Specialist Vibroflotation Contractor confirm that vibrations will not detrimentally affect adjacent/ nearby buildings, structures, services and/or slopes/ retaining walls.

With regard to the choice of pile type, consideration could be given to driven piles, continuous flight auger (CFA) piles or cast in-situ bored piles with the driven pile option probably being the most economical. However, in considering piles driven to a pre-determined set in the more competent strata at depth, it is essential to ensure that any vibrations set up during the driving process are not transmitted to adjacent/ nearby buildings, structures, services and/or slopes/ retaining walls as they may be detrimentally affected. Consequently, in respect of driven piles, we recommend that any tendering Specialist Piling Contractor confirm that vibrations will not detrimentally affect adjacent/ nearby buildings, structures, services and/or slopes/ retaining walls. If

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such confirmation cannot be given, as is likely, then we would recommend using either CFA or cast in-situ bored piles.
Care must be taken to space the piles in any group to ensure the adequate utilisation of skin friction where this has been assumed in the calculation of the load bearing capacity of an individual pile. Checks must also be undertaken to confirm that the underlying ground supporting the pile group is not overstressed.

In determining the final pile design it should be noted that up to 4.00m of the piles may be in made ground and due regard should be paid to the lack of lateral restraint over this length in cases where significant lateral forces are to be catered for.

If consideration is to be given to a piled foundation solution, then we recommend that additional investigation should be undertaken using cable percussive drilling to obtain strength parameters for the deeper strata. To formulate the most satisfactory and economic scheme we suggest that competitive tenders and designs from Specialist Piling Contractors should be sought using the additional borehole information obtained.

4.3 Floor Slab Construction

With regard to the design and construction of normal ground bearing floor slabs, it should be noted that due to the thickness of made ground there will be a risk of significant total and differential settlements, the extent of which will be a matter of chance rather than being assessable by calculation.

To obviate any significant damaging settlements we would recommend using a suspended floor slab with intermediate support designed on the same basis as the main foundations where the spans are too large for economical single suspended slab design.

Should vibroflotation ground treatment be proposed for the main foundations consideration could be given to extending the ground treatment in a grid pattern beneath the whole of the building followed by the construction of a suitably reinforced concrete ground bearing floor slab cast on a granular base layer.

4.4 Excavations and Groundwater

There should be no particular difficulties in excavating the strata indicated in the exploratory holes utilising an appropriate and suitably sized mechanical excavator.

It is recommended that all excavations to greater than 1.20m depth, or for shallower excavations where groundwater is encountered above this level, are closely supported, especially where man entry is required. Alternatively, where space permits, the excavations might be battered back to an appropriate angle.

The boreholes did not encounter groundwater, although it should be noted that they were only left open for a relatively short period of time and groundwater levels and rates of inflow may be subject to seasonal and/ or climatic variations.

The standpipe installed in M1 was found to be dry during all of the monitoring visits. The standpipes installed in M2 and M3 were found to be dry during the first five monitoring visits, however the final visit found standing water depths of 2.30m and 1.70m respectively.

Should groundwater seepages occur and water accumulate in the excavation it should be able to be removed by pumping from a filtered sump.

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4.5 Buried Concrete

For the design of buried concrete the recommendations given in Building Research Establishment (BRE) Special Digest 1 (February 2017 revision), "Concrete in Aggressive Ground", should be followed.

Determination of pH on the soil samples gave values in the range of 7.7 to 8.4. Soluble sulphate concentrations were also determined for the soil samples and the results were <0.01 g/l.

The results indicate that the Design Sulphate Class for the site should be DS-1.

Our knowledge of the site and ground conditions indicates that the site is "brownfield" with potentially mobile groundwater. Consequently, in accordance with the Design Sulphate Class for the site together with the site and groundwater conditions an Aggressive Chemical Environment for Concrete (ACEC) classification of AC-1 should be used as detailed on the appended extract.

4.6 Contamination Considerations

A Phase I Desk Study Report for this site, ref. A3274/19 and dated November 2019 has previously been issued by Earth, Environmental & Geotechnical Limited, and this Phase II ground investigation has been undertaken to provide an initial contamination risk assessment in accordance with the Phase I Conceptual Ground Model. Based upon the findings of the above additional sampling, analysis and assessment may be required.

It should be appreciated that the suite of determinants analysed for consists of a range of contaminants identified in the Conceptual Ground Model. However, the absence of any other specific contaminants cannot be guaranteed.

4.6.1 Assessment (Soil)

In order to provide an assessment of the presence of contamination three soil samples have been analysed for a suite of determinants and the results are appended.

The concentrations of the determinants have been compared against published generic assessment criteria (GACs). The Department for Environment, Food and Rural Affairs (DEFRA) and the Environment Agency published soil guideline values (SGVs) for mercury, selenium, benzene, toluene, ethylbenzene and xylene on 31 March 2009, arsenic and nickel on 12 May 2009 and cadmium and phenols in June 2009. Contaminated Land: Applications in Real Environments (CL:AIRE) guideline values were also published in December 2009 to supplement the above. DEFRA published in March 2014 Category 4 Screening Levels (C4SLs) for arsenic, cadmium, lead, hexavalent chromium, benzo(a)pyrene and benzene. In November 2014 Suitable for Use Levels (S4ULs) were then published by LQM/ CIEH and updated S4ULs values for cadmium and phenols were published in July 2015 and for nickel in August 2015. The assessment criteria (SGVs, S4ULs, CL:AIRE and C4SLs) vary dependent upon the land use; allotment and residential use being the most sensitive and commercial/ industrial use being the least sensitive. The S4ULs are the copyright of Land Quality Management Limited and have been used with permission under Publication Number S4UL3114.

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To assess the polycyclic aromatic hydrocarbon (PAH) contamination the surrogate marker approach has been used. The ratios of the seven genotoxic PAHs (benzo(a)anthracene, chrysene, benzo(b)fluoranthene, benzo(k)fluoranthene, indeno(123-cd)pyrene, dibenzo(ah)anthracene and benzo(ghi)perylene) to benzo(a)pyrene, have been determined and compared with the published ratio profile of a coal tar test material (Culp et al in 1998). The comparison indicates that the PAH contamination matches the Culp profile within reasonable bounds (as defined in DEFRA 2014) allowing the genotoxic PAHs to be assessed against the C4SL for benzo(a)pyrene as a surrogate marker.

For the purposes of assessment, as the proposed development is a residential bungalow, contamination analyses have been compared with the guideline values for a standard land use of residential with plant uptake (with homegrown produce).

When compared with the GACs the contamination analyses determined a slightly elevated concentration of genotoxic PAH (6.0mg/kg vs a C4SL of 5.0mg/kg).

GACs for the assessment can be supplied directly to the Regulator, if requested.

An asbestos screen was undertaken on the soil samples and no asbestos was detected.

In addition to the above, an assessment of risk to personnel who will come into contact with on-site materials throughout the site has been undertaken.

4.6.2 Conclusions and Recommendations

Section 78a(2) of the Environmental Protection Act: 1990 as amended by the Contaminated Land (England) (Amendment) regulations 2012, and Section 86 of the Water Act 2003, defines CONTAMINATED LAND for the purposes of Part IIA as:

“any land which appears to the LOCAL AUTHORITY in whose area it is situated to be in such a condition, by reason of substances in, on or under the land, that:

(a) SIGNIFICANT HARM is being caused or there is a SIGNIFICANT POSSIBILITY of such harm being caused; or
(b) SIGNIFICANT POLLUTION OF CONTROLLED WATERS is being, or is likely to be, caused”

Before a LOCAL AUTHORITY can make the judgement that land appears to be CONTAMINATED LAND on the basis that SIGNIFICANT HARM is being caused, or that there is a SIGNIFICANT POSSIBILITY of such harm being caused, the LOCAL AUTHORITY must identify a SIGNIFICANT POLLUTANT LINKAGE. This means that each of the following has to be identified:

(a) a CONTAMINANT;
(b) a relevant RECEPTOR (defined as living organisms, ecological systems, controlled waters or property); and
(c) a PATHWAY by means of which either:
  (i) the CONTAMINANT is causing SIGNIFICANT HARM to that RECEPTOR, or
  (ii) there is a SIGNIFICANT POSSIBILITY of such harm being caused by that CONTAMINANT to that RECEPTOR

It should be noted that the words in capitals have a legal definition within the legislation.

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Without a clear identification of all three elements of the pollutant linkage, land cannot be identified as contaminated under the regime.

The National Planning Policy Framework states that, “after remediation, as a minimum, land should not be capable of being determined as contaminated land under Part IIA of the Environmental Protection Act 1990”. Therefore, the general principles detailed above apply to this assessment.

Our assessment, based on the soil samples tested, indicates a slightly elevated level of PAH is present in the near surface made ground (source) in the area of M5. Given the slight exceedance we would recommend additional sampling and analyse are undertaken in this area to delineate and assess the statistical significance of the PAH contamination, which may find that no remedial action is required or may reduce the are requiring intervention. However, it should be noted we cannot guarantee the outcome of the additional investigation.

Alternatively, the pathway from the source to site operatives during earthworks, the end users of the development and any proposed planting (receptors) will need to be removed by precautions and/ or remedial measures.

End Users

There is no volatile pathway associated with the genotoxic PAH compounds and therefore where the contaminated materials are covered by buildings or a hard surface cover of concrete or bituminous macadam no further remediation will be required with regard to soil contamination. However, in gardens and other open space areas the end users should be protected from the contaminated materials and plants should be provided with a medium in which they can safely grow.

For this site we would recommend a 600mm blanket of clean topsoil/ subsoil (equivalent to two spade depths) is provided in back gardens and a 450mm blanket of imported clean topsoil/ subsoil is provided in front and side gardens and other open spaces. In addition deeper rooted bushes and trees should be pit planted on and in clean topsoil.

