INVESTIGATE

REMEDIATE

REGENERATE

SUB SURFACE
Site Investigation Specialists,
Geotechnical & Environmental Consultants

REMEDIATION STRATEGY REPORT

AT
OLD MARKET STREET,
MANCHESTER,
M9 8HY

PREPARED FOR
ZAHID KHALID

REPORT NO. 7268B
MARCH 2022

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CONTENTS

1. INTRODUCTION	1.1	Site Location and Description
	1.2	Proposed Development and Purpose of the Remediation Statement
2. SITE ASSESSMENT	2.1	Current Status
	2.2	Summary of Previous Reports
	2.3	Environmental Setting
	2.4	Source, Pathway, Receptor Linkages
	2.5	Updated Conceptual Ground Model
3. REMEDIATION & VERIFICATION STRATEGY	3.1	Remediation Objectives
	3.2	Soil Contamination Remediation
	3.3	Ground Gas Remediation
	3.4	Site Operatives
	3.5	Environmental Mitigation Measures
	3.6	Caveats, Assumptions & Contingency Plan
	3.7	Verification Report
4. GENERAL		
APPENDICES		Figures

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REMEDIATION STRATEGY REPORT FOR OLD MARKET STREET, MANCHESTER, M9 8HY

CLIENT: ZAHID KHALID

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1. INTRODUCTION

Our brief is to provide a Phase III Remediation Strategy Report for submission to the Local Planning Authority (Manchester City Council).

We have prepared this Remediation Strategy Report following receipt of an email, dated 17th February 2022, from the Client.

The following reports have previously been issued for the site:

- Phase I Desk Study Report for this site, ref. A3274/19 and dated November 2019 by Earth, Environmental & Geotechnical Limited.
- Phase II Ground Investigation Report, ref. 7268 and dated August 2021 by Sub Surface Consultants Limited.
- Phase II Gas Updated Report, ref.7268A and dated November 2021 by Sub Surface Consultants Limited.

The above reports should be read in conjunction with this report and summaries are given in Section 2.2 below.

This report has been prepared in general accordance with the Environment Agency's Land Contamination Risk Management (LCRM) guidance (October 2020) and also meets the criteria for a Remediation Statement, to comply with Section 78H of Part 2A of the Environmental Protection Act 1990.

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 Remediation Statement

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 Remediation Statement is to set out the proposed remediation strategy and subsequent verification methodology.

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2. SITE ASSESSMENT

2.1 Current Status

A site reconnaissance was undertaken by Earth Environment and Geotechnical on 12th November 2019.

At the time of the survery the site was accessed via Grant Close and comprised a small disused grassy parcel of land with two hardstanding parking bays along the southern boundary. It was understood the site had been vacant for many years, most recently being used as part of a print works dating from 1848.

The site is covered by shrubs and grasses alongside large boulders. The site is bordered by wooden panel fencing and hedges to the west. The boundary to the north, east and south is demarcated by a public walkway.

The immediate surrounding areas to the south and west comprised of residential properties. To the north there was a church and to the east a works. The areas to the north were raised above the areas to the south meaning the site is sloping towards the south.

There were no significant changes to the site prior to the ground investigation undertaken in August 2021.

2.2 Summary of Previous Reports

2.2.1 Phase I

The Phase I investigation was undertaken by Earth Environment and Geotechnical in July 2021.

The earliest survey (1848) showed the site to be part of a print works. However, by 1891 the site was unoccupied. By 1932 the western part of the site was shown to be within the boundary of a neighbouring property although the site itself remained undeveloped. The current layout with the two small parking bays along the southern boundary was in place by 1988 with no further changes shown on site on the historical Ordnance Survey maps up to the current time. Google Earth™ imagery reveals the site was entirely covered in trees in 2000 with the majority cleared by 2009 and all remaining trees cleared by 2019.

In the wider area numerous industrial activities were identified, the most pertinent being the print works which included the site on the earliest survey, a works 60m to the south and a garage 80m to the south east on the 1959 survey, and an unspecified works revealed adjacent to the east on the 2000 Google Earth™ imagery.

