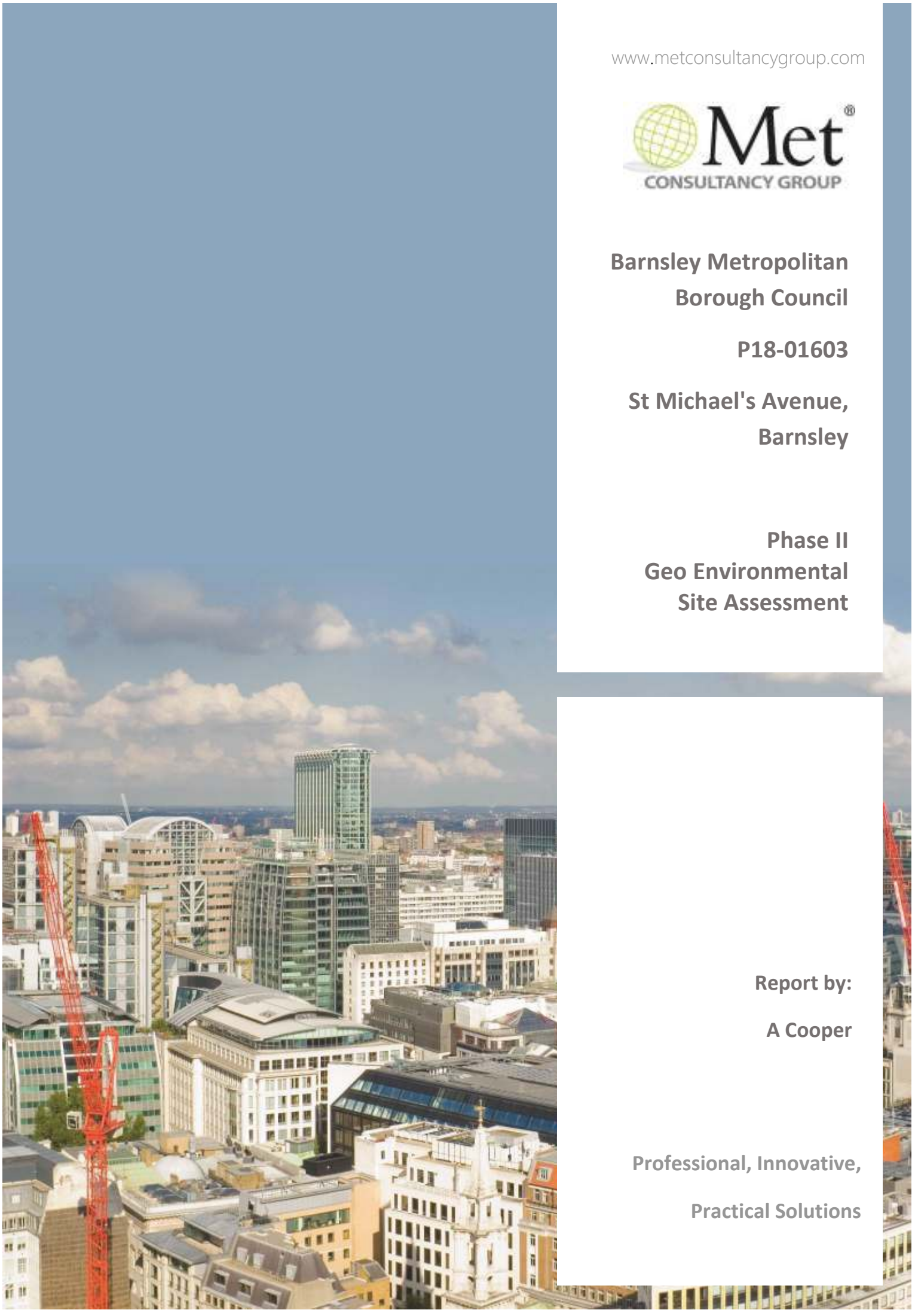

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Met CONSULTANCY GROUP

Barnsley Metropolitan Borough Council

P18-01603

St Michael's Avenue, Barnsley

Phase II Geo Environmental Site Assessment

Report by:

A Cooper

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1. REVISION RECORD

Report Ref: P18-01603 / Phase II					
Rev	**Description**	**Date**	**Originator**	**Checked**	**Approved**
1	Initial Issue	04/02/19	AEC	RJS	IFL

Prepared For:	**Prepared By:**
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2. INTRODUCTION

2.1. GENERAL INTRODUCTION

This Report presents the findings of a Phase II Geo-environmental assessment of a site at St Michael's Road, Barnsley, S71 2SD (Grid Reference: 436743, 408710) for Barnsley Metropolitan Borough Council.

The Intrusive Site Investigation (Phase II) comprised of windowless sampler boreholes and trial pits to establish the sub surface strata and remove samples for contamination and geotechnical testing. The test results combined with the findings of the intrusions will then be used to make recommendations for any remedial works which may be necessary. A site plan including positions of the boreholes and trial pits can be found in Appendix I of this report.

2.2. OBJECTIVES

The intrusive investigation was conducted to assess and confirm the immediate sub-surface ground conditions and extract in-situ soil samples for laboratory testing as recommended in Phase I Report dated 22nd December by Hamson Barron Smith (HBS), to determine the geotechnical and environmental position of the site.

2.3. SCOPE OF WORKS

Based upon the recommendations of the Desk Study and a visual assessment of the sub-surface materials during the intrusive works, soil samples were taken for laboratory testing. CLEA Guidelines and recommendations given in Land Quality Management General Assessment Criteria have been applied to establish a risk based CLEA Model to assess the likely contamination issues and to comment on potential constraints for development of the site.

Judgement is based strictly on the findings of the specific boreholes, trial pits and soil samples tested and therefore may not be representative of the site as a whole. The findings of the intrusive investigation will also be used in conjunction with the findings of the Desk Study to establish parameters which may be used in formulating a foundation design.

2.4. LIMITATIONS OF THE REPORT

Barnsley Metropolitan Borough Council (the Client) has requested that a Phase II Site Investigation, CLEA Conceptual Model and Risk Assessment be undertaken in order to assess the suitability of the site for redevelopment. The report is not a comprehensive site characterisation and should not be construed as such.

This report has been prepared for the sole internal use and reliance of Barnsley Metropolitan Borough Council. The report shall not be relied upon or transferred to any other parties without the express written authority of Met Engineers Limited. If any unauthorised third party comes into possession of the report, they rely on it at their own risk and Met Engineers Limited owes them no duty of care.

The findings and opinions conveyed via this report are based on information obtained from a variety of sources as detailed within this report and which Met Engineers Limited, believes are reliable. Nevertheless, Met Engineers Limited, cannot and does not guarantee the authenticity or reliability of the information it has relied upon. The information contained in this report is to the

best of our knowledge accurate at the date of issue, however, sub-surface conditions, including ground water levels, may vary, especially with time.

In preparing this report it has been assumed that all past and present occupants and Third Parties have provided accurate information, especially relating to known or potential hazards. This report does not identify deficiencies or mistakes in the information provided by the user/owner, or from any other source, except where obvious in the light of other information.

This report is relevant at the date the report was written and should be read in the light of any subsequent changes in legislation, statutory requirement or industry practices.

The report represents the technical findings and opinions of Met Engineers Limited, and does not constitute any legal advice. As such, the advice of a Solicitor may also be required.

3. SITE HISTORY AND ENVIRONMENTAL SETTING

A detailed review of the published history, hydrological, geological and available environmental information was carried out by HBS in a Phase I Desk Study report dated 22nd December 2017. The following is a brief summary of those findings.

The area of land referred to as 'The Site' within this document is indicated in Appendix I.