The proposed remediation strategy should be set out in a formal remediation statement and submitted to the Local Planning Authority for their consideration and written approval obtained prior to commencement.

Waste Soil Management

Contaminated materials should, where possible, be retained on site. However, it should be appreciated that contaminated material left on site is the legal responsibility of the landowner, unless the person who created the contamination can be identified.

If waste materials are to be removed from the site, classification of the waste should be undertaken to determine the most appropriate tip to use and the associated costs. It should be noted that significant cost savings can sometimes be made on waste disposal by correct classification of the waste, a service that we can provide.

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Construction Workers

S4ULs, C4SLs and CL:AIRE assume long term contact with contamination and assess chronic health risk. The risk of short term acute exposure to site personnel is dealt with in the remit of the Health and Safety Executive under the Health and Safety at Work Act: 1974 and Regulations made under the Act, including the Control of Substances Hazardous to Health (COSHH) Regulations. The levels of contamination and risk to site personnel should be considered under the Construction Design and Management (CDM) Regulations at the planning stage and in the development of the designers and contractors Health and Safety Plans and Method Statements. The risk of contact with on-site soils should be minimised and suitable personal protective equipment (PPE) should be worn.

Controlled Waters

Based on the generally low concentrations of contaminants recorded in the soil samples and the low water table, in our opinion the risk of contaminant migration to controlled waters (including the Secondary A and Secondary B Aquifers, the groundwater abstraction 607m to the west and the Boggart Hole Brook 45m to the south) is very low.

Risk Assessment for Water Pipes

If it is intended to use standard polyethylene (PE) pipes for new water supply connections to the site, then as the site is brownfield a risk assessment will be required by the Local Water Authority (in this case United Utilities) this is a service we can provide.

It should be noted that some Water Authorities require a pipeline risk assessment to be completed even if it is intended to use barrier pipe for new water supply connection and in this case, we would recommend contacting United Utilities for approval prior to installation.

4.7 Ground Gas Considerations

Ground gas monitoring has been undertaken on six scheduled occasions and the results of the monitoring visits are appended.

Ground gases: methane, carbon dioxide and oxygen and flow rate have been monitored and the ranges of ground gases and flow rate during the monitoring period are as follows:

TABLE 2 GROUND GAS CONCENTRATIONS AND FLOW RATE

Methane (% vol. In air)	Carbon Dioxide (% vol. in air)	Oxygen (% vol. in air)	Gas Flow Rate (litres/ hour)
0.0	0.5 – 6.0	14.7 – 19.9	<0.1

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It can be seen from the monitoring that no elevated levels of methane, and no gas flow has been detected. However elevated concentrations of carbon dioxide and depleted levels of associated oxygen have been detected.

Methane gas when present between 5% volume in air (Lower Explosive Limit - L.E.L.) and 15% volume in air (Upper Explosive Limit - U.E.L.) is potentially explosive and inflammable whilst carbon dioxide in conjunction with depleted oxygen is an asphyxiant. Both methane and carbon dioxide are a by-product of the anaerobic and aerobic decomposition of biodegradable materials.

The levels of gas have been assessed in accordance with British Standard 8485, "Code of practice for the design of protective measures for methane and carbon dioxide gasses for new buildings", published in June 2015 and updated in January 2019 (BS.8485:2015+A1:2019).

The characteristic hazardous gas flow rate (Q_{hg}) is calculated by dividing the maximum gas (methane or carbon dioxide) concentration by 100 and multiplying by the maximum flow rate in litres per hour (minimum 0.1 l/hr for Sub Surface monitoring equipment). For this site Q_{hg} = 6.0 / 100 x 0.1 = 0.006 l/hr.

Based on the monitoring to date, BS.8485:2015+A1:2019, Table 2, indicates that the site falls into Characteristic Situation 1 (CS1).

However, as on this site carbon dioxide levels are typically >5% the CS1 is increased by one to CS2 in line with the recommendations given in BS.8485:2015+A1:2019.

BS.8485:2015+A1:2019, Table 4, indicates that for a CS2 and the type of development proposed (Type A) a score of 3.5 gives the level of protection and remedial measures required.

BS.8485:2015+A1:2019 Tables 5, 6 and 7 indicate that a combination of the following protection and remedial measures could be considered to achieve the required score:

Table 5.1 precast suspended segmental sub-floor slab (block and beam).
(Score 0.0)

AND

Table 6.3 passive sub floor ventilation/ dispersal layer (clear void/ polystyrene void former/ geocomposite void former/ no fines gravel layer with gas drains/ no fines gravel layer) of good performance.
(Score 1.5)

AND

Table 7 gas resistant membrane meeting the following criteria:

- sufficiently impervious to gases with a methane gas transmission rate of <40.0 ml/day/m^2/atm (average) for sheets and joints (tested in accordance with BS.ISO.15105-1 manometric method).
- sufficiently durable to remain serviceable for the anticipated life of the building and duration of gas emissions.
- sufficiently strong to withstand in-service stresses due to say settlement if placed below a floor slab.
- sufficiently strong to withstand the installation process and following trades (penetration from steel fibres in fibre reinforced concrete/

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penetration from reinforcement ties/ tearing due to working above it or dropped tools) until covered.
- after installation being capable of providing a complete barrier to the entry of the relevant gas.
- verified in accordance with CIRIA C735 [N1].
(Score 2.0)

OR

Table 5.3 reinforced cast in-situ suspended floor slab with minimal penetrations.
(Score 1.0)

AND

Table 6.1 pressure relief pathway (low fines gravel blanket/ thin geocomposite blanket/ strips terminating in gravel trench external to the building)
(Score 0.5)

AND

Table 7 gas resistant membrane meeting the following criteria:
- sufficiently impervious to gases with a methane gas transmission rate of <40.0 ml/day/m^2/atm (average) for sheets and joints (tested in accordance with BS.ISO.15105-1 manometric method).
- sufficiently durable to remain serviceable for the anticipated life of the building and duration of gas emissions.
- sufficiently strong to withstand in-service stresses due to say settlement if placed below a floor slab.
- sufficiently strong to withstand the installation process and following trades (penetration from steel fibres in fibre reinforced concrete/ penetration from reinforcement ties/ tearing due to working above it or dropped tools) until covered.
- after installation being capable of providing a complete barrier to the entry of the relevant gas.
- verified in accordance with CIRIA C735 [N1].
(Score 2.0)

The proposed remediation strategy should be set out in a formal remediation statement and submitted to the Local Planning Authority for their consideration and written approval obtained prior to commencement.

All excavations of greater than 1.20m depth should be routinely checked for air quality prior to man entry and appropriate precautions taken.

Any manholes, inspection chambers or other void spaces formed beneath the sites ground surface are potential ground gas traps. Precautions, as per the excavations above, should be taken.

4.8 General

It should be noted that we have made recommendations for further investigation in Section 4.5 to refine the contamination risk assessment.

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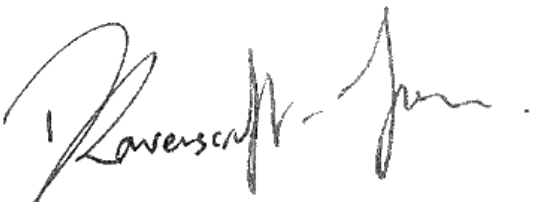
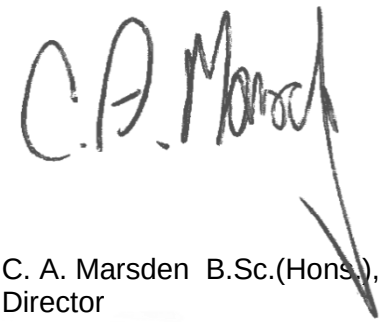
We recommend that consultation should be undertaken with, and the written approval obtained from, the Local Authority Environmental Health Officer and the Local Authority Building Control Officer prior to commencing development.

We trust that this report fulfils your present requirements but if you have any queries or we can be of further assistance please contact the undersigned or Ms Anna Marsden at our Preston office.

SUB SURFACE CONSULTANTS LIMITED
REPORT No. 7268A
NOVEMBER 2021



D. Ravenscroft-Jones Cert Nat Sci (Open), BSc.(Hons.), MSc., CEnv, MIEnvSc, AMRSC
Senior Geoenvironmental Engineer
For and on behalf of
Sub Surface Consultants Limited



C. A. Marsden B.Sc.(Hons.), C.Eng., M.I.C.E.
Director
For and on behalf of
Sub Surface Consultants Limited.

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INSITU TEST RESULTS

SUB SURFACE
SITE INVESTIGATION SPECIALISTS, GEOTECHNICAL & ENVIRONMENTAL CONSULTANTS
3 Peel Street, Preston, Lancashire, PR2 2QS. Tel: (01772) 561135 Fax: (01772) 204907

Standard Penetration Test Results

Site : OLD MARKET STREET, MANCHESTER

Client : ZAHID KHALID

Engineer :