The site was anticipated to be underlain by Glaciofluvial Sheet deposits, described as sand and gravel, in turn underlain by mudstone of the Manchester Marls Formation.

The preliminary conceptual ground model identified a potential for the presence of contamination associated with the following:

- Made Ground from on site development
- Past Industrial Site Use
- Asbestos containing materials (ACM) from former structures nearby to site
- Ground gas associated with deep made ground and both onsite and nearby industrial processes

Contaminants of potential concern were identified as heavy metals, polycyclic aromatic hydrocarbons (PAH), total petroleum hydrocarbons (TPH), BTEX compounds, Volatile Organic Compounds (VOC), Polychlorinated Biphenyls (PCB), asbestos and ground gases (Carbon dioxide and methane).

2.2.2 Phase II

The Phase II investigation was undertaken by Sub Surface North West Limited in August 2021. The investigation comprised five mini boreholes which encountered 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.

No groundwater was encountered in any of the exploratory holes during drilling 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.

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.

Contamination Assessment

In order to provide an assessment of the presence of contamination three soil samples were analysed for a suite of determinants and the results are appended. 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 for benzo(a)pyrene) in the area of M5.

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

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Given the slight exceedance the report recommend additional sampling and analysis to delineate and assess the statistical significance of the PAH contamination, which it was suggested may find that no remedial action is required or may reduce the area requiring intervention. Alternatively, the report recommended the pathway from the source to site operatives during earthworks, the end users of the development and any proposed planting (receptors) could be removed by precautions and/ or remedial measures. For this site it was recommended that a 600mm blanket of clean topsoil/ subsoil (equivalent to two spade depths) should be provided in back gardens and a 450mm blanket of imported clean topsoil/ subsoil should be provided in front and side gardens and other open spaces. In addition, it was recommended that deeper rooted bushes and trees should be pit planted on and in clean topsoil.

Ground Gas Assessment

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 1 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

Based on the monitoring data the report concluded that the site falls into Characteristic Situation CS2 (Low), and that for the type of development proposed (Type A), remedial measures giving a score of 3.5 would be required.

2.3 Environmental Setting

2.3.1 Topography

The site itself is generally flat, although the topography of the wider area has a slight slope down towards the Boggart Hole Brook in the south east.

2.3.2 Potentially Contaminative Land Use

According to the Phase I Desk Study There are eleven. records of potentially contaminative current land uses identified within 250m of the site. The closest record refers to an office and shop equipment supplier located 57m to the northeast of the site. Other records in the vicinity refer to unspecified works and factories, electrical features, signs, vehicle repair, testing and servicing.

2.3.3 Geology & Aquifer Designation

The site was anticipated to be underlain by Glaciofluvial Sheet deposits, described as sand and gravel, in turn underlain by mudstone of the Manchester Marls Formation.

The superficial deposits are classified by the Environment Agency (EA) as a Secondary A Aquifer. The glaciofluvial sheet deposits have a intergranular flow type and high to very high permeability.

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The Manchester Marl Formation is classified by the Environment Agency (EA) as a Secondary B Aquifer with a fracture flow type and low permeability.

The groundwater vulnerability and soil leaching potential of the soils at the site has been classified as a minor aquifer with high leaching potential.

2.3.4 Abstractions

At the time of the Phase I Desk Study there were eight groundwater abstraction licence records within 2km of the site, the nearest being a historical license for general cooling some 607m to the west of the site. There were no surface water abstraction licence records or potable water abstraction licence records within 2km of the site.

2.3.5 Surface Water

The Ordnance Survey indicate that there are no watercourses (river, stream or canal) within 250 metres of the site boundary.

The nearest surface water features (ponds or lakes) is located some 45m to the south east of the site (Boggart Hole Brook).

2.4 Source Pathway Receptor Linkages

The potential source, pathway, receptor linkages have been updated taking into account the findings of the intrusive ground investigation as follows:

2.4.1 Sources

Potential sources of contamination identified in the desk study and confirmed by the Phase II investigation are:

- PAH contaminants associated with the sites past industrial use and with made ground derived from the past development of the site.