3.1. SITE DESCRIPTION

Site Name	St Michael's Avenue, Barnsley, S71 2SD
Location	Grid Reference: 436743, 408710
Setting	The site is located approximately 3.2km north east of Barnsley and is accessed via a wooden gateway off St Michael's Avenue. The site comprises a rectangular area of land, 1.2 hectares (Ha) in size which is currently used for horse grazing. The topography of the site is irregular with grassed mounds of earth in the north east. The elevations range from approximately 75mAOD in the south east to 67mAOD in the north west. A line of trees separates two different land parcels and a concrete base assumed to be associated with a former shed remains in the centre of the site. The surrounding land uses are residential houses to the south east and north east, fields to the south west and industrial units to the north west.
Site History	The site has remained undeveloped throughout the history shown on available OS mapping.
Development Proposal	It is proposed to develop the site with residential houses, gardens and associated parking areas.

3.2. GEOLOGY & SOILS

Geology	The 1:50,000 scale British Geological Survey (BGS) geological mapping indicates that the geology of the site can be split into to two distinct areas. Two bedrock lithology's are shown beneath the site, the change between the two occurs approximately within the centre of the site, with the boundaries between the two units trending north east to south west. The solid geology across the south eastern half of the site is shown as the Oaks Rock, a sandstone flag of the Pennine Middle Coal Measures. The north western half is mapped as Pennine Middle Coal Measures, in which is mapped a Fossil Horizon. The Pennine Middle Coal Measures are described by the BGS as "*Interbedded grey mudstone, siltstone, pale grey sandstone and commonly coal seams, with a bed of mudstone containing marine fossils at the base, and several such marine fossil-bearing mudstones in the upper half of the unit*". No Made Ground is mapped on site. The 1:10,000 scale mapping shows localised Made Ground is present beyond the northern boundary of the site.
Radon	The Groundsure radon report states that the site is in an area where the estimated probability of homes being above the action level of 200Bqm-3 is between 1% and 3%. No radon protective measures are required in the construction of new buildings.
Ground workings	The Phase 1 Desk Study did not identify any current or historical ground workings within 250m of the site. There are raised mounds of earth in the north east of the site from previous earth works.

Mining	A Coal Authority Mining Report was obtained by HBS as part of the Phase 1 Desk Study, this report confirmed: The property is in a surface area that could be affected by underground mining in six seams of coal at 100m to 330m depth, and last worked in 1958. Any movement in the ground due to coal mining activity should have stopped. There are no known mine entries on or within 20m of the site. The Authority is not aware of any evidence of damage arising due to geological faults or other lines of weakness that have been affected by coal mining. The property is not within the boundary of an opencast site from which coal has been removed by opencast methods. The Coal Authority has not received a damage notice or claim for the subject property, or any property within 50 metres of the enquiry boundary, since 31st October 1994. The Coal Authority has no record of a mine gas emission requiring action. The SYMAS Report indicated the following: The site is located on the Oaks Rock sandstone and Middle Coal Measures. There no conjectured geological faulting is present within the site, however the report notes that the bedrock may contain natural fissures which may have been opened out from past deep mining. There are no workable coal seams at shallow depth. Made Ground is present to the north, and that given the visual appearance of the site that some ground working has taken place. That risk of uncharted shallow workings is Low. Deep mining operations have taken place beneath the site in various coal seams. The latest being in the Winter Coal Seam at circa 100m deep in the late 1950s. All subsidence movement will be long complete and as no deep coals remain it should not be affected for the foreseeable future.
Natural Ground Subsidence	The Groundsure GeoInsight report states that the Compressible Ground risk at the site is “negligible”. Based on the expected geology, compressible soils are not anticipated. The Groundsure GeoInsight report states that the Shrinking or Swelling Clay risk at the site is “negligible to very low”. This is based on the anticipated Oaks Rock and Pennine Coal Measures. However, the near surface soils may include clays, which could be shrinkable. The Groundsure GeoInsight report states that the Collapsible Ground risk at the site is “very low”. Based on the anticipated ground conditions, collapsible soils are not expected. The Groundsure GeoInsight report states that the Running Sand risk at the site is “negligible”. Based on the anticipated ground conditions, running sands are not expected. The site is expected to be underlain by strata which are not prone to dissolution. The Groundsure GeoInsight report states that the Ground Dissolution risk at the site is “negligible”.

Boreholes	The BGS hole records for a number of boreholes in the area. The nearest are located circa 180m west of the site within the industrial area. These boreholes are located within an area mapped as underlain by the Pennine Middle Coal Measures. The boreholes indicate a thin layer of Made Ground (circa 0.4m) overlying a firm grey brown mottled silty Clay, to circa 1.1m to 1.8 m bgl. Beneath the Clay, strata described as very stiff grey brown mudstone, siltstone and shale were proven to 5.5m bgl.

3.3. ENVIRONMENTAL OVERVIEW

Historical Land Use	**On site** There is no evidence of any development on the site. An earthworks bund is located around the site entrance and an area of possible filling /earthworks was noted to the rear of properties 30 to 42 Preston Way. **Off Site** The surrounding land use was typically undeveloped farmland becoming principally residential properties during the early 1960s. The industrial estate towards the west was development in circa the early 1980s.
Current Land Use	Within the industrial estate, there are facilities associated with waste management and two tanks. The industrial site is located down slope of the site. Consequently, the operations of the estate are unlikely to have a significant impact on the site. Small electrical substations present locally. The nearest is located 60 south of the site.
Environmental Permits	There are no Environmental Permits within 250m of the site. There is a Red List Discharge consent located just over 250m north west associated with P& J Heat Exchanger where the authorised substances are copper and zinc.
Pollution Incidents	There are 2№ pollution incidents recorded within 250m of the site. In December 2001 there was an incident involving biodegradable food and drink waste 148m south west which had a minor impact on land. In September 2002 there was an incident involving commercial waste 183m east of the site which also had a minor impact on land.
Landfill Sites	There are no current or historical landfills located within 250m of the site.
Waste Transfer & Processing Stations	There are waste transfer sites located 105m and 135m north west of the site.
Hydrogeology	The bedrock underlying the site is classed as a Secondary A Aquifer. There are no abstraction licences or source protection zones (SPZs) within 250m of the site.
Hydrology	There are no watercourses within 250m of the site.
Flooding	The site is not located within a flood risk area.
Environmental Sensitivity	The site is not located within an environmentally sensitive area. The Liverpool, Manchester and West Yorkshire Greenbelt is located 167m north east.

3.4. PHASE I PRELIMINARY RECOMMENDATIONS

The Phase I report identifies localised Made Ground and ground gas as potential sources of contamination however determined that the risks from these sources were likely to be low. In order to confirm the risks it was recommended that representative soil samples were taken and tested for a suite of contaminants during a Phase 2 site investigation. It was also recommended that boreholes were installed for gas monitoring, with the number of rounds to be determined following the site investigation.

In addition, the Phase 1 report recommended that a number of boreholes and/ or trial pits were undertaken in order to make comment on the foundation solution for the proposed development.

A preliminary coal mining risk assessment was undertaken which identified the risk from shallow depth coal mining works was low to negligible, therefore no mining specific ground investigation was recommended.

4. INTRUSIVE INVESTIGATION

4.1. FIELDWORK

The intrusive investigation consisted of 5№ windowless sampler boreholes and 7№ Trial Pits excavated by JCB. The intrusive investigations were carried out on 7th January; the locations of which can be found within Appendix I. The intrusions were spread evenly across the site to give a good overview of the underlying strata. The weather was cold and dry.

All boreholes and trial pits found between 0.15m and 0.30m topsoil.

Possible reworked/ Made Ground was identified in WS01, WS02 and WS03 to depths of between 0.42m and 0.80mbgl. This comprised clayey gravels and sandy clay with fragments of brick, concrete and some plastic in the surface soils in WS01.

Firm to stiff silty gravelly CLAY deposits were identified under the entire site with the exception of WS01 from depths of between 0.15mbgl (WS03) and 0.75mbgl (WS05).