Job Number 7268

Sheet 1 / 1

Borehole Number	Base of Borehole (m)	End of Seating Drive (m)	End of Test Drive (m)	Test Type	Seating Blows per 75mm		Blows for each 75mm penetration				Result	Comments
					1	2	1	2	3	4		
M1	1.20	1.35	1.65	SPT	1	1	1	1	2	2	N=6	
M1	2.00	2.15	2.45	SPT	2	3	4	5	5	6	N=20	
M1	3.00	3.15	3.45	SPT	8	6	7	7	8	8	N=30	
M1	4.00	4.15	4.45	SPT	5	8	9	9	8	9	N=35	
M2	1.20	1.35	1.65	SPT	1	1	1	1	1	2	N=5	
M2	2.00	2.15	2.45	SPT	1	2	2	2	2	3	N=9	
M2	3.00	3.15	3.45	SPT	2	2	3	3	3	3	N=12	
M2	4.00	4.15	4.45	SPT	3	4	5	5	5	5	N=20	
M3	1.20	1.35	1.65	SPT	2	2	1	0	1	0	N=2	No Recovery
M3	2.00	2.15	2.45	SPT	1	0	0	1	1	0	N=2	No Recovery
M3	3.00	3.15	3.45	SPT	2	3	3	4	4	4	N=15	
M3	4.00	4.15	4.45	SPT	4	4	5	5	4	5	N=19	
M4	1.20	1.35	1.65	SPT	1	2	2	2	3	2	N=9	
M4	2.00	2.15	2.45	SPT	2	3	3	3	3	4	N=13	
M4	3.00	3.15	3.45	SPT	3	3	4	4	5	5	N=18	
M4	4.00	4.15	4.45	SPT	4	5	4	5	6	6	N=21	
M4	5.00	5.15	5.45	SPT	4	7	6	6	7	7	N=26	

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Insitu Test Results

Site: OLD MARKET STREET, MANCHESTER, M9 8HY

Client: ZAHID KHALID

Engineer:

Job Number: 7268A

Sheet: 1 / 1

GROUND GAS AND GROUNDWATER MONITORING RESULTS SHEET

Date	Hole No.	Methane (% Volume)	Carbon Dioxide (% Volume)	Oxygen (% Volume)	Gas Flow Rate (l/hr)	Atmospheric Pressure (millibars)	Depth to Groundwater (m)
18/06/21	M1	0.0	***2.9***	18.5	<0.1	1009 F	DRY
	M2	0.0	***4.7***	***16.7***	<0.1	1009 F	DRY
	M3	0.0	1.2	18.9	<0.1	1009 F	DRY
14/07/21	M1	0.0	0.5	19.9	<0.1	1011 S	DRY
	M2	0.0	***5.0***	***16.2***	<0.1	1011 S	DRY
	M3	0.0	***1.8***	18.4	<0.1	1011 S	DRY
16/08/21	M1	0.0	***4.2***	***16.9***	<0.1	1010 R	DRY
	M2	0.0	***5.9***	***14.7***	<0.1	1010 R	DRY
	M3	*	*	*	*	*	*
24/08/21	M1	0.0	***4.2***	17.1	<0.1	1025 F	DRY
	M2	0.0	***6.0***	***15.0***	<0.1	1025 F	DRY
	M3	*	*	*	*	*	*
23/09/21	M1	0.0	***3.3***	18.0	<0.1	1011 S	DRY
	M2	0.0	***5.1***	***16.4***	<0.1	1011 S	DRY
	M3	0.0	***1.5***	19.2	<0.1	1011 S	DRY
15/10/21	M1	0.0	***1.6***	19.4	<0.1	1019 S	DRY
	M2	0.0	***5.5***	***15.2***	<0.1	1019 S	2.30
	M3	0.0	***2.1***	17.9	<0.1	1019 S	1.70

Remarks: Elevated levels of methane and carbon dioxide and depleted levels of oxygen are shown in ***bold/italics*** .

* CAR PARKED OVER STANDPIPE, UNABLE TO MONITOR.

F = Falling Pressure R = Rising Pressure S = Steady Pressure

LABORATORY TEST RESULTS

SUB SURFACE
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Laboratory Test Results

Site : OLD MARKET STREET, MANCHESTER

Client : ZAHID KHALID

Engineer :

Job Number 7268

Sheet 1 / 1

DETERMINATION OF MOISTURE CONTENT, LIQUID LIMIT AND PLASTIC LIMIT AND DERIVATION OF PLASTICITY AND LIQUIDITY INDEX

Borehole/ Trial Pit	Depth (m)	Sample	Natural Moisture Content %	Sample Passing 425µm Sieve		Liquid Limit %	Plastic Limit %	Plasticity Index %	Liquidity Index	Group Symbol	Laboratory Description
				Percentage %	Moisture Content %						
M1	2.00	D*	9	91	10	18				NP	Orangish brown slightly silty fine to medium SAND.
M2	2.00	D*	15	74	20	21				NP	Dark brown slightly gravelly very sandy silty CLAY with occasional rootlets.
M3	3.00	D*	17	94	18	21				NP	Brown slightly gravelly very sandy silty CLAY with occasional rootlets.

Method of Preparation : BS 1377:PART 1:1990:7.4 Preparation of samples for classification tests BS 1377:PART 2:1990:4.2 & 5.2 Sample preparations

Method of Test : BS 1377:PART 2:1990:3 Determination of moisture content 1990:4 Determination of the liquid limit BS 1377:PART 2:1990:5 Determination of the plastic limit and plasticity index

Remarks : *No test possible - too sandy NP = Non Plastic

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3 Peel Street, Preston, Lancashire, PR2 2QS. Tel: (01772) 561135 Fax: (01772) 204907

Laboratory Test Results

Site : OLD MARKET STREET, MANCHESTER

Client : ZAHID KHALID

Engineer :

Job Number 7268

Sheet 1 / 1

DETERMINATION OF pH, SULPHATE CONTENT AND TOTAL SULPHUR OF SOIL AND GROUNDWATER AND MAGNESIUM, CHLORIDE, AMMONIA AND NITRATE CONTENT

Borehole/ Trial Pit	Depth (m)	Sample	Concentration of Sulphate			Total Sulphur %	Magnesium mg/l	Ammonium NH4 mg/l	Water Soluble Chloride mg/l	Water Soluble Nitrate mg/l	pH	Design Class	Laboratory Description
			Soil		Ground Water g /l								
			Total S03 %	S04 in 2:1 water:soil g /l									
M1	1.20	D		<0.01							7.7	DS-1	MADE GROUND: dark brown slightly gravelly slightly sandy silty clay with occasional rootlets.
M2	2.00	D		<0.01							7.8	DS-1	Dark brown slightly gravelly very sandy silty CLAY with occasional rootlets.
M3	0.60	B		<0.01							8.4	DS-1	MADE GROUND: dark brown slightly gravelly slightly sandy silty clay with low stone cobble content.

Method of Preparation : BS 1377:PART 1:1990:7.5 Preparation of soil for chemical tests BS 1377:PART 3:1990:5.2, 5.3, 5.4 & 9.4

Method of Test : Lab in-house methods based on BS1377: Part 3 for contents of water sol sulphate, pH, chloride and magnesium. Lab in-house method based on MEWAM (EA, 2006) for total sulphur

Remarks : Classification relates to Design Sulphate Class of BRE Special Digest 1 (2005)

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AGGRESSIVE CHEMICAL ENVIRONMENT FOR CONCRETE (ACEC) SITE CLASSIFICATION.

Table C1 Aggressive Chemical Environment for Concrete (ACEC) classification for natural ground locations [a]

Sulfate				Groundwater		
Design Sulfate Class for location	2:1 water/soil extract [b]	Groundwater	Total potential sulfate [c]	Static water	Mobile water	ACEC Class for location
1	2 (SO_4 mg/l)	3 (SO_4 mg/l)	4 (SO_4 %)	5 (pH)	6 (pH)	7
DS-1	< 500	< 400	< 0.24	≥ 2.5		AC-1s
					> 5.5 [d]	AC-1 [d]
					2.5–5.5	AC-2z
DS-2	500–1500	400–1400	0.24–0.6	> 3.5		AC-1s
					> 5.5	AC-2
				2.5–3.5		AC-2s
					2.5–5.5	AC-3z
DS-3	1600–3000	1500–3000	0.7–1.2	> 3.5		AC-2s
					> 5.5	AC-3
				2.5–3.5		AC-3s
					2.5–5.5	AC-4
DS-4	3100–6000	3100–6000	1.3–2.4	> 3.5		AC-3s
					> 5.5	AC-4
				2.5–3.5		AC-4s
					2.5–5.5	AC-5
DS-5	> 6000	> 6000	> 2.4	> 3.5		AC-4s
				2.5–3.5	≥ 2.5	AC-5

Notes
a Applies to locations on sites that comprise either undisturbed ground that is in its natural state (ie is not brownfield – Table C2) or clean fill derived from such ground.
b The limits of Design Sulfate Classes based on 2:1 water/soil extracts have been lowered relative to previous Digests (Box C7).
c Applies only to locations where concrete will be exposed to sulfate ions (SO_4) which may result from the oxidation of sulfides (eg pyrite) following ground disturbance (Appendix A1 and Box C8).
d For flowing water that is potentially aggressive to concrete owing to high purity or an aggressive carbon dioxide level greater than 15 mg/l (Section C2.2.3), increase the ACEC Class to AC-2z.

Explanation of suffix symbols to ACEC Class
- Suffix 's' indicates that the water has been classified as static.
- Concrete placed in ACEC Classes that include the suffix 'z' primarily have to resist acid conditions and may be made with any of the cements or combinations listed in Table D2 on page 42.