2.4.2 Pathways

Potential pathways between sources and receptors for the proposed development are:

1. Direct contact with and ingestion of contaminated soil.
2. Ingestion of contaminated homegrown produce.
3. Inhalation of dust.
4. Environmental deposition of airborne pollutants.
5. Ingress of permanent ground gases into enclosed spaces.

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2.4.3 Receptors

Potential receptors for the proposed development are:

Construction Phase:

1. Site workers during any demolition and construction phases.
2. Adjacent properties and local residents.

Post Development Phase:

1. The residents who will be the end users of the site.
2. Adjacent properties and local residents.
3. The building structures and buried services including water supply pipes.
4. Vegetation, plants and bushes in garden and soft landscaped areas.

2.4.4 Potential Pollutant Linkages

Construction Phase:

- Direct contact with and ingestion of contaminated soil and inhalation of dust by site workers during construction.
- Inhalation by local residents of dust generated during construction.

Post Development Phase:

- Inhalation by local residents of airborne dust arising from exposed soil in the gardens and soft landscaping.
- Direct contact with and ingestion of contaminated soil and inhalation of dust arising from exposed soil in the gardens and soft landscaping by the residents who will be the end users of the site.
- Ingestion of contaminated homegrown produce by the end users of the site.
- Restricted growth of vegetation, plants or bushes.
- Ingress and accumulation of ground gas and subsequent inhalation by residents.
- Ingress and accumulation of ground gas and subsequent ignition.

2.5 Updated Conceptual Ground Model

The conceptual ground model of a site has been updated with regards to contamination sources, pathways and receptors, taking into account the findings of the intrusive ground investigation, as follows:

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TABLE 3 CONCEPTUAL GROUND MODEL

Potential Source	Contaminants Associated with the Source	Pathway	Receptor	Risk Rating	Proposed Mitigation
Contaminants in made ground derived from past industrial site use.	Gen. Contaminants Polynuclear Aromatic Hydrocarbons (PAH)	Ingestion of soil Ingestion of dust Dermal contact Inhalation of dust	Site Operatives during the construction phase	Moderate	Personal protective equipment (PPE)
		Ingestion of soil Ingestion of dust Dermal contact Inhalation of dust	End Users of the site on completion of the development	Moderate	Topsoil cover system
		Ingestion of dust Inhalation of dust	Local residents of off-site properties and passers-by during the construction phase	Low	Damping down and covering of stockpiled excavated soils when needed.
		Direct contact	Structures and Services	Low	United Utilities risk assessment for any new water supply pipes will be required.
Potential gas generation within made ground on site.	Ground Gas (Asphyxiation, fire and explosion) Methane Carbon Dioxide	Inhalation of gas Ignition of gas	Site Operatives	CS2 (low).	Air quality of trenches and excavations to be assessed prior to entry
			End Users	CS2 (low).	Proprietary gas barrier membrane and sub floor ventillation

3. REMEDIATION & VERIFICATION STRATEGY

3.1 Remediation Objectives

Elevated concentrations of PAH compounds have been determined in the made ground and remedial measures are therefore required to break the source-receptor pathways where the impacted soil is not covered by buildings or permanent hard surfacing.

The Phase II ground investigation also identified a low risk to buildings constructed on the site from ground gases (Characteristic Situation CS2).

The aims of the remediation strategy are:

- To provide a remediated site that is safe and suitable for the proposed end use (i.e. bungalow)
- To ensure the remediation is undertaken in a sustainable manner in compliance with current guidelines and with a suitably robust verification plan.
- To satisfy the requirements of the Local Planning Authority (Manchester City Council).

3.2 Soil Contamination Remediation

3.2.1 Preparatory Works

Preparations for remedial works need to address issues of health and safety, pollution and nuisance in relation to site operatives, visitors to the site and associated plant, surrounding residents and the general public who may be affected by on-site works.

The site area should be made secure to prevent unauthorised access during site remediation works when contaminated materials are to be exposed. Access to site should be regulated by the site manager with records kept of on-site personnel and visitors, lorry movements, materials imported and exported from the site etc. This information should be made available for the Phase IV Validation Report.