In WS01, the reworked/ Made Ground was underlain by medium dense SAND and GRAVEL, recorded as possibly completely weathered sandstone bedrock.

Completely weathered mudstone bedrock was identified under the entire site from depths of 0.60mbgl (TP05) and 1.8mbgl (WS01).

A shallow trial pit was excavated into one of the earth mounds in the north east of the site. This confirmed the mound comprised surface topsoil with occasional fragments and whole bricks underlain by silty CLAY.

Logs of the Boreholes and Trial Pits can be found in Appendix II and III of this report respectively.

Soil samples were removed for laboratory contamination analysis from 8№ sampling points for laboratory contamination testing. Samples of the clay deposits were taken from 3№ of these locations for geotechnical testing.

4.2. GROUNDWATER

Groundwater was infiltrating the sides of trial pits TP03 and TP06 form 2.0mbgl and water strikes were also recorded in WS02 and WS03 at depths of 1.8mbgl and 2.0mbgl respectively.

4.3. GAS MONITORING

Gas and groundwater monitoring equipment was installed in 3№ borehole positions (WS01, WS02 and WS04). Response zones were set from 0.5mbgl to 3mbgl in order to evaluate the gas risk from natural venting from the aquifer.

Monitoring was undertaken using a Geotech GA5000 portable gas analyser which is calibrated on a 6 monthly basis. UKAS calibration certificates can be provided on request. Monitoring is currently ongoing. The results of this monitoring will be presented as an amendment to this report.

4.4. LABORATORY TESTING

The desk study recommended a regime of contamination testing on soil samples recovered from the intrusive investigation. Samples were obtained during the site investigation and tested at a UKAS accredited laboratory for contaminants including:

- *Heavy Metals*
- *Polycyclic Aromatic Hydrocarbons*
- *Total Petroleum Hydrocarbons*
- *Asbestos*

Geotechnical testing was also carried out on the soils. The samples were tested for:

- *pH*
- *Water Soluble Sulphate (2:1)*
- *Atterberg limits*

5. CONTAMINATION ASSESSMENT

5.1. GENERAL

Current Environmental Legislation, in particular Part IIA of the Environmental Protection Act 1990, adopts a risk-based approach to the evaluation of contaminated sites, based on the proposed end use of the site. The commonly accepted approach is to adopt a Source-Pathway-Receptor model where the Source of the contaminant is examined in relation to potential Receptors (i.e. humans, controlled waters etc.) to determine if there is a Pathway (i.e. contaminant linkage) connecting them. If any of these elements (i.e. contaminant, pathway or receptor) are absent or removed, then there is no risk.

The Department of the Environment, Food and Rural Affairs (DEFRA) have published a series of guidelines in connection with Risk Assessment. In addition The Environment Agency has produced the Contaminated Land Exposure Model (CLEA) which models guideline values for those elements which pose the greatest risk to human health.[1] Using values derived from CLEA, a site specific, conceptual model has been used to determine any significant contaminant linkages and identify suitable risk management proposals on which remediation design (if any required) can be based. The conceptual model is summarised at the end of this section in tabular form.

By considering the Source-Pathway-Receptors Model, an assessment can be made as to whether the source contamination can reach a receptor. The degree and significance of any resulting risk is then determined. The categorisation of the risk is based on consideration of both:

- The likelihood or probability of an event (taking into account both the presence of the Source and the Receptor, and the integrity of the Pathway).

- The severity of the potential consequence (taking into account both the potential severity of the Source and the sensitivity of the Receptor).

The following categorisation of risk has been adopted in this report:

Very High	There is a high probability that severe harm could arise to a designated receptor from an identified hazard at the site without appropriate remedial action.
High	Harm is likely to arise to a designated receptor from an identified hazard without appropriate remedial action.
Moderate	It is possible that, without appropriate remedial action, harm could arise to a designated receptor, but it is relatively unlikely that any such harm would be severe and, if harm were to occur, it is more likely that such harm would be relatively mild.
Low	It is possible that harm could arise to a designated receptor from an identified hazard, but it is likely that, at worst, this harm, if realised, would normally be mild.
Negligible	The presence of an identified hazard does not give rise to the potential to cause any significant harm to a designated receptor on this site.

[1] Updated technical background to the CLEA model, Science Report SC050021/SR3, The Environment Agency, 2009

5.2. PRELIMINARY CONCEPTUAL SITE MODEL

The following table provides a list of the potential Sources, Pathways and Receptors that have potential to exist on this site as determined within the Phase I desk study.

Potential Source	Contaminants	Receptor	Pathway	Potential Risk
Soil based Contaminants (Solid) - Localised made ground	Heavy Metals PAH TPH	Construction Workers Maintenance Workers End user	Direct contact with soil Ingestion of soils Inhalation of soil dust/asbestos fibres Inhalation of gases/vapours Plant uptake followed by ingestion	Low
		Flora & Fauna	Plant uptake	Low
		Buildings & Infrastructure	Direct Contact with soil	Low
Soil based Contaminants (as Leachate)	Heavy Metals PAH TPH	Flora & Fauna	Plant uptake	Low
		Aquifer	Leaching/ migration of liquids	Low
Asbestos within Made Ground	Asbestos Fibres	Construction Workers Maintenance Workers End user	Inhalation of soil dust/ asbestos fibres	Low
Land Gas		Construction Workers Maintenance Workers End user	Inhalation of gases/vapours	Low
Radon		End user	Inhalation of gases/vapours	Low

Based on the above conceptual site model, the following sources of contamination have been investigated;

- Soils
  - Heavy Metals
  - Poly Aromatic Hydrocarbons
  - Total Petroleum Hydrocarbons
  - Asbestos
- Land Gas

5.3. CONTAMINATION CRITERIA FOR SOIL TESTING

Suitable 4 Use Levels (S4ULs) published by Land Quality Management, have been used to assess risk.[2] Where there are no S4ULs, Defra Category 4 Screening Levels (C4SLs) have been used as intervention values to assess risk.[3]

It is proposed that the site will be developed with residential houses and gardens. Therefore, the proposed land use can be classified as 'residential with home produce' in accordance with the CLEA Guidelines.

Soils were taken from site and tested for % Soil Organic Matter (SOM).

Location	TP01	WS01	WS02	TP03	TP05	TP06	TP07	WS04
Depth (m)	0.20	0.60	0.30	0.50	0.30	0.50	0.50	0.20
Strata	Topsoil	Made Ground	Made Ground	Natural Clay	Natural Clay	Natural Clay	Natural Sand	Topsoil
SOM (%)	4.7	2.0	2.6	0.6	4.6	1.9	0.7	4.9

Taking the lowest SOM recorded as the worst-case scenario, the results of the chemical analysis on the soil samples are compared against the S4ULs for 'residential with home produce' developments with 1% SOM (where there are published S4ULs) and C4SLs where there are no published S4ULs. These values are then used as Intervention Values (IV) to assess the risk.

5.4. RESULTS OF CONTAMINATION TESTING

The following tables are summaries of the laboratory test results. Please see the key below for the origin of each intervention value.