Table C2 Aggressive Chemical Environment for Concrete (ACEC) classification for brownfield locations [a]

Sulfate and magnesium						Groundwater		ACEC
Design Sulfate Class for location	2:1 water/soil extract [b]		Groundwater		Total potential sulfate [c]	Static water	Mobile water	Class for location
1	2 (SO_4 mg/l)	3 (Mg mg/l)	4 (SO_4 mg/l)	5 (Mg mg/l)	6 (SO_4 %)	7 (pH) [d]	8 (pH) [d]	9
DS-1	< 500		< 400		< 0.24	≥ 2.5		AC-1s
							> 6.5 [d]	AC-1
							5.5–6.5	AC-2z
							4.5–5.5	AC-3z
							2.5–4.5	AC-4z
DS-2	500–1500		400–1400		0.24–0.6	> 5.5		AC-1s
							> 6.5	AC-2
						2.5–5.5		AC-2s
							5.5–6.5	AC-3z
							4.5–5.5	AC-4z
							2.5-4.5	AC-5z
DS-3	1600–3000		1500–3000		0.7–1.2	> 5.5		AC-2s
							> 6.5	AC-3
						2.5–5.5		AC-3s
							5.5–6.5	AC-4
							2.5–5.5	AC-5
DS-4	3100–6000	≤ 1200	3100–6000	≤ 1000	1.3–2.4	> 5.5		AC-3s
							> 6.5	AC-4
						2.5–5.5		AC-4s
							2.5–6.5	AC-5
DS-4m	3100–6000	> 1200 [e]	3100–6000	> 1000 [e]	1.3–2.4	> 5.5		AC-3s
							> 6.5	AC-4m
						2.5–5.5		AC-4ms
							2.5–6.5	AC-5m
DS-5	> 6000	≤ 1200	> 6000	≤ 1000	> 2.4	> 5.5		AC-4s
						2.5–5.5	≥ 2.5	AC-5
DS-5m	> 6000	> 1200 [e]	> 6000	> 1000 [e]	> 2.4	> 5.5		AC-4ms
						2.5–5.5	≥ 2.5	AC-5m

Notes
a Brownfield locations are those sites, or parts of sites, that might contain chemical residues produced by or associated with industrial production (Section C5.1.3).
b The limits of Design Sulfate Classes based on 2:1 water/soil extracts have been lowered from previous Digests (Box C7).
c Applies only to locations where concrete will be exposed to sulfate ions (SO_4), which may result from the oxidation of sulfides such as pyrite, following ground disturbance (Appendix A1 and Box C8).
d An additional account is taken of hydrochloric and nitric acids by adjustment to sulfate content (Section C5.1.3).
e The limit on water-soluble magnesium does not apply to brackish groundwater (chloride content between 12 000 mg/l and 17 000 mg/l). This allows 'm' to be omitted from the relevant ACEC classification. Seawater (chloride content about 18 000 mg/l) and stronger brines are not covered by this table.

Explanation of suffix symbols to ACEC Class
- Suffix 's' indicates that the water has been classified as static.
- Concrete placed in ACEC Classes that include the suffix 'z' have primarily to resist acid conditions and may be made with any of the cements in Table D2 on page 42.
- Suffix 'm' relates to the higher levels of magnesium in Design Sulfate Classes 4 and 5.

CONTAMINATION ANALYSIS RESULTS

SUB SURFACE LIMITED

SITE INVESTIGATION AND SPECIALIST GEOTECHNICAL CONSULTANTS

3 Peel Street, Preston, PR2 2QS. Tel. (01772) 561135 Fax (01772) 204907

Contamination Analysis

Site: OLD MARKET STREET, MANCHESTER

Client: ZAHID KHALID

Engineer:

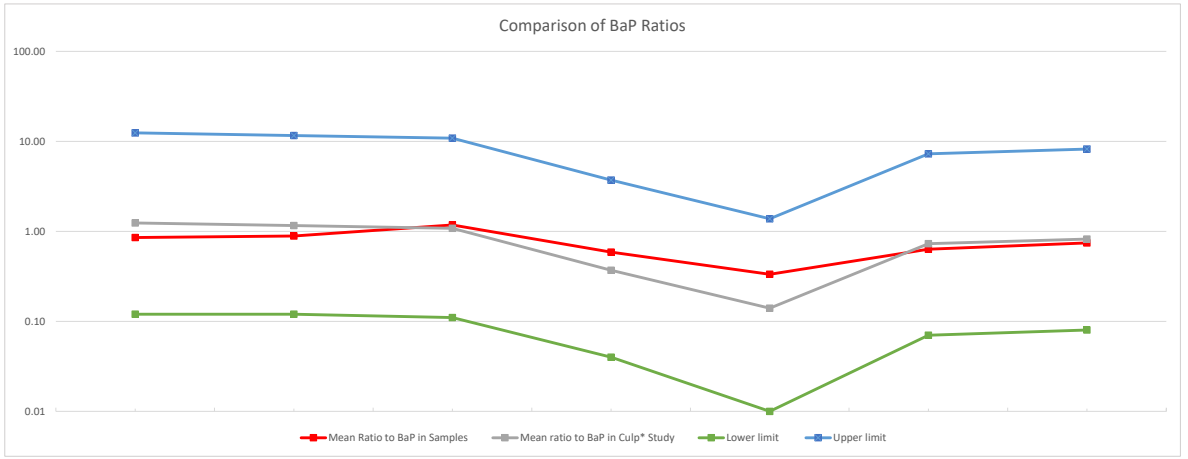
Job Number: 7268

Sheet: 1 / 1

Benzo(a)pyrene Surrogate Marker Test

		Exp. Hole No./ Depth	M3	M4	M5																				Mean Concentrations
		Depth	0.60	0.00	0.00																				
		Units	mg/kg	mg/kg	mg/kg																				mg/kg
Ratio to BaP	Benzo(a)pyrene		< 0.10	3.00	6.00																				4.50
	Benzo[a]anthracene		0.85	2.70	8.00																				3.85
	Chrysene		0.78	3.30	7.90																				3.99
	Benzo[b]fluoranthene		< 0.10	3.00	7.60																				5.30
	Benzo[k]fluoranthene		< 0.10	1.60	3.70																				2.65
	Dibenz[ah]anthracene		< 0.10	1.40	1.60																				1.50
	Indeno[123-cd]pyrene		< 0.10	1.50	4.20																				2.85
	Benzo[ghi]perylene		< 0.10	2.00	4.70																				3.35

PAH	Units	Mean Concentrations in samples	Mean Ratio to BaP in Samples	Mean ratio to BaP in Culp* Study	Lower limit	Upper limit
Benzo(a)pyrene	mg/kg	4.50	1.00	_	_	_
Benz[a]anthracene	mg/kg	3.85	0.86	1.24	0.12	12.43
Chrysene	mg/kg	3.99	0.89	1.16	0.12	11.61
Benzo[b]fluoranthene	mg/kg	5.30	1.18	1.08	0.11	10.85
Benzo[k]fluoranthene	mg/kg	2.65	0.59	0.37	0.04	3.72
Dibenz[ah]anthracene	mg/kg	1.50	0.33	0.14	0.01	1.38
Indeno[123-cd]pyrene	mg/kg	2.85	0.63	0.73	0.07	7.27
Benzo[ghi]perylene	mg/kg	3.35	0.74	0.82	0.08	8.22



Comments:

*CULP, S.J., GAYLOR, D.W., SHELDON, W.G. GOLDSTEIN, L.W., BELAND, F.A., 1998. A comparison of the tumors induced by coal tar and benzo(a)pyrene in a 2-year bioassay.

Assessed in accordance with Development of Category 4 Screening Levels for assessment of land affected by contamination - SP1010 Appendix E

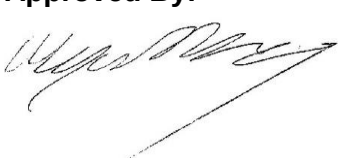
Eurofins Chemtest Ltd
Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.com

Final Report

Report No.:	21-20984-1
Initial Date of Issue:	28-Jun-2021
Client	Sub Surface
Client Address:	3 Peel Street Preston Lancashire PR2 2QS
Contact(s):	Simon Gabbatt
Project	7268 Old Market Street, Manchester

Quotation No.:		**Date Received:**	21-Jun-2021
Order No.:		**Date Instructed:**	21-Jun-2021
No. of Samples:	5		
Turnaround (Wkdays):	7	**Results Due:**	29-Jun-2021
Date Approved:	28-Jun-2021		

Approved By:



Details: Glynn Harvey, Technical Manager

Results - Soil

Project: 7268 Old Market Street, Manchester

Client: Sub Surface			**Chemtest Job No.:**		21-20984	21-20984	21-20984	21-20984	21-20984
Quotation No.:			**Chemtest Sample ID.:**		1224759	1224760	1224761	1224762	1224763
			Client Sample ID.:		177	148	169	153	182
			Sample Location:		M1	M2	M3	M4	M5
			Sample Type:		SOIL	SOIL	SOIL	SOIL	SOIL
			Top Depth (m):		1.20	2.00	0.60	0.00	0.00
			Bottom Depth (m):		1.65	2.45	1.20	0.60	0.60
			Date Sampled:		09-Jun-2021	09-Jun-2021	09-Jun-2021	09-Jun-2021	09-Jun-2021
			Asbestos Lab:				COVENTRY	COVENTRY	COVENTRY
Determinand	**Accred.**	**SOP**	**Units**	**LOD**					
ACM Type	U	2192		N/A			-	-	-
Asbestos Identification	U	2192		N/A			No Asbestos Detected	No Asbestos Detected	No Asbestos Detected
Moisture	N	2030	%	0.020	17	14	16	8.4	31
pH	U	2010		4.0	7.7	7.8	8.4	8.2	7.8
Boron (Hot Water Soluble)	U	2120	mg/kg	0.40			< 0.40	0.55	< 0.40
Sulphate (2:1 Water Soluble) as SO4	U	2120	g/l	0.010	< 0.010	< 0.010	< 0.010		
Cyanide (Total)	U	2300	mg/kg	0.50			< 0.50	< 0.50	< 0.50
Sulphide (Easily Liberatable)	N	2325	mg/kg	0.50			< 0.50	5.4	5.4
Sulphate (Total)	U	2430	%	0.010			2.6	0.12	0.091
Arsenic	U	2450	mg/kg	1.0			12	21	9.8
Cadmium	U	2450	mg/kg	0.10			0.19	0.36	0.26
Chromium	U	2450	mg/kg	1.0			18	23	15
Molybdenum	U	2450	mg/kg	2.0			< 2.0	< 2.0	< 2.0
Copper	U	2450	mg/kg	0.50			34	47	50
Mercury	U	2450	mg/kg	0.10			0.16	0.81	0.23
Nickel	U	2450	mg/kg	0.50			22	25	17
Lead	U	2450	mg/kg	0.50			76	110	110
Selenium	U	2450	mg/kg	0.20			0.28	0.42	0.28
Zinc	U	2450	mg/kg	0.50			61	96	87
Chromium (Hexavalent)	N	2490	mg/kg	0.50			< 0.50	< 0.50	< 0.50
TPH >C6-C10	N	2670	mg/kg	1.0			< 1.0	< 1.0	< 1.0
TPH >C10-C21	N	2670	mg/kg	1.0			< 1.0	29	98
TPH >C21-C40	N	2670	mg/kg	1.0			< 1.0	64	140
Total TPH >C6-C40	U	2670	mg/kg	10			< 10	93	240
Naphthalene	U	2700	mg/kg	0.10			< 0.10	0.17	1.0
Acenaphthylene	U	2700	mg/kg	0.10			< 0.10	0.21	1.1
Acenaphthene	U	2700	mg/kg	0.10			< 0.10	0.27	1.0
Fluorene	U	2700	mg/kg	0.10			< 0.10	0.30	1.8
Phenanthrene	U	2700	mg/kg	0.10			< 0.10	2.1	12
Anthracene	U	2700	mg/kg	0.10			< 0.10	0.61	4.2
Fluoranthene	U	2700	mg/kg	0.10			0.66	4.1	14
Pyrene	U	2700	mg/kg	0.10			0.85	4.4	15
Benzo[a]anthracene	U	2700	mg/kg	0.10			0.85	2.7	8.0
Chrysene	U	2700	mg/kg	0.10			0.78	3.3	7.9
Benzo[b]fluoranthene	U	2700	mg/kg	0.10			< 0.10	3.0	7.6
Benzo[k]fluoranthene	U	2700	mg/kg	0.10			< 0.10	1.6	3.7

Results - Soil

Project: 7268 Old Market Street, Manchester

Client: Sub Surface					**Chemtest Job No.:**	21-20984	21-20984	21-20984	21-20984	21-20984
Quotation No.:					**Chemtest Sample ID.:**	1224759	1224760	1224761	1224762	1224763
					Client Sample ID.:	177	148	169	153	182
					Sample Location:	M1	M2	M3	M4	M5
					Sample Type:	SOIL	SOIL	SOIL	SOIL	SOIL
					Top Depth (m):	1.20	2.00	0.60	0.00	0.00
					Bottom Depth (m):	1.65	2.45	1.20	0.60	0.60
					Date Sampled:	09-Jun-2021	09-Jun-2021	09-Jun-2021	09-Jun-2021	09-Jun-2021
					Asbestos Lab:			COVENTRY	COVENTRY	COVENTRY
Determinand	**Accred.**	**SOP**	**Units**	**LOD**						
Benzo[a]pyrene	U	2700	mg/kg	0.10				< 0.10	3.0	6.0
Indeno(1,2,3-c,d)Pyrene	U	2700	mg/kg	0.10				< 0.10	1.5	4.2
Dibenz(a,h)Anthracene	U	2700	mg/kg	0.10				< 0.10	1.4	1.6
Benzo[g,h,i]perylene	U	2700	mg/kg	0.10				< 0.10	2.0	4.7
Total Of 16 PAH's	U	2700	mg/kg	2.0				3.1	31	94
Dichlorodifluoromethane	U	2760	µg/kg	1.0				< 1.0		
Chloromethane	U	2760	µg/kg	1.0				< 1.0		
Vinyl Chloride	U	2760	µg/kg	1.0				< 1.0		
Bromomethane	U	2760	µg/kg	20				< 20		
Chloroethane	U	2760	µg/kg	2.0				< 2.0		
Trichlorofluoromethane	U	2760	µg/kg	1.0				< 1.0		
1,1-Dichloroethene	U	2760	µg/kg	1.0				< 1.0		
Trans 1,2-Dichloroethene	U	2760	µg/kg	1.0				< 1.0		
1,1-Dichloroethane	U	2760	µg/kg	1.0				< 1.0		
cis 1,2-Dichloroethene	U	2760	µg/kg	1.0				< 1.0		
Bromochloromethane	U	2760	µg/kg	5.0				< 5.0		
Trichloromethane	U	2760	µg/kg	1.0				< 1.0		
1,1,1-Trichloroethane	U	2760	µg/kg	1.0				< 1.0		
Tetrachloromethane	U	2760	µg/kg	1.0				< 1.0		
1,1-Dichloropropene	U	2760	µg/kg	1.0				< 1.0		
Benzene	U	2760	µg/kg	1.0				< 1.0	< 1.0	< 1.0
1,2-Dichloroethane	U	2760	µg/kg	2.0				< 2.0		
Trichloroethene	N	2760	µg/kg	1.0				< 1.0		
1,2-Dichloropropane	U	2760	µg/kg	1.0				< 1.0		
Dibromomethane	U	2760	µg/kg	1.0				< 1.0		
Bromodichloromethane	U	2760	µg/kg	5.0				< 5.0		
cis-1,3-Dichloropropene	N	2760	µg/kg	10				< 10		
Toluene	U	2760	µg/kg	1.0				< 1.0	< 1.0	< 1.0
Trans-1,3-Dichloropropene	N	2760	µg/kg	10				< 10		
1,1,2-Trichloroethane	U	2760	µg/kg	10				< 10		
Tetrachloroethene	U	2760	µg/kg	1.0				< 1.0		
1,3-Dichloropropane	U	2760	µg/kg	2.0				< 2.0		
Dibromochloromethane	U	2760	µg/kg	10				< 10		
1,2-Dibromoethane	U	2760	µg/kg	5.0				< 5.0		
Chlorobenzene	U	2760	µg/kg	1.0				< 1.0		
1,1,1,2-Tetrachloroethane	U	2760	µg/kg	2.0				< 2.0		
Ethylbenzene	U	2760	µg/kg	1.0				< 1.0	< 1.0	< 1.0

Results - Soil

Project: 7268 Old Market Street, Manchester

Client: Sub Surface			**Chemtest Job No.:**		21-20984	21-20984	21-20984	21-20984	21-20984
Quotation No.:			**Chemtest Sample ID.:**		1224759	1224760	1224761	1224762	1224763
			Client Sample ID.:		177	148	169	153	182
			Sample Location:		M1	M2	M3	M4	M5
			Sample Type:		SOIL	SOIL	SOIL	SOIL	SOIL
			Top Depth (m):		1.20	2.00	0.60	0.00	0.00
			Bottom Depth (m):		1.65	2.45	1.20	0.60	0.60
			Date Sampled:		09-Jun-2021	09-Jun-2021	09-Jun-2021	09-Jun-2021	09-Jun-2021
			Asbestos Lab:				COVENTRY	COVENTRY	COVENTRY
Determinand	**Accred.**	**SOP**	**Units**	**LOD**					
m & p-Xylene	U	2760	µg/kg	1.0			< 1.0	6.1	< 1.0
o-Xylene	U	2760	µg/kg	1.0			< 1.0	< 1.0	< 1.0
Styrene	U	2760	µg/kg	1.0			< 1.0		
Tribromomethane	U	2760	µg/kg	1.0			< 1.0		
Isopropylbenzene	U	2760	µg/kg	1.0			< 1.0		
Bromobenzene	U	2760	µg/kg	1.0			< 1.0		
1,2,3-Trichloropropane	N	2760	µg/kg	50			< 50		
N-Propylbenzene	U	2760	µg/kg	1.0			< 1.0		
2-Chlorotoluene	U	2760	µg/kg	1.0			< 1.0		
1,3,5-Trimethylbenzene	U	2760	µg/kg	1.0			< 1.0		
4-Chlorotoluene	U	2760	µg/kg	1.0			< 1.0		
Tert-Butylbenzene	U	2760	µg/kg	1.0			< 1.0		
1,2,4-Trimethylbenzene	U	2760	µg/kg	1.0			< 1.0		
Sec-Butylbenzene	U	2760	µg/kg	1.0			< 1.0		
1,3-Dichlorobenzene	U	2760	µg/kg	1.0			< 1.0		
4-Isopropyltoluene	U	2760	µg/kg	1.0			< 1.0		
1,4-Dichlorobenzene	U	2760	µg/kg	1.0			< 1.0		
N-Butylbenzene	U	2760	µg/kg	1.0			< 1.0		
1,2-Dichlorobenzene	U	2760	µg/kg	1.0			< 1.0		
1,2-Dibromo-3-Chloropropane	U	2760	µg/kg	50			< 50		
1,2,4-Trichlorobenzene	U	2760	µg/kg	1.0			< 1.0		
Hexachlorobutadiene	U	2760	µg/kg	1.0			< 1.0		
1,2,3-Trichlorobenzene	U	2760	µg/kg	2.0			< 2.0		
Methyl Tert-Butyl Ether	U	2760	µg/kg	1.0			< 1.0	< 1.0	< 1.0
Total Phenols	U	2920	mg/kg	0.10			< 0.10	< 0.10	< 0.10

Report Information

Key

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

Comments or interpretations are beyond the scope of UKAS accreditation
The results relate only to the items tested
Uncertainty of measurement for the determinands tested are available upon request
None of the results in this report have been recovery corrected
All results are expressed on a dry weight basis

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

For all other tests the samples were dried at < 37°C prior to analysis
All Asbestos testing is performed at the indicated laboratory
Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