3.2.2 Cover System Methodology

In order to break the pathway from the contaminated soils (source) to the end users of the development (receptors) the following measures are to be adopted:

- a 600mm blanket of clean topsoil/ subsoil (equivalent to two spade depths) is provided in the gardens
- Deeper rooted bushes and trees should be pit planted on and in clean topsoil/ subsoil.

The above depths have been determined on the basis that in the gardens there may be a potential for the cultivation of fruit and vegetables, and in these areas residents may dig down to two spade depths to improve the soil condition (double digging). The proposed depths also allow for some degree of bioturbation, which normally occurs in the upper 300mm, and exceed the minimum requirement of BRE Report BR465 'Cover Systems for Land Regeneration' which recommends a minimum cover depth of 300mm for imported clean soil based on the maximum concentrations of contaminants found on site.

3.2.3 Verification Plan

An appropriately qualified and experienced person should have a "watching brief" during the remediation and the observations of this person should be made available for the Phase IV Validation Report.

In order to demonstrate that the imported material used in the cover system is suitable for the intended use chemical analyses should be undertaken. The analyses should be carried out after materials have been imported to site, though it would be advisable to undertake some screening prior to import in order to reduce the risk of the imported material being rejected.

A number of soil samples should be tested for a range of common contaminants and include hydrocarbons and asbestos and the testing should be carried out at an MCERTS and UKAS accredited laboratory. The testing results should be assessed against up to date generic assessment criteria for a residential development with plant uptake.

The sampling frequency should be set as a minimum of six samples or one per 100m^3 (whichever is greater) for a brownfield source, or a minimum of three samples or one sample per 250m^3 (whichever is greater) for a greenfield source, in line with the guidance given in the Yorkshire and Lincolnshire Pollution Advisory Group guidance document 'Technical Guidance for Developers, Landowners and Consultants' Version 4.1 (2021).

The testing suite should include the following contaminants as a minimum:

Arsenic	Nickel
Asbestos	pH
Boron	Phenols
Cadmium	Polynuclear Aromatic Hydrocarbons (16 EPA PAH)
Chromium	Selenium
Copper	Sulphide
Cyanide	Sulphate
Lead	Total Petroleum Hydrocarbons (3-BAND SPECIATION)
Mercury	Zinc

An appropriately qualified and experienced person should assess the results of the contamination analysis which should be compared with up to date UK based generic assessment criteria (GACs) for a residential with homegrown produce end use, to determine whether it is suitable for use in the cover system.

We recommended that the imported clean material is stockpiled and protected/ covered until the analyses is received and assessed.

Transfer documentation for each load of imported clean topsoil/ subsoil should be made available for the Phase IV Validation Report.

The site will be visited by a suitably qualified person to inspect the cover system. The thickness of clean cover system will be checked either by comparison of before and after topographical surveys or by taking out an appropriate number of hand dug trial pits. A photographic record will be made during placement of the cover system or during the trial pitting. The above information will form part of the Phase IV Verification Report.

3.2.4 Waste Soil Management

If it is necessary to reduce levels to accommodate the proposed cover system, then classification of the waste soil arisings should be undertaken prior to removing it to a licensed waste disposal facility.

Transfer documentation for each load of contaminated material exported from the site will be obtained and made available for the Phase IV Validation Report.

3.3 Ground Gas Remediation.

The Phase II ground investigation found a potential risk to buildings constructed on the site from ground gases. After consideration of the remedial options presented in BS.8485:2015+A1:2019 the following remedial measures have been chosen:

- 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 (as defined in BS.8485).
- 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].

The membrane is to be installed in accordance with both the manufacturer's instructions and the guidelines given in BRE BR414. In particular the following watch points should be observed:

- There should be no movement joints in any masonry below the membrane level and gaps and openings should be sealed.
- All projections that may puncture or damage the membrane must be removed.
- The membrane should span the cavity and be supported over the cavity and be continuous across the internal walls.
- Joints in the membrane should be overlapped and taped or site-welded to manufacturer's specifications.
- The barrier membrane should be protected until the floor slab and screed are laid, for example with boarding.
- Care should be taken to ensure the barrier membrane and damp-proof course are continuous around door openings.
- Service entries should be sealed using appropriate top hat assemblies or the manufacturers approved detailing strip for non-standard entries.