Intervention Value Key

Author	Type	Land Use
Land Quality Management	S4UL	Residential with home produce
DEFRA	C4SL	Residential with home produce

Heavy Metals

Location	TP01	WS01	WS02	TP03	TP05	TP06	TP07	WS04		
Depth (m)	0.20	0.60	0.30	0.50	0.30	0.50	0.50	0.20		
Strata	Topsoil	Made Ground	Made Ground	Natural Clay	Natural Clay	Natural Clay	Natural Sand	Topsoil		
Contaminant (mg/kg)									**IV**	**Number Exceeding**
Arsenic	12	10	14	5	8	2	7	8	37	0
Cadmium	1.6	0.8	1.4	1.7	1.9	1.5	1.2	1.4	11	0
Copper	22	13	25	33	22	17	5	19	2400	0

[2] The LQM/CIEH S4ULs for Human Health Risk Assessment, Land Quality Press, Nathanail et. al, 2015.
[3] SP1010, Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination, DEFRA 2014

Location	TP01	WS01	WS02	TP03	TP05	TP06	TP07	WS04		
Depth (m)	0.20	0.60	0.30	0.50	0.30	0.50	0.50	0.20		
Strata	Topsoil	Made Ground	Made Ground	Natural Clay	Natural Clay	Natural Clay	Natural Sand	Topsoil		
Contaminant (mg/kg)									**IV**	**Number Exceeding**
Chromium	22	11	18	34	27	22	12	20	910	0
Chromium (VI)	<1	<1	<1	<1	<1	<1	<1	<1	6	0
Lead	45	27	49	25	48	23	9	38	200	0
Mercury	<0.17	<0.17	<0.17	<0.17	<0.17	<0.17	<0.17	<0.17	1.2	0
Nickel	24	14	22	42	28	24	12	22	130	0
Selenium	<1	<1	<1	<1	2	1	<1	<1	250	0
Zinc	83	35	75	86	89	57	27	66	3700	0

Polycyclic Aromatic Hydrocarbons

Location	TP01	WS01	WS02	TP03	TP05	TP06	TP07	WS04		
Depth (m)	0.20	0.60	0.30	0.50	0.30	0.50	0.50	0.20		
Strata	Topsoil	Made Ground	Made Ground	Nat-Clay	Nat-Clay	Nat-Clay	Nat-Clay	Topsoil		
Contaminant (mg/kg)									**IV**	**Number Exceeding**
Acenaphthene	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	210	0
Acenaphthylene	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	170	0
Anthracene	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	2400	0
Benzo(a)anthracene	0.09	0.07	0.1	<0.04	<0.04	<0.04	<0.04	<0.04	7.2	0
Benzo(a)pyrene	0.1	0.05	0.1	<0.04	<0.04	<0.04	<0.04	<0.04	2.2	0
Benzo(b)fluoranthene	0.13	0.07	0.13	<0.05	<0.05	<0.05	<0.05	<0.05	2.6	0
Benzo(ghi)perylene	<0.05	<0.05	0.06	<0.05	<0.05	<0.05	<0.05	<0.05	320	0
Benzo(k)fluoranthene	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	77	0
Chrysene	0.12	0.08	0.13	<0.06	<0.06	<0.06	<0.06	<0.06	15	0
Dibenzo(ah)anthracene	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	0.24	0
Fluoranthene	0.17	0.13	0.19	<0.08	<0.08	<0.08	<0.08	<0.08	280	0
Fluorene	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	170	0
Indeno(123-cd)pyrene	0.06	0.03	0.07	<0.03	<0.03	<0.03	<0.03	<0.03	27	0
Naphthalene	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	2.3	0
Phenanthrene	0.07	0.06	0.08	<0.03	<0.03	<0.03	<0.03	<0.03	95	0
Pyrene	0.15	0.11	0.17	<0.07	<0.07	<0.07	<0.07	<0.07	620	0
Total PAH	0.89	0.6	1.03	<0.08	<0.08	<0.08	<0.08	<0.08		-

Total Petroleum Hydrocarbons

Location	TP01	TP03	TP05	TP06		
Depth (m)	0.20	0.50	0.30	0.50		
Strata	Topsoil	Natural Clay	Natural Clay	Natural Clay		
Contaminant (mg/kg)					**IV**	**Number Exceeding**
Ali >C5-C6	<0.01	<0.01	<0.01	<0.01	42	0
Ali >C6-C8	<0.01	<0.01	<0.01	<0.01	100	0
Ali >C8-C10	<0.01	<0.01	<0.01	<0.01	27	0
Ali >C10-C12	<0.1	<0.1	<0.1	<0.1	130	0
Ali >C12-C16	<0.1	<0.1	<0.1	<0.1	1100	0
Ali >C16-C21	<0.1	<0.1	<0.1	<0.1	65000	0
Ali >C21-C35	<0.1	<0.1	<0.1	<0.1	65000	0
Total Aliphatics	<0.1	<0.1	<0.1	<0.1		-
Aro >C5-C7	<0.01	<0.01	<0.01	<0.01	70	0
Aro >C7-C8	<0.01	<0.01	<0.01	<0.01	130	0
Aro >C8-C9	<0.01	<0.01	<0.01	<0.01		-
Aro >C9-C10	<0.01	<0.01	<0.01	<0.01		-
Aro >C10-C12	<0.1	<0.1	<0.1	<0.1	74	0
Aro >C12-C16	<0.1	<0.1	<0.1	<0.1	140	0
Aro >C16-C21	<0.1	<0.1	<0.1	<0.1	260	0
Aro >C21-C35	0.7	<0.1	<0.1	<0.1	1100	0
Total Aromatics	0.7	<0.1	<0.1	<0.1		-
TPH (Ali & Aro)	0.7	<0.1	<0.1	<0.1	1600	-
BTEX - Benzene	<0.01	<0.01	<0.01	<0.01	0.087	0
BTEX - Toluene	<0.01	<0.01	<0.01	<0.01	130	0
BTEX - Ethyl Benzene	<0.01	<0.01	<0.01	<0.01	47	0
BTEX - m & p Xylene	<0.01	<0.01	<0.01	<0.01	56	0
BTEX - o Xylene	<0.01	<0.01	<0.01	<0.01	60	0
MTBE	<0.01	<0.01	<0.01	<0.01		-

Asbestos

Location	TP01	WS01	WS02	TP03	TP05	TP06	TP07	WS04	
Depth (m)	0.20	0.60	0.30	0.50	0.30	0.50	0.50	0.20	
Strata	Topsoil	Made Ground	Made Ground	Nat-Clay	Nat-Clay	Nat-Clay	Nat-Clay	Topsoil	
Contaminant									**Number Exceeding**
Asbestos in Soil	NAD	NAD	NAD	NAD	NAD	NAD	NAD	NAD	0

The full test certificates are included in Appendix IV of this report.

5.5. RADON AND LAND GAS

1 – 3 % of properties in the area are above the radon action level. However radon specific protection measures are not required for new buildings in accordance with BRE publication BR211.[4]

Gas and water monitoring equipment was installed in 3№ positions across the site. Response zones were set from 0.5m to 3mbgl so as to assess the risk from any natural venting from the aquifer. The monitoring is currently ongoing and the results will be presented as an amendment to this report.

Results

Date	BH Number	CH_4 (%)	CO_2 (%)	O_2 (%)	Atmos. Pres.(mb)	Pres. Trend (24hrs)	Flow (l/h)	Water (mbgl)	Depth to Bottom (m)
23.01.19	WS01	0.1	2.1	19.2	996	↑	0.1	Dry	3
	WS02	0.1	0.4	20.9	996	↑	0.2	1.45	3
	WS04	0.1	0.3	20.1	996	↑	0	0.75	2.6

Analysis

Instead of monitoring on predetermined dates to a set schedule, it is best practice to gas monitor on occasions where the worst case scenario is likely to occur. Generally this is determined to be when sharp falls of atmospheric pressure occur or when low atmospheric pressures are recorded, (below 1000mb). Thus the remaining gas results will be collected in periods of high to low falling pressure as well as low pressure.

One round of monitoring has been undertaken to date. Five further rounds of monitoring are proposed.

The gas monitoring results have been evaluated in conjunction with BS8485:2015[5] and the characteristic situations defined in CIRIA C665[6].

The maximum concentrations of CH_4 and CO_2 recorded were 0.1 and 2.1% respectively. The maximum flow rate recorded across the site was 0.2l/h. Therefore the gas screening values (GSVs) for both methane and carbon dioxide are 0.0002l/h and 0.0042l/h respectively.