Sample Deviation Codes

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

Sample Retention and Disposal

All soil samples will be retained for a period of 30 days from the date of receipt
All water samples will be retained for 14 days from the date of receipt
Charges may apply to extended sample storage

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

MINI BOREHOLE RECORD SHEETS

SUB SURFACE

SITE INVESTIGATION SPECIALISTS, GEOTECHNICAL & ENVIRONMENTAL CONSULTANTS
3 Peel Street, Preston, Lancashire, PR2 2QS. Tel: (01772) 561135 Fax: (01772) 204907

Site	Borehole Number
OLD MARKET STREET, MANCHESTER	M1

Boring Method	Casing Diameter	Ground Level (mOD)	Client	Job Number
MINI PERCUSSIVE			ZAHID KHALID	7268
	Location AS PLAN	**Dates** 09/06/2021	**Engineer**	**Sheet** 1/1

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
0.00-0.70	B					(0.70)	MADE GROUND: soft dark brown, slightly gravelly slightly sandy clayey silt with occasional rootlets and occasional fragments of wood. Gravel sized fragments are fine to coarse stone, concrete and glass. (Topsoil).			
0.70-1.20	B					0.70	MADE GROUND: soft dark brown, slightly gravelly slightly sandy silty clay with occasional rootlets. Gravel sized fragments are fine to medium stone.			
1.20-1.65 1.20-2.00 1.20-1.65	D C SPT N=6			1.20m to 2.00m - 100% recovery 1,1/1,1,2,2		(0.90)				
						1.60	Loose orangish brown slightly gravelly slightly clayey silty fine to coarse SAND with occasional rootlets. Gravel is angular to subrounded quartz, siltstone and coal.			
						(0.40)				
2.00-2.45 2.00-3.00 2.00-2.45	D C SPT N=20			2.00m to 3.00m - 70% recovery 2,3/4,5,5,6		2.00	Medium dense becoming dense orangish brown slightly silty fine to medium SAND.			
3.00-3.45 3.00-4.00 3.00-3.45	D C SPT N=30			3.00m to 4.00m - 100% recovery 8,6/7,7,8,8		(2.45)	.... below 3.15m : dense			
4.00-4.45 4.00-4.45	SPT N=35 D			5,8/9,9,8,9						
				09/06/2021:DRY		4.45	Complete at 4.45m			

Remarks
Hand dug inspection pit from GL to 1.20m to check for services.
C = Plastic lined core sample
Core diameter : 84mm to 2.00m and 64mm to 4.00m
On completion installed a 50mm dia slotted standpipe with a gas valve and a gravel surround to 4.00m, a Bentonite seal from 1.00m to 0.20m and a concreted in lockable steel protective cover from 0.20m to GL.

Scale (approx)	Logged By
1:25	PM/SJ

Figure No. 7268.M1

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SUB SURFACE

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3 Peel Street, Preston, Lancashire, PR2 2QS. Tel: (01772) 561135 Fax: (01772) 204907

Site	Borehole Number
OLD MARKET STREET, MANCHESTER	M2

Boring Method	Casing Diameter	Ground Level (mOD)	Client	Job Number
MINI PERCUSSIVE			ZAHID KHALID	7268
	Location AS PLAN	**Dates** 09/06/2021	**Engineer**	**Sheet** 1/1

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
0.00-0.90	B					(0.90)	MADE GROUND: soft dark brown slightly gravelly slightly sandy clayey silt with low cobble sized fragments of stone and some rootlets. Gravel sized fragments are fine to coarse stone, concrete and wood. (Topsoil).			
0.90-1.20	B					0.90	MADE GROUND: soft dark brown slightly gravelly sandy silty clay with low cobble sized fragments of stone and occasional rootlets. Gravel sized fragments are fine to coarse stone and brick.			
1.20-1.65 1.20-2.00 1.20-1.65	D C SPT N=5			1.20m to 2.00m - 100% recovery 1,1/1,1,1,2		(0.80)				
						1.70	Soft locally stiff low strength becoming medium then high strength dark brown slightly gravelly very sandy silty CLAY with occasional rootlets. Gravel is subangular to subrounded fine to coarse siltstone and quartz.			
2.00-2.45 2.00-3.00 2.00-2.45	D C SPT N=9			2.00m to 3.00m - 80% recovery 1,2/2,2,2,3						
3.00-3.45 3.00-4.00 3.00-3.45	D C SPT N=12			3.00m to 4.00m - 65% recovery 2,2/3,3,3,3		(2.75)	.... below 3.15m : medium strength			
4.00-4.45 4.00-4.45	SPT N=20 D			3,4/5,5,5,5			.... below 4.15m : high strength			
				09/06/2021:DRY		4.45	Complete at 4.45m			

Remarks
Hand dug inspection pit from GL to 1.20m to check for services.
C = Plastic lined core sample
Core diameter : 84mm to 3.00m and 64mm to 4.00m
On completion installed a 50mm dia slotted standpipe with a gas valve and a gravel surround to 4.00m, a Bentonite seal from 1.00m to 0.20m and a concreted in lockable steel protective cover from 0.20m to GL.

Scale (approx)	Logged By
1:25	PM/SJ

Figure No. 7268.M2

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3 Peel Street, Preston, Lancashire, PR2 2QS. Tel: (01772) 561135 Fax: (01772) 204907

Site	Borehole Number
OLD MARKET STREET, MANCHESTER	M3

Boring Method	Casing Diameter	Ground Level (mOD)	Client	Job Number
MINI PERCUSSIVE			ZAHID KHALID	7268
	Location AS PLAN	**Dates** 09/06/2021	**Engineer**	**Sheet** 1/1

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
0.00-0.60	B					(0.60)	MADE GROUND: soft light grey gravelly slightly sandy clayey silt with low cobble sized fragments of stone and tarmac. Gravel sized fragments are fine to coarse brick, stone, concrete and tarmac.			
0.60-1.20	B					0.60 (0.90)	MADE GROUND: soft dark brown slightly gravelly slightly sandy silty clay with low cobble sized fragments of stone. Gravel sized fragments are fine to coarse stone, brick, concrete and tile.			
1.20-1.65 1.20-2.00 1.20-1.65	D C SPT N=2			1.20m to 2.00m - 95% recovery 2,2/1,0,1,0		1.50 (1.50)	Very soft extremely low strength brown slightly gravelly sandy silty CLAY. Gravel comprises subangular to subrounded fine to coarse quartz and siltstone. .... below 2.25m : with low siltstone cobble content			
2.00-2.45 2.00-3.00 2.00-2.45	D C SPT N=2			2.00m to 3.00m - 75% recovery 1,0/0,1,1,0						
3.00-3.45 3.00-4.00 3.00-3.45	D C SPT N=15			3.00m to 4.00m : 65%% recovery 2,3/3,4,4,4		3.00 (1.45)	Firm locally stiff, medium strength becoming high strength brown slightly gravelly very sandy silty CLAY with occasional rootlets. Gravel sized fragments are subangular to rounded fine to coarse siltstone and quartz. .... below 4.15m : high strength			
4.00-4.45 4.00-4.45	SPT N=19 D			4,4/5,5,4,5 09/06/2021:DRY		4.45	Complete at 4.45m			

Remarks
Hand dug inspection pit from GL to 1.20m to check for services.
C = Plastic lined core sample
Core diameter : 84mm to 3.00m and 65mm to 3.65m
On completion backfilled with arisings and installed a 50mm dia slotted standpipe with a gas valve and a gravel surround to 4.00m, a Bentonite seal from 1.00m to 0.20m and a concreted in lockable steel protective cover from 0.20m to GL.

Scale (approx)	Logged By
1:25	PM/SJ

Figure No. 7268.M3

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SUB SURFACE

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3 Peel Street, Preston, Lancashire, PR2 2QS. Tel: (01772) 561135 Fax: (01772) 204907

Site	Borehole Number
OLD MARKET STREET, MANCHESTER	M4

Boring Method	Casing Diameter	Ground Level (mOD)	Client	Job Number
MINI PERCUSSIVE			ZAHID KHALID	7268
	Location AS PLAN	**Dates** 09/06/2021	**Engineer**	**Sheet** 1/2

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-0.60	B					(0.60)	MADE GROUND: soft dark brown slightly gravelly slightly sandy clayey silt with many rootlets. Gravel sized fragments are fine to coarse brick and stone. (Topsoil).		
0.60-1.20	B					0.60 (0.60)	MADE GROUND: soft dark brown slightly gravelly slightly sandy silty clay with occasional rootlets. Gravel sized fragments are fine to medium siltstone and coal.		
1.20-1.65 1.20-2.00 1.20-1.65	D C SPT N=9			1.20m to 2.00m - 100% recovery 1,2/2,2,3,2		1.20	MADE GROUND: soft locally firm dark brown slightly gravelly slightly sandy silty clay with occasional rootlets. Gravel sized fragments are fine to medium stone.		
2.00-2.45 2.00-3.00 2.00-2.45	D C SPT N=13			2.00m to 3.00m - 100% recovery 2,3/3,3,3,4		(1.80)			
3.00-3.45 3.00-4.00 3.00-3.45	D C SPT N=18			3.00m to 4.00m - 80% recovery 3,3/4,4,5,5		3.00 (1.00)	MADE GROUND: soft dark brown gravelly slightly sandy clayey silt with occasional lenses of sand and some rootlets. Gravel sized fragments are fine to coarse brick, stone, concrete and coal.		
4.00-4.45 4.00-5.00 4.00-4.45	D C SPT N=21			4.00m to 5.00m - 55% recovery 4,5/4,5,6,6		4.00 (1.00)	Medium dense orangish brown fine to medium SAND.		
5.00-5.45	SPT N=26			4,7/6,6,7,7					

Remarks
Hand dug inspection pit from GL to 1.20m to check for services.
C = Plastic lined core sample
Core diameter : 84mm to 2.00m, 74mm to 3.00m, 64mm to 4.00m and 54mm to 5.00m
On completion backfilled with arisings.