<u>Verification Plan</u>

The membrane installation will be subjected to verification inspections by a suitably qualified person to ensure that the correct installation procedures have been followed.

The verification methodology should include the following as a minimum:

- Verification that the chosen membrane meets the required specification.
- Inspection of the membrane immediately after installation to ensure there are no puncture risks, gaps or breaches in the membrane.
- Inspection of the taping and sealing of the membrane and details of where it crosses the wall cavity and door openings.

Photographs should be taken during the inspections and technical data sheets for the membrane and sealing tape, etc. should be provided for inclusion in the Phase IV verification report.

3.4 Site Operatives

Measures need to be put in place to prevent site operatives coming into direct contact with contaminated materials either by skin contact or by breathing in dust due to the elevated levels of PAH..

Site personnel involved in earthworks and excavations should be made aware of the hazards of working with contaminated materials found on site. Strict personal hygiene should be observed and suitable personal protective equipment (PPE) should be worn.

Consideration needs to be given to site operatives who may be at risk from elevated levels of carbon dioxide and/or depleted levels of oxygen in confined spaces below ground. 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.

3.5 Environmental Mitigation Measures

All vehicles carrying contaminated material should be securely sheeted and the wheels and undercarriages cleaned before leaving site to ensure that hazardous materials are not dropped onto public roads.

Earthworks undertaken during dry weather might generate dust and in this instance dust should be damped down and dust masks made available to site operatives. In addition stockpiled materials should be sheeted over to prevent excessive airborne dust being formed which could potentially migrate off site.

If groundwater is to be pumped out of excavations, then contamination analyses should be undertaken for groundwater to be disposed of, and the results submitted to the appropriate authority or a waste disposal operator to determine the most cost effective method of disposal. Groundwater should not be discharged to a sewer without firstly obtaining a discharge consent from the appropriate authority.

Discharge consents and/or transfer documentation for groundwater exported from the site should be obtained and made available for the Phase IV Validation Report.

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3.6 Caveats, Assumptions and Contingency Plan

It should be appreciated that only a small proportion of the area to be developed has been sampled and consequently the recommendations made and opinions expressed the previous reports can only be applied to such conditions as were encountered in the exploratory holes.

The exploratory holes indicated 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. For the purposes of this remediation strategy it is assumed that the findings of the Phase I and Phase II investigations are representative of the site conditions, however with any site it is possible that unrecorded potentially contaminative activities may have taken place, or that zones of contamination exist which have not been encountered by the intrusive investigation.

We recommend that a contingency plan is put in place to deal with unforeseen contaminated ground being found. In this regard a “watching brief” should be employed during earthworks and the following procedure followed if unforeseen ground conditions are encountered:

- Cease earthworks.
- Liaise with the Client and/ or Regulator.
- Agree revised course of action with the Client and/ or Regulator.
- Revise Remediation Statement, if necessary.

3.7 Verification Report

On satisfactory completion of all of the remediation works a Phase IV Verification Report should be produced by an independent qualified person. The report should include records of on-site observations together with contamination analyses certificates, transfer notes, discharge consents, specifications etc.

4. GENERAL

This Remediation Statement should be submitted to the Regulator, for approval in writing, prior to initiating the development. On completion of the actions set out in the Phase III Remediation Statement and receipt of an instruction, we would be happy to validate the remedial works and prepare a Phase IV Verification Report.