Based on preliminary gas monitoring results, In accordance with the BS8485:2015, the site is classed as Characteristic Situation 1 and the proposed future buildings on the site will be Type A, therefore, gas protection measures are not required for the proposed development.

It should be noted that monitoring is still on-going and the above recommendations are to be considered as **PRELIMINARY**, to be confirmed on completion of the monitoring.

5.6. CONTAMINATION SOURCES

No elevated levels have been identified on site for the contaminants tested for.

[4] BRE 211, Radon: guidance on protective measures for new buildings, BREPress, Scivyer, 2007
[5] Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings (BS 8485:2015) BSI, 2015
[6] Assessing Risks Posed by Hazardous Ground Gases to Buildings (C665), CIRIA, Wilson et al., 2007

Source	Elevated Levels Present?
Heavy Metals	No
Poly Aromatic Hydrocarbons	No
Total Petroleum Hydrocarbons	No
Asbestos	No
Land Gas and Radon	TBC

5.7. PATHWAYS

Based on the proposed land use, the possible pathways that exist on site for any possible source of contamination are as follows;

Pathway	Pathway Present	Comments
Direct Contact with soil/ water	Yes	Potential for contact with soil/ water during future development and landscaping works
Incidental ingestion	Yes	Potential for ingestion of soils/ water during future development and landscaping works
Inhalation of soil dust/ asbestos fibres	Yes	Potential for inhalation of soil dust/ asbestos during future development and landscaping works and ground disturbance
Leaching/ migration of liquids	Yes	Potential for leaching to aquifer as the site will be developed with soft, vegetative cover
Surface water run-off	No	Site will be covered include garden areas with vegetation, allowing infiltration and reducing surface water run off
Migration/ emission/accumulation inhalation of land gas/ vapours	Yes	Migration and emission of land gas/ vapours possible, increased potential for accumulation in buildings on proposed site
Plant uptake/ plant uptake followed by ingestion	Yes	Site is to be landscaped, increasing plant uptake

5.8. RECEPTORS

Based on the identified sources of contamination, and the present pathways, the potential receptors for the development are:-

Receptor	Receptor Present	Comments
Site worker	Yes	Contractors carrying out ground works and landscaping
Maintenance staff	Yes	Future maintenance staff. It is assumed these workers will visit infrequently and will not carry out intrusive works
Long term site user/ future resident	Yes	Future residents of the proposed development
Off-site resident	Yes	Residential housing within 250m of the site
Flora & Fauna	Yes	Flora on landscaped areas
Aquifer	Yes	Bedrock is a Secondary A Aquifer, however there are no groundwater abstractions or source protection zones in the vicinity of the site
Surface water	No	No surface watercourses in the vicinity of the site
Buildings & Infrastructure	Yes	No buildings proposed on the site

5.9. SITE SPECIFIC MODEL

Source	Contaminant	Receptor	Pathway	Risk
Soil based contaminants (Solid)	*Heavy Metals*[2]	**A – Construction Workers**[1] **B – Maintenance Worker**[1] **C – Future End user**[1] **D – Off-Site Resident**[1] **E – Flora & Fauna**[1] **F- Aquifer**[1] *G- Surface Water*[2]	**a – Direct contact with soil/ water**[1] **b – Incidental ingestion**[1] **c – Inhalation of soil dust/ asbestos fibres**[1] **d – Leaching/ migration**[1] *e – Surface water run off*[2] **g – Plant uptake/ plant uptake followed by ingestion**[1]	Negligible
	Polycyclic Aromatic Hydrocarbons[2]	**A – Construction Workers**[1] **B – Maintenance Worker**[1] **C – Future End user**[1] **D – Off-Site Resident**[1] **E – Flora & Fauna**[1] **F- Aquifer**[1] *G- Surface Water*[2] **H- Buildings and Infrastructure**[1]	**a – Direct contact with soil/ water**[1] **b – Incidental ingestion**[1] **c – Inhalation of soil dust/ asbestos fibres**[1] **d – Leaching/ migration**[1] *e – Surface water run off*[2] **f – Migration/ emission/ inhalation of land gas/ vapours**[1] **g – Plant uptake/ plant uptake followed by ingestion**[1]	Negligible
	Total Petroleum Hydrocarbon[2]	**A – Construction Workers**[1] **B – Maintenance Worker**[1] **C – Future End user**[1] **D – Off-Site Resident**[1] **E – Flora & Fauna**[1] **F- Aquifer**[1] *G- Surface Water*[2] **H- Buildings and Infrastructure**[1]	**a – Direct contact with soil/ water**[1] **b – Incidental ingestion**[1] **c – Inhalation of soil dust/ asbestos fibres**[1] **d – Leaching/ migration**[1] *e – Surface water run off*[2] **f – Migration/ emission/ inhalation of land gas/ vapours**[1] **g – Plant uptake/ plant uptake followed by ingestion**[1]	Negligible
Asbestos in Made Ground	*Asbestos fibres* [2]	**A – Construction Workers**[1] **B – Maintenance Worker**[1] **C – Future End user**[1] **D – Off-Site Resident**[1]	**c – Inhalation of soil dust/ asbestos fibres**[1]	Negligible
Land Gas and Radon[2]		**C – Future End user**[1]	**f – Migration/ emission/ inhalation of land gas/ vapours**[1]	Negligible

[1] **Source/ Pathway/ Receptor PRESENT on site**
[2] *Source/ Pathway/ Receptor NOT PRESENT on site*

5.10. CONTAMINATION ISSUES

Based upon the conceptual site model, there are no contamination linkages present for the sources tested for.

5.11. ASSESSED RISKS AND MANAGEMENT

No elevated concentrations have been recorded on site for the sources tested for.

As a precaution, a site induction should warn construction workers as to the presence of potentially contaminated material onsite. Appropriate personal protective equipment should be worn, accompanied with employing good personal hygiene standards (especially before eating) in order to minimise the risk to construction workers on site.

Source	Pathway	Receptor	Risk	Management / Remediation Proposals	Residual Risk
Land Gas	f	**C**	**TBC**	6№ rounds of gas monitoring to be completed to confirm the risks from possible migration of land gas and to determine any remediation measures required.	**Negligible**

All ground works should be monitored by a suitably qualified person and significant deviation from the findings of this document is to be reported to the Engineer immediately prior to commencing any further works.

5.12. ENVIRONMENTAL SUMMARY

No elevated concentrations have been recorded on site for the sources tested for.

Gas monitoring is currently on-going and the final results will be provided as an amendment to this report.

All ground works should be monitored by a suitably qualified person and any significant deviation from the findings of this document is to be reported to the Engineer immediately prior to commencing any further works.

6. GEOTECHNICAL ASSESSMENT

6.1. GENERAL

The site investigation was required to make recommendations as to a suitable foundation solution for the development. 7№ № trial pits and 5№ windowless sampler boreholes were undertaken to depths of between 1.9mbgl (TP01) and 4.3mbgl (WS02) in order to achieve this aim.

6.2. GEOLOGICAL ASSESSMENT

Artificial Deposits

Possible reworked/ Made Ground was identified in WS01, WS02 and WS03 to depths of between 0.42m and 0.80mbgl. This comprised clayey gravels and sandy clay with fragments of brick, concrete and some plastic in the surface soils in WS01.

Residual Soils

Firm to stiff silty gravelly CLAY deposits were identified under the entire site with the exception of WS01 from depths of between 0.15mbgl (WS03) and 0.75mbgl (WS05).

In WS01, the reworked/ Made Ground was underlain by medium dense SAND and GRAVEL recorded as possibly completely weathered sandstone bedrock.

Bedrock
Completely weathered mudstone bedrock was identified under the entire site from depths of 0.60mbgl (TP05) and 1.8mbgl (WS01).

6.3. MINING

No evidence of mining was uncovered during the site investigation and no further works related to this matter is considered necessary.