Scale (approx)	Logged By
1:25	PM/SJ

Figure No. 7268.M4

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Site	Borehole Number
OLD MARKET STREET, MANCHESTER	M4

Boring Method	Casing Diameter	Ground Level (mOD)	Client	Job Number
MINI PERCUSSIVE			ZAHID KHALID	7268
	Location AS PLAN	**Dates** 09/06/2021	**Engineer**	**Sheet** 2/2

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
				09/06/2021:DRY		5.00 (0.45) 5.45	Medium dense orangish brown slightly gravelly fine to medium SAND. Gravel is subangular to subrounded fine to coarse siltstone. Complete at 5.45m		

Remarks

Scale (approx)	Logged By
1:25	PM/SJ

Figure No. 7268.M4

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Site	Borehole Number
OLD MARKET STREET, MANCHESTER	M5

Boring Method	Casing Diameter	Ground Level (mOD)	Client	Job Number
MINI PERCUSSIVE			ZAHID KHALID	7268
	Location AS PLAN	**Dates** 09/06/2021	**Engineer**	**Sheet** 1/1

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.00-0.50	B			09/06/2021:DRY		(0.50) 0.50	MADE GROUND: soft dark brown gravelly slightly sandy clayey silt with low cobble sized fragments of brick, many rootlets and occasional fragments of wood. Gravel sized fragments are fine to coarse brick and stone.		
							Complete at 0.50m		

Remarks
Hand dug inspection pit from GL to 1.20m to check for services.
On completion backfilled with arisings.

Scale (approx)	Logged By
1:25	PM/SJ

Figure No. 7268.M5

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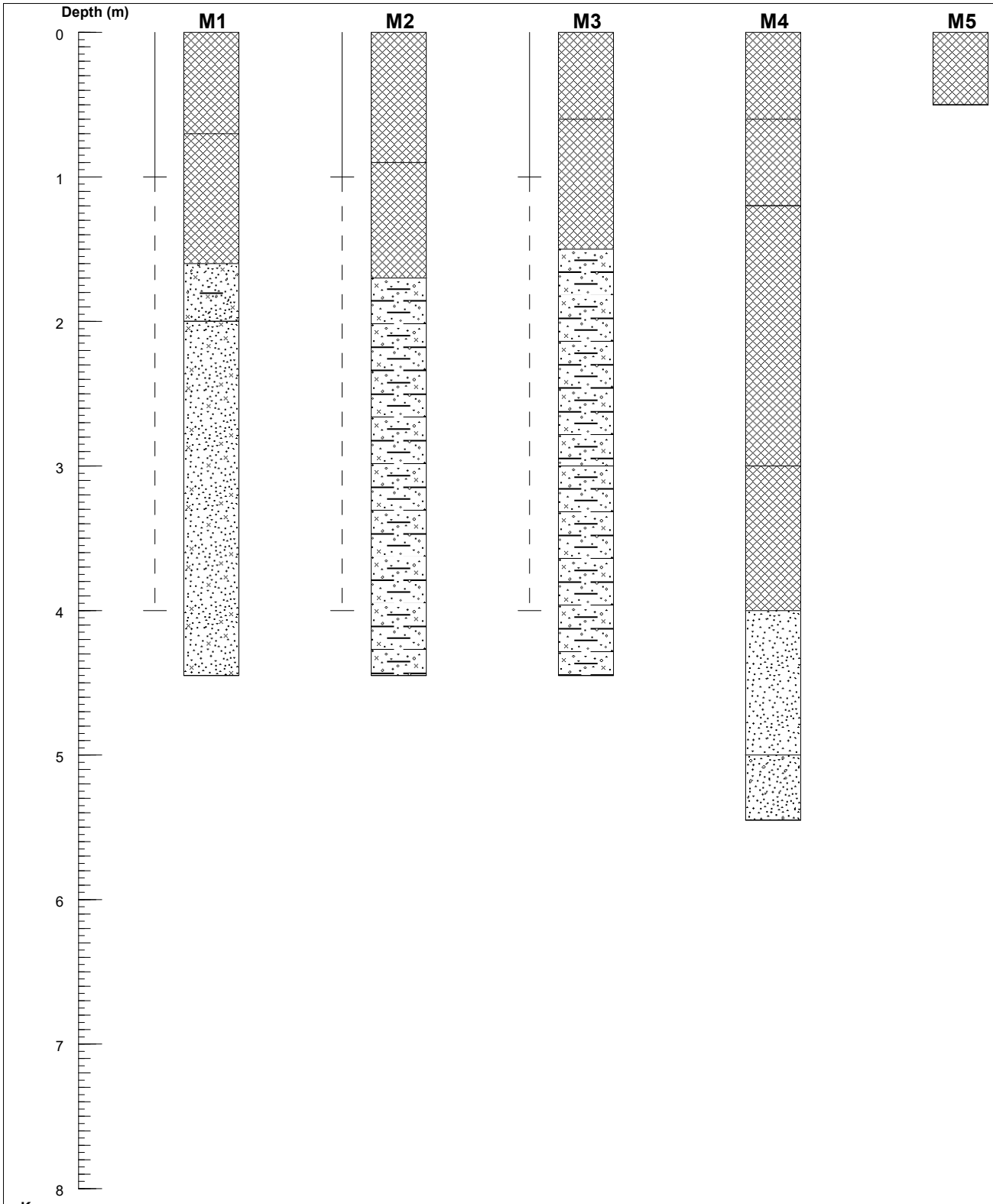

Key

- Groundwater Strike
- Strike Rise Level
- Highest recorded piezo level
- Piezometer Tip
- Slotted Standpipe
- MADE GROUND
- Silty sandy gravelly CLAY
- SAND
- Silty SAND
- Gravelly SAND
- Clayey silty gravelly SAND

SUB SURFACE
SITE INVESTIGATION SPECIALISTS, GEOTECHNICAL & ENVIRONMENTAL CONSULTANTS
3 Peel Street, Preston, Lancashire, PR2 2QS. Tel: (01772) 561135 Fax: (01772) 204907

Nominal Section

Site	Date Drawn	Date Checked	Sheet	Job Number
OLD MARKET STREET, MANCHESTER	05/08/2021		1/1	7268
Client	**Drawn By**	**Checked By**	**Scale**	**Figure No.**
ZAHID KHALID			1:40[V]	7268.1