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. 7268B
MARCH 2022

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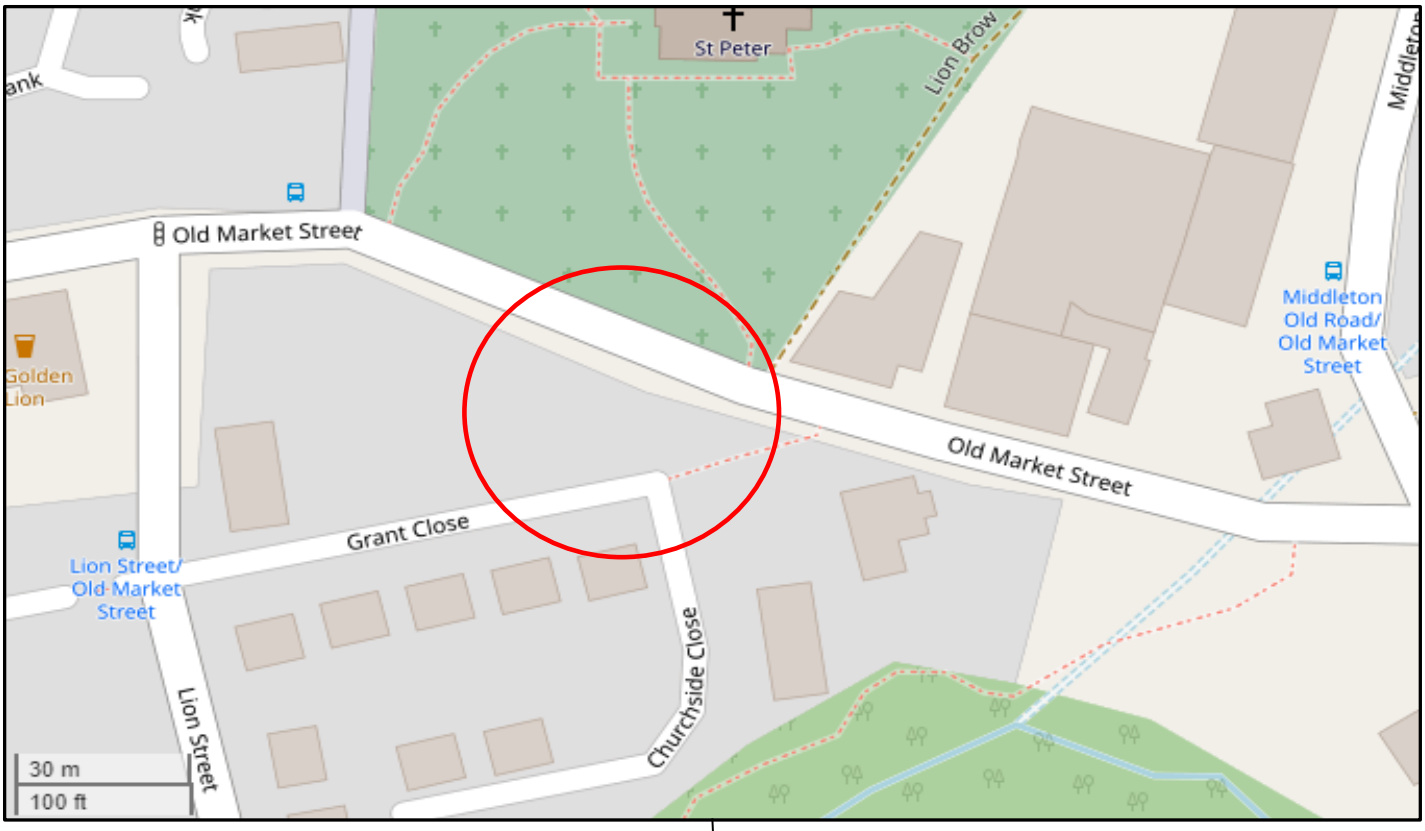