6.4. FOUNDATIONS AND SUBSTRUCTURES

Based on the geological conditions found below the site, shallow depth spread foundations are suitable for the proposed development. Foundations should be on to the stiff clays underlying the site from depths of 0.40mbgl to 1.10mbgl with a maximum allowable bearing pressure of 100kN/m^2. Alternatively, if foundations are taken on to the weathered mudstone bedrock encountered under the site at depths of between 0.6mbgl and 1.8mbgl the allowable bearing pressure can be increased to 150kN/m^2. Each block should be founded wholly on the same strata to prevent differential settlement.

6.5. GEOTECHNICAL TEST RESULTS

Soil samples were taken from site and submitted for the following geotechnical testing.

Location	WS01	WS02	WS04
Depth (m)	1.80	0.70	0.60
pH	5.39	7.14	7.28
SO4 (2:1)	0.04	0.03	0.05
Plasticity Index	29	38	24
% <425µm	100	92	82
Modified Plasticity	29	34.96	19.68

Based on the soil sulphate concentrations and pH levels, AC-1s conditions exist for buried concrete in accordance with BRE Special Digest 1:2005 – Concrete in Aggressive Ground.[7]

The Plasticity Index for the soils tested, have been modified as per chapter 4.2 of NHBC guidelines. The results show medium volume change soils exist on site. As trees already exist on site, foundations should be designed in accordance with chapter 4.2 of NHBC guidelines.[8]

6.6. GROUND FLOOR CONSTRUCTION

Suspended ground floors are preferable for the ground floor of the development.

6.7. GEOTECHNICAL SUMMARY

Shallow depth spread foundations are deemed suitable for the development.

The foundations should be founded onto the stiff clays or weathered mudstone bedrock underlying the site dependent on levels. Foundations for each block should be wholly on to the same strata to prevent differential settlement.

Suspended ground floors are preferable for the proposed buildings.

Based on the soluble sulphate levels found, AC-1s conditions exist on site in accordance with BRE Special Digest 1:2005 – Concrete in Aggressive Ground.

Medium volume change soils exist below the site. Foundations should be designed in accordance with chapter 4.2 of NHBC guidelines.

All ground works should be monitored by a suitably qualified person and any significant deviation from the findings of this document is to be reported to the Engineer immediately prior to commencing any further.

[7] BRE Special Digest 1, Concrete in Aggressive Ground, BRE Press, 2005
[8] NHBC Standards, Chapter 4.2 Building Near Trees, NHBC, 2014

7. CONCLUSIONS AND RECOMMENDATIONS

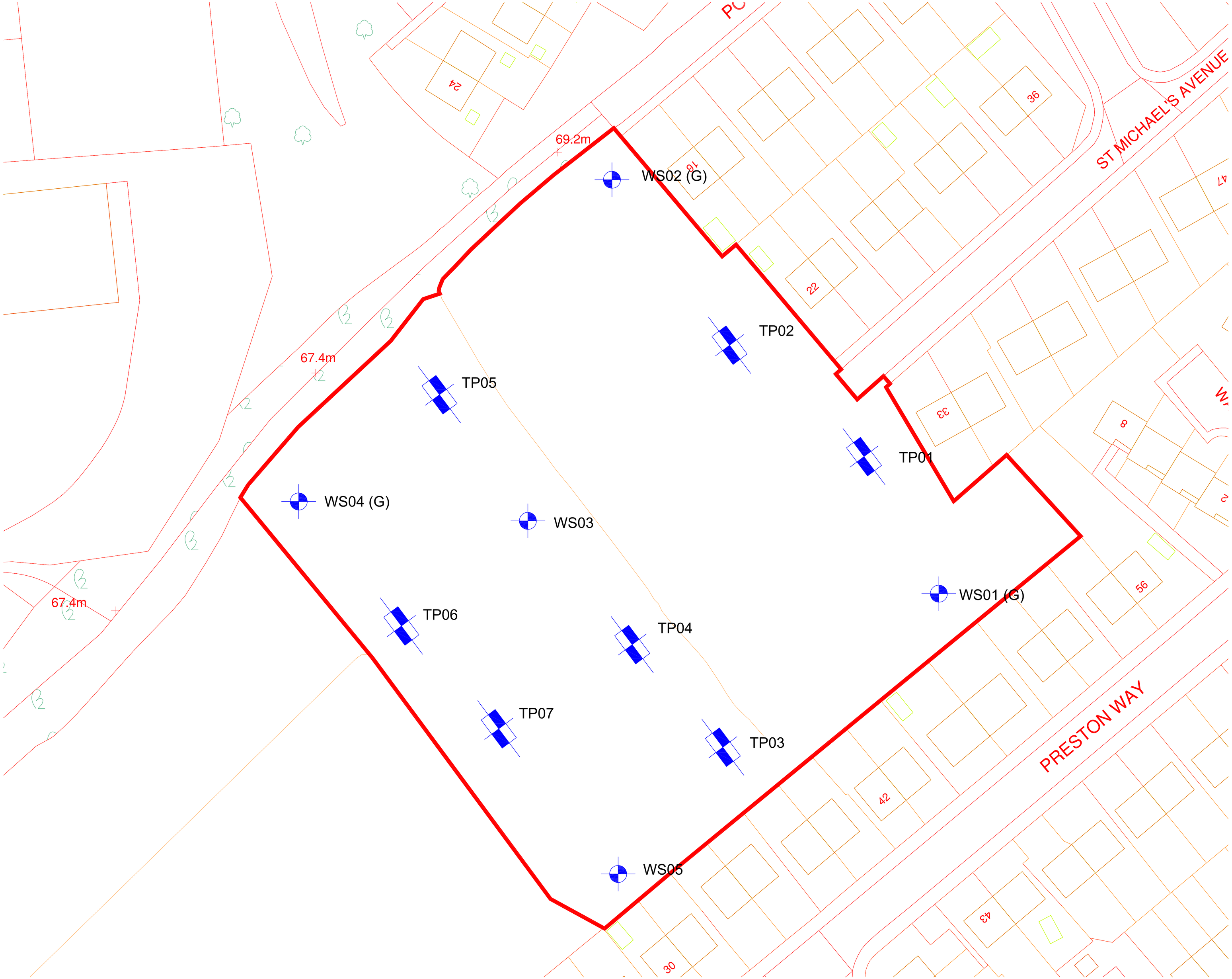
In conclusion:

- No contamination linkages are deemed exist on the site therefore no remediation measures are considered necessary for the proposed development.
- Based on **preliminary** gas monitoring results, gas protection measures are not required for the proposed development.
- The site is underlain by firm to stiff clays above weathered mudstone and sandstone strata of the Pennine Middle Coal Measures.
- Shallow depth spread foundations are deemed suitable for the proposed development.
- Foundations should be on to the stiff clays or weathered bedrock underlying the site, depending on final site levels.
- Foundations for each block should be wholly on to the same strata to prevent differential settlement.

APPENDIX I

Site Investigation Plan

1. Do not scale dimensions from this drawing in either paper or electronic format.
2. To be read in conjunction with all relevant Engineer's, Architect's and Other drawings and specifications.
3. All building products to be used in strict accordance with the manufacturer's recommendations.
4. Any discrepancies are to be reported to the Engineer immediately.
5. Main Contractor to provide a detailed method statement for all works prior to commencement on site.