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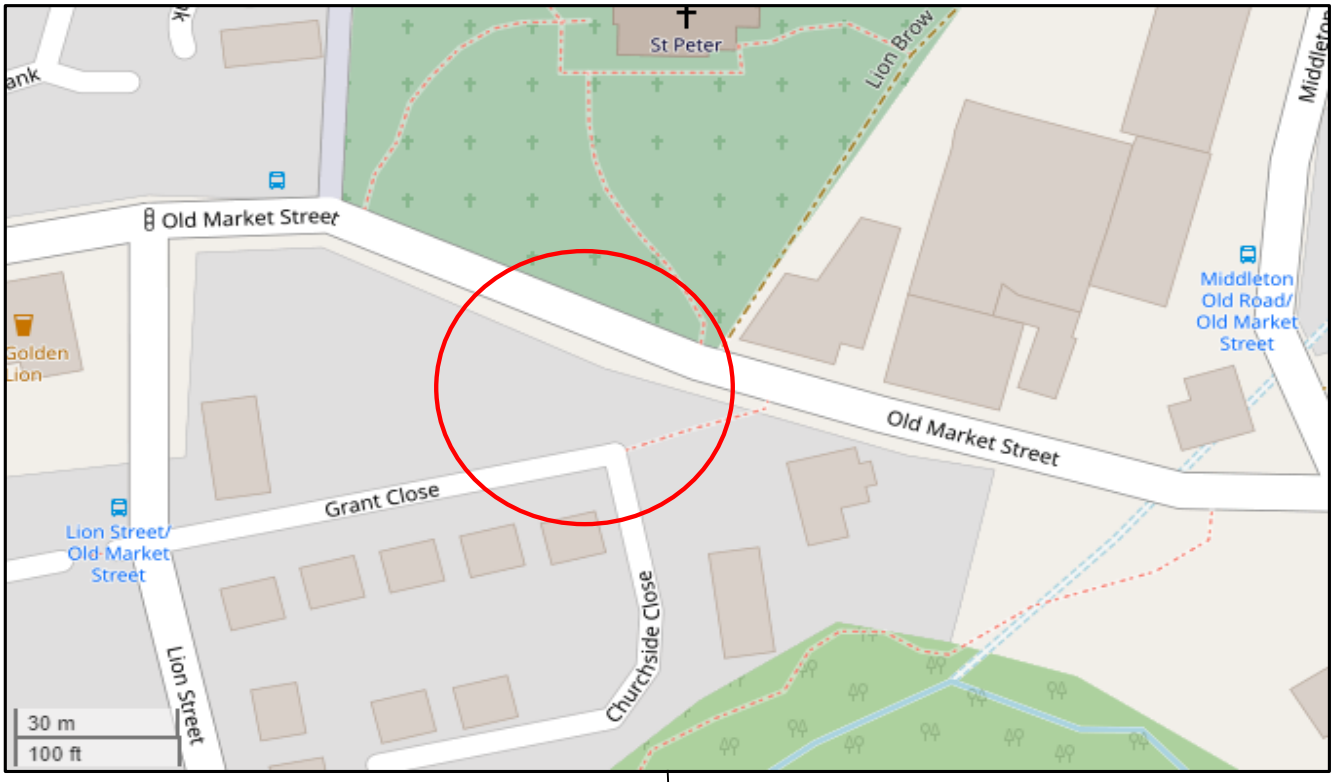
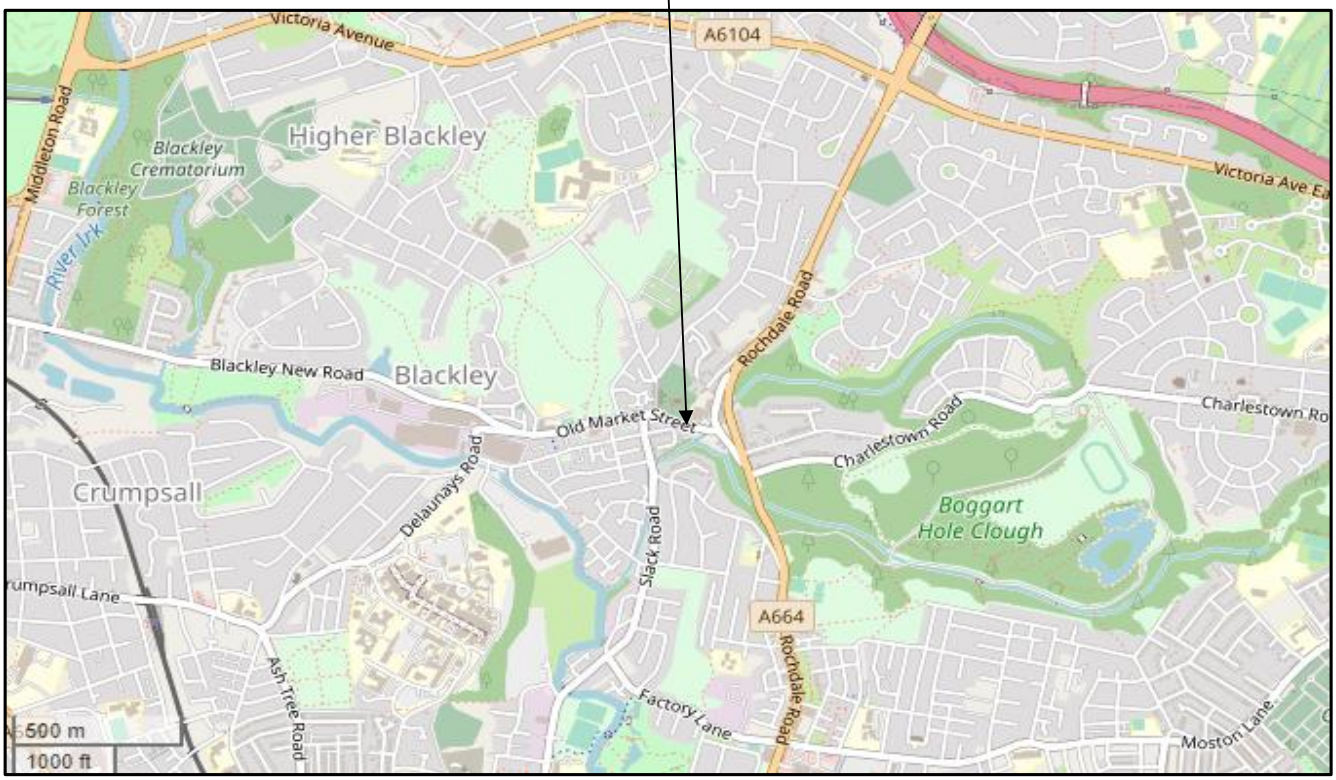
FIGURES





SUB SURFACE SITE INVESTIGATION AND SPECIALIST GEOTECHNICAL CONSULTANTS 3 Peel Street, Preston, PR2 2QS. Tel. (01772) 561135 Fax (01772) 204907		General Site Location		
Site OLD MARKET STREET, MANCHESTER	Date Drawn 03/08/2021	Date Checked	Orientation N	Job No. 7268
Client ZAHID KHALID	Drawn By DJ	Checked By	Scale As Shown	Figure No. 1

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1 Storey - Bungalow

2 Storey - Semi-Detached

Services/Civic

Commercial

Client	ZAHID KHALID
Site	OLD MARKET STREET, MANCHESTER
	SUB SURFACE
	SITE INVESTIGATION AND SPECIALIST GEOTECHNICAL CONSULTANTS
	3 Peel Street, Preston, PR2 2QS. Tel. (01772) 561135 Fax (01772) 204907
	Site location
Drawn By	DJ
Date Drawn	03-Aug-21
Checked By	
Date Checked	
Scale	–
Orientation	
Figure No.	2
Job No.	7268

01 | Site Context
19003 | 0m 5 10 15 20 25 m | 1 : 500 @ A3 | Development
Old Market Street, Manchester, M9 8DX

P4BA
P4B ARCHITECTURE | 15 MEMORIAL ROAD
P4BA.COM | WORSLEY
INFO@P4BA.COM | MANCHESTER
0800 731 4707 | M28 3AQ

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02 19003 | **Ground Floor Plan** 0m 1 2 3 4 5m | 1 : 200 @ A3 | **Development** Old Market Street, Manchester, M9 8DX

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SUB SURFACE

SITE INVESTIGATION AND SPECIALIST GEOTECHNICAL CONSULTANTS

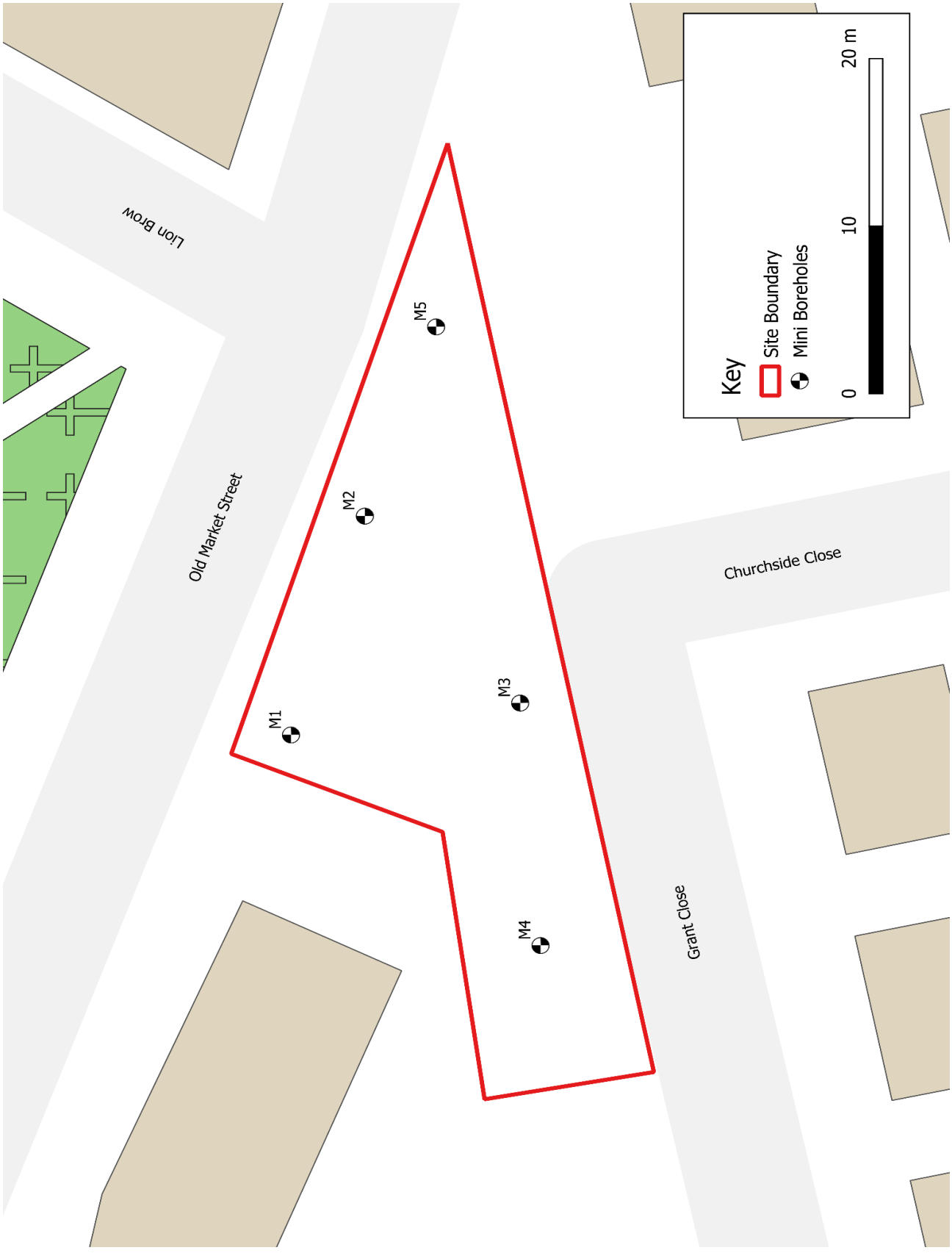
3 Peel Street, Preston, PR2 2QS. Tel. (01772) 561135 Fax (01772) 204907

Site: OLD MARKET STREET, MANCHESTER

Client: ZAHID KHALID

Proposed Development

Drawn By	Date Drawn	Checked By	Date Checked	Scale	Orientation	Job No.	Figure No.
DJ	03-Aug-21			–		7268	3



SUB SURFACE

SITE INVESTIGATION AND SPECIALIST GEOTECHNICAL CONSULTANTS

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Locations of Exploratory Holes

Site	Date Drawn	Date Checked	Orientation	Job No.
OLD MARKET STREET, MANCHESTER	03-Aug-21			7268
Client	**Drawn By**	**Checked By**	**Scale**	**Figure No.**
ZAHID KHALID	DJ		–	4