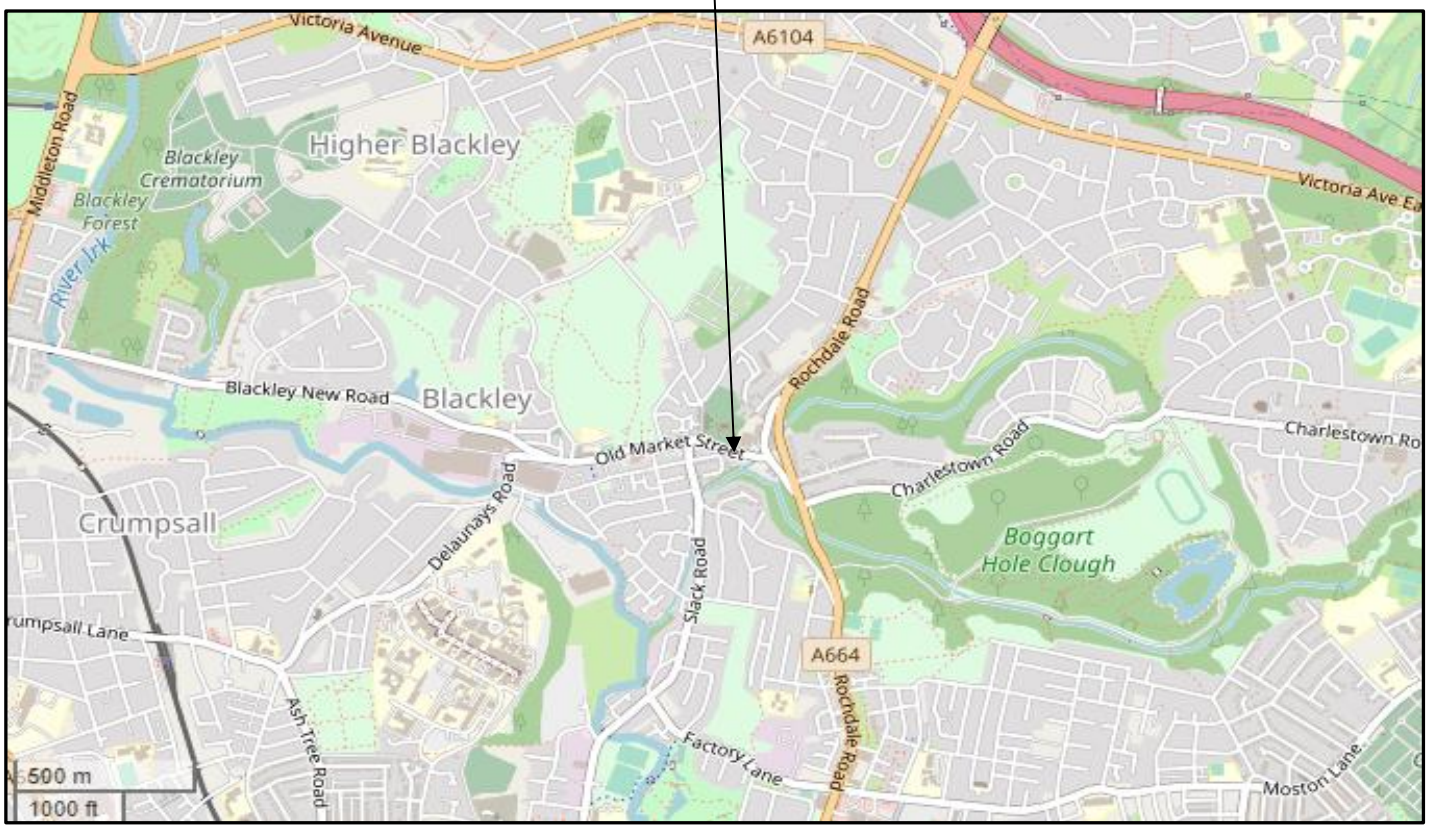
Principal Geoenvironmental Engineer
For and on behalf of
Sub Surface Consultants Limited