Windowless sampler borehole location

Trial Pit location

(G) Gas Monitoring Location

Issue	Date	Drawn	Ch'k'd
--	--/--/----	--	--

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www.metengineers.com

Client: Barnsley Metropolitan Borough Council

Project: St Michael's Avenue, Barnsley
P18-01603

Title: Site Investigation Location Plan

Drawn	AEC	Checked		Scale	NTS
Date	31.01.19	Date			
Status				Original Size	A3

Drawing No: P18-01603-Met-M2-GE-001 | Issue: 1

APPENDIX II

Windowless Sampler Logs

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Windowless Sampler Borehole Log

Borehole No. **WS01**
Sheet 1 of 1

Project Name:	St Michael's Avenue, Barnsley	Project No. P18-01603	Co-ords:	436818E - 408703N	Hole Type WS
Location:	St Michael's Avenue, Barnsley, S71 2SD		Level:	77.00	Scale 1:25
Client:	NPS Property Consultants Ltd		Dates:	07/01/2019	Logged By SWWS

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					0.22	76.78		Made Ground: Grass overlying dark brown sandy GRAVEL with brick, concrete and some plastic fragments and rootlets
								Made Ground: Compact brown very sandy clayey sandstone GRAVEL with rootlets
		0.60	ES		0.60	76.40		Made Ground/ Possible relic topsoil: Stiff dark brown very sandy gravelly CLAY
					0.80	76.20		Medium dense yellow brown fine to medium SAND with many fine to medium sandstone GRAVEL. Possible completely weathered sandstone recovered as sandy gravel
		1.00	SPT	N=22 (3,4/4,3,5,10)				
		1.80	B		1.80	75.20		Highly weathered light grey/ orange brown/ brown silty friable MUDSTONE
		2.00	SPT	N=24 (2,4/4,4,8,8)				
		3.00	SPT	N=50 (9,1/50 for 420mm)				
					3.10	73.90		Highly weathered light brown/ orange brown sandy MUDSTONE
		3.42	SPT	50 (0 for 0mm/50 for 270mm)	3.42	73.58		End of Borehole at 3.42m

Remarks

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Windowless Sampler Borehole Log

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

Project Name:	St Michael's Avenue, Barnsley	Project No. P18-01603	Co-ords:	436736E - 408767N	Hole Type WS
Location:	St Michael's Avenue, Barnsley, S71 2SD		Level:	72.00	Scale 1:25
Client:	NPS Property Consultants Ltd		Dates:	07/01/2019	Logged By SWWS

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
								Grass overlying dark brown sandy clayey gravel with some brick fragments and rootlets (TOPSOIL)
		0.30	ES		0.26	71.74		
					0.42	71.58		Possible Reworked/ Made Ground: Firm dark brown sandy silty CLAY with some gravels of mixed lithology, coal fragments and rootlets.
								Firm brown sandy CLAY with sandstone gravels
		0.70	B		0.70	71.30		
								Firm becoming stiff (0.80m) orange brown/ grey mottled silty CLAY with some sandstone and ironstone gravels
		1.00	SPT	N=7 (1,1/2,2,1,2)				
					1.10	70.90		Stiff orange brown/ grey mottled silty CLAY. Possible completely weathered mudstone
	▼				1.80	70.20		Completely weathered black/ dark orange/ brown shaley MUDSTONE
		2.00	SPT	N=28 (2,4/6,6,8,8)				
		3.00	SPT	N=38 (5,6/6,8,11,13)				
					3.70	68.30		Highly weathered light grey/ orangeish brown sandy MUDSTONE
		4.00	SPT	50 (10,15/50 for 150mm)				
		4.15	SPT	8 (22,20/8 for 175mm)				
					4.33	67.68		End of Borehole at 4.33m

Remarks

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Windowless Sampler Borehole Log

Borehole No. **WS03**
Sheet 1 of 1

Project Name:	St Michael's Avenue, Barnsley	Project No. P18-01603	Co-ords:	436730E - 408713N	Hole Type WS
Location:	St Michael's Avenue, Barnsley, S71 2SD		Level:	76.00	Scale 1:25
Client:	NPS Property Consultants Ltd		Dates:	07/01/2019	Logged By SWWS

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
								Grass overlying dark brown sandy clayey gravel with rootlets (TOPSOIL)	
					0.20	75.80		Possibly Reworked/ Made Ground:: Compact (Firm) dark orange brown/ light brown very sandy silty CLAY with many sandstone gravels. Damp. Rootlets at base.	
					0.75	75.25		Stiff orange brown/ grey/ light brown mottled silty CLAY with some fine sandstone gravels	
		1.00	SPT	N=11 (1,2/3,2,3,3)	1.00	75.00		Stiff light brown/ orangeish brown friable CLAY. Possible completely weathered mudstone.	1
					1.50	74.50		Highly weathered brown/ grey friable MUDSTONE with some ironstone fragments at 2.0m	
	▼	2.00	SPT	N=23 (2,2/4,4,7,8)					2
					2.60	73.40		HIghly weathered grey/ brown friable MUDSTONE	
		3.00	SPT	N=43 (6,8/10,10,10,13)					3
					3.40	72.60		Highly weathered black/ orange brown friable MUDSTONE	
		3.80	SPT	50 (8,11/50 for 315mm)					
					3.95	72.05		Highly weathered light grey/ orange brown friable MUDSTONE	4
		4.12	SPT	50 (0 for 0mm/50 for 165mm)	4.12	71.89		End of Borehole at 4.12m	
									5

Remarks

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Windowless Sampler Borehole Log

Borehole No. **WS04**
Sheet 1 of 1

Project Name:	St Michael's Avenue, Barnsley	Project No. P18-01603	Co-ords:	436688E - 408714N	Hole Type WS
Location:	St Michael's Avenue, Barnsley, S71 2SD		Level:	69.00	Scale 1:25
Client:	NPS Property Consultants Ltd		Dates:	07/01/2019	Logged By SWWS

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.20	ES		0.20	68.80		Grass overlying dark brown sandy clayey gravel with rootlets (TOPSOIL)
					0.40	68.60		Firm brown very sandy silty CLAY with many fine sandstone gravels.
		0.60	B					Stiff orange/ brown/ grey/ light brown mottled silty CLAY with some sandstone fragments at base
		1.00	SPT	N=10 (2,2/2,2,3,3)	1.00	68.00		Stiff orange brown/ grey/ light brown friable CLAY. Possible completely weathered mudstone
					1.70	67.30		Highly weathered dark brown/ grey friable MUDSTONE
		2.00	SPT	N=50 (4,6/9,12,13,16)	1.98	67.03		Black shaley COAL
					2.05	66.95		Highly weathered light grey/ orange brown sandy MUDSTONE
		2.60	SPT	50 (9,12/50 for 365mm)				
					2.97	66.04		End of Borehole at 2.97m

Remarks

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Windowless Sampler Borehole Log

Borehole No. **WS05**
Sheet 1 of 1

Project Name:	St Michael's Avenue, Barnsley	Project No. P18-01603	Co-ords:	436739E - 408648N	Hole Type WS
Location:	St Michael's Avenue, Barnsley, S71 2SD		Level:	76.00	Scale 1:25
Client:	NPS Property Consultants Ltd		Dates:	07/01/2019	Logged By SWWS

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					0.15	75.85		Grass overlying dark brown sandy clayey gravel with rootlets (TOPSOIL)
					0.30	75.70		Firm light brown very sandy silty CLAY with many fine sandstone gravels
					0.90	75.10		Stiff orange brown/ grey/ light brown mottled silty sandy CLAY with some fine sandstone gravels
		1.00	SPT	N=15 (1,2/3,3,4,5)				Stiff light brown/ orange brown/ grey silty CLAY. Possible completely weathered mudstone
					1.60	74.40		Highly weathered grey/ brown friable MUDSTONE
		2.00	SPT	N=30 (4,4/6,8,8,8)				
		3.00	SPT	N=50 (7,11/50 for 420mm)				
		3.42	SPT	50 (0 for 0mm/50 for 270mm)	3.42	72.58		End of Borehole at 3.42m

1 2 3 4 5

Remarks

APPENDIX III

Trial Pit Logs

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Trial Pit Log

TrialPit No: TP01
Sheet 1 of 1

Project Name: St Michael's Avenue, Barnsley	Project No. P18-01603	Co-ords: 436791.00 - 408726.00 Level: 74.00	Date 07/01/2019
Location: St Michael's Avenue, Barnsley, S71 2SD		Dimensions (m): 2.70 x 1.10 Depth 1.90	Scale 1:25
Client: NPS Property Consultants Ltd			Logged AEC

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
	0.20	ES		0.30	73.70		Grass overlying dark brown slightly gravelly silty clay with rootlets (TOPSOIL)
				0.80	73.20		Firm light brown gravelly CLAY. Gravel is subangular to angular medium mudstone
				1.80	72.20		Light brown clayey angular fine to medium mudstone GRAVEL. Possible completely weathered mudstone bedrock
				1.90	72.10		Light brown/ grey medium laminated SANDSTONE bedrock End of Pit at 1.90m

Remarks: Terminated on sandstone bedrock

Stability:	Sides stable	Weather:	Cold and dry

Trial Pit Photos

TP01	
St Michael's Avenue, Barnsley	P18-01603

Photograph 01. Trial Pit 01.