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

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. 7268B
Client ZAHID KHALID	Drawn By DJ	Checked By	Scale As Shown	Figure No. 1

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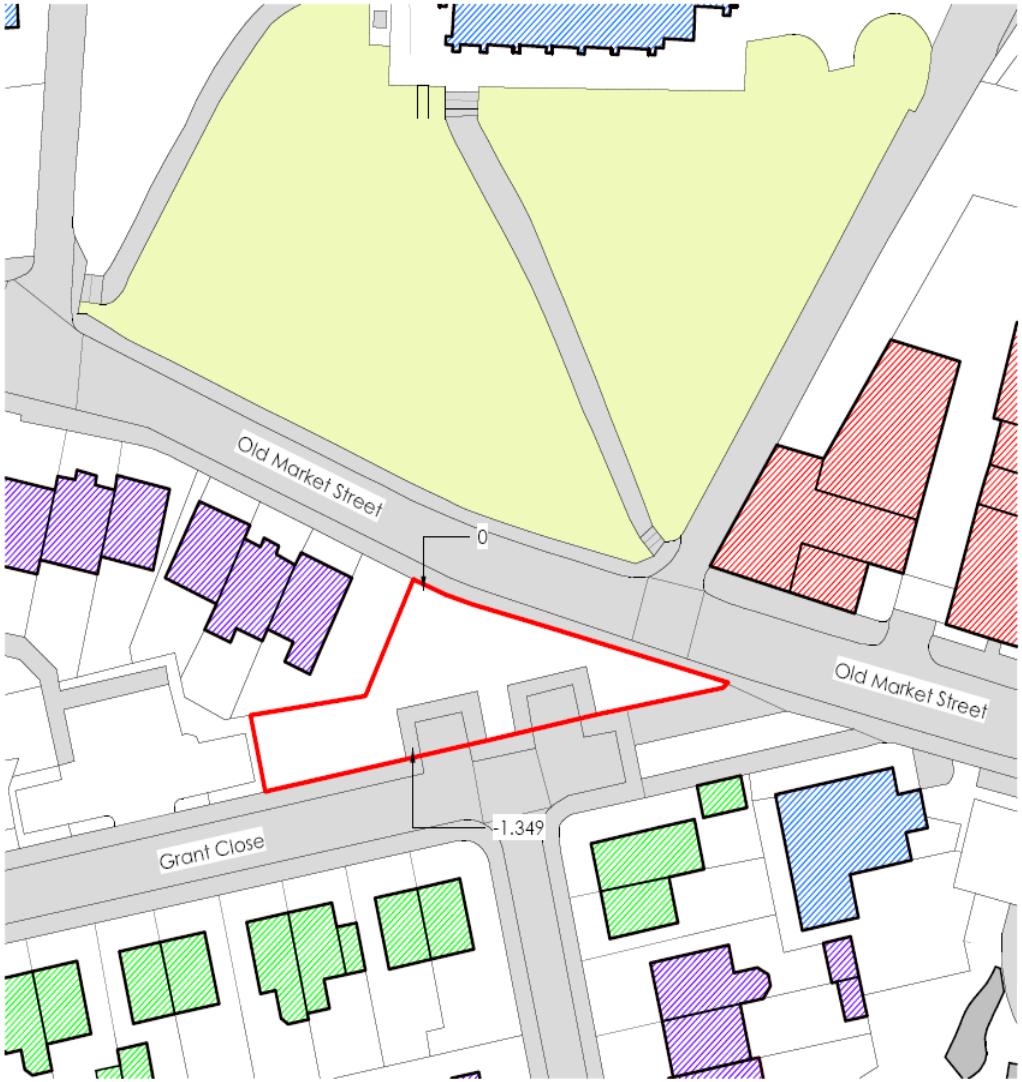
- 1 Storey - Bungalow
- 2 Storey - Semi-Detached
- Services/Civic
- Commercial



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SITE INVESTIGATION AND SPECIALIST GEOTECHNICAL CONSULTANTS
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Site	OLD MARKET STREET, MANCHESTER
Client	ZAHID KHALID
Date Drawn	03-Aug-21
Drawn By	DJ
Date Checked	
Checked By	
Orientation	N
Scale	–
Job No.	7268B
Figure No.	2

Site location

01
19003

Site Context

0m 5 10 15 20 25 m

1 : 500 @ A3

Development

Old Market Street, Manchester, M9 8DX

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

02 | Ground Floor Plan

19003

0m 1 2 3 4 5m

1 : 200 @ A3

Development

Old Market Street, Manchester, M9 8DX

P4BA

P4B ARCHITECTURE
P4BA.COM
INFO@P4BA.COM
0800 731 4707

15 MEMORIAL ROAD
WORSLEY
MANCHESTER
M28 3AG

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SUB SURFACE

SITE INVESTIGATION AND SPECIALIST GEOTECHNICAL CONSULTANTS

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Proposed Development

Site	Date Drawn	Date Checked	Orientation	Job No.
OLD MARKET STREET, MANCHESTER	03-Aug-21		N	7268B
Client	**Drawn By**	**Checked By**	**Scale**	**Figure No.**
ZAHID KHALID	DJ		–	3