Photograph 02. Trial Pit 01 - Arisings.

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Trial Pit Log

TrialPit No: TP02
Sheet 1 of 1

Project Name: St Michael's Avenue, Barnsley	Project No. P18-01603	Co-ords: 436711.00 - 408745.00 Level: 74.00	Date 07/01/2019
Location: St Michael's Avenue, Barnsley, S71 2SD		Dimensions (m): 2.70 x 1.10 Depth 2.90	Scale 1:25
Client: NPS Property Consultants Ltd			Logged AEC

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.20	73.80		Grass overlying medium to dark brown slightly gravelly silty clay with rootlets (TOPSOIL)
				0.50	73.50		Dark orangish brown slightly gravelly clayey SILT. Gravel is sub-angular fine to medium mudstone, siltstone and sandstone
				0.90	73.10		Firm light brown slightly gravelly silty CLAY. Gravel is sub-angular fine to medium mudstone, siltstone and sandstone
				1.90	72.10		Light brown clayey angular medium to coarse mudstone GRAVEL. Possible completely weathered mudstone.
				2.90	71.10		Weathered MUDSTONE recovered as light grey friable thinly laminated angular medium to coarse mudstone gravel
							End of Pit at 2.90m

1
2
3
4
5

Remarks: Terminated on mudstone bedrock

Stability:	Sides stable	Weather:	Dry and cold

Trial Pit Photos

TP02	
St Michael's Avenue, Barnsley	P18-01603

Photograph 03. Trial Pit 02.

Photograph 04. Trial Pit 02 - Arisings.

Met Consultancy Group Ltd
Southgate House
Pontefract Road
Leeds
LS10 1SW
Email: admin@metconsultancygroup.com
Phone: 0113 200 8900

Trial Pit Log

TrialPit No: TP03
Sheet 1 of 1

Project Name:	St Michael's Avenue, Barnsley	Project No. P18-01603	Co-ords: 436759.00 - 408671.00 Level: 76.00	Date 07/01/2019
Location:	St Michael's Avenue, Barnsley, S71 2SD		Dimensions (m): 2.70 x 1.10 Depth 2.00	Scale 1:25
Client:	NPS Property Consultants Ltd			Logged AEC

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.20	75.80		Grass overlying dark brown slightly gravelly silt (TOPSOIL)
	0.50	ES		0.80	75.20		Firm light brown, orange and grey mottled silty CLAY
				1.70	74.30		Light brown friable angular fine to coarse mudstone GRAVEL. Possible completely weathered mudstone
				2.00	74.00		Weathered SANDSTONE bedrock recovered as angular medium to coarse sandstone gravel and subangular to angular sandstone cobbles
							End of Pit at 2.00m

Remarks: Terminated on sandstone bedrock. Water infilling base of pit from 2.0mbgl.

Stability:	Sides stable	Weather:	Dry and cold

Trial Pit Photos

TP03	
St Michael's Avenue, Barnsley	P18-01603

Photograph 05. Trial Pit 03.

Photograph 06. Trial Pit 03 - Arisings.

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Trial Pit Log

TrialPit No: TP04
Sheet 1 of 1

Project Name: St Michael's Avenue, Barnsley	Project No. P18-01603	Co-ords: 436744.00 - 408698.00 Level: 76.00	Date 07/01/2019
Location: St Michael's Avenue, Barnsley, S71 2SD		Dimensions (m): 2.70 x 1.10 Depth 2.60	Scale 1:25
Client: NPS Property Consultants Ltd			Logged AEC

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.20	75.80		Dark brown slightly gravelly silt with rootlets (TOPSOIL)
				1.10	74.90		Firm to stiff light brown and orange mottled silty CLAY
				1.60	74.40		Stiff light borwn gravelly CLAY. Gravel is angular friable fine to medium mudstone. Completely weathered mudstone.
				2.20	73.80		Light grey weathered MUDSTONE recovered as angular fine to coarse gravels of thinly laminated mudstone.
				2.60	73.40		Dark grey thinly laminated SHALE/ MUDSTONE recovered as angular fine to coarse gravels.
							End of Pit at 2.60m

Remarks: Terminated on weathered mudstone.

Stability:	Sides stable	Weather:	Cold and dry

Trial Pit Photos

TP04	
St Michael's Avenue, Barnsley	P18-01603

Photograph 07. Trial Pit 04.

Photograph 08. Trial Pit 04- Arisings.

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Trial Pit Log

TrialPit No: TP05
Sheet 1 of 1

Project Name: St Michael's Avenue, Barnsley	Project No. P18-01603	Co-ords: 436713.00 - 408736.00 Level: 72.00	Date 07/01/2019
Location: St Michael's Avenue, Barnsley, S71 2SD		Dimensions (m): 2.70 x 1.10 Depth 2.70	Scale 1:25
Client: NPS Property Consultants Ltd			Logged AEC

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.00	72.00		Grass overlying dark brown slightly gravelly silty clay (TOPSOIL)
	0.30	ES		0.30	71.70		Firm light brown silty CLAY
				0.60	71.40		Dark grey/ black band of weathered thinly laminated MUDSTONE
				0.70	71.30		Light grey completely weathered friable MUDSTONE recovered as slightly clayey angular fine to coarse mudstone gravel
				1.20	70.80		Dark grey completely weathered friable MUDSTONE recovered as slightly clayey angular fine to coarse mudstone gravel
				2.00	70.00		Black COAL
				2.05	69.95		Light grey completely weathered friable MUDSTONE recovered as slightly clayey angular fine to coarse mudstone gravel
				2.70	69.30		End of Pit at 2.70m

Remarks: Terminated on weathered mudstone.

Stability:	Stable	Weather:	Cold and dry

Trial Pit Photos

TP05	
St Michael's Avenue, Barnsley	P18-01603

Photograph 09. Trial Pit 05.

Photograph 10. Trial Pit 05 - Arisings.

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Trial Pit Log

TrialPit No: TP06
Sheet 1 of 1

Project Name: St Michael's Avenue, Barnsley	Project No. P18-01603	Co-ords: 436702.00 - 408687.00 Level: 74.00	Date 07/01/2019
Location: St Michael's Avenue, Barnsley, S71 2SD		Dimensions (m): 2.70 x 1.10 Depth 2.10	Scale 1:25
Client: NPS Property Consultants Ltd			Logged AEC

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.20	73.80		Grass overlying medium brown slightly gravelly silty clay (TOPSOIL)
	0.50	ES					Firm light brown slightly gravelly silty CLAY
				0.75	73.25		
				1.30	72.70		Black COAL
				1.30	72.70		Black/ orange completely weathered MUDSTONE recovered as clayey angular fine to medium mudstone gravel
▼							Light grey weathered MUDSTONE recovered as angular thinly laminated clayey gravel
				2.10	71.90		End of Pit at 2.10m

Remarks: Terminated on weathered mudstone. Water infilling pit from 2.0mbgl.

Stability:	Stable	Weather:	Dry and cold

Trial Pit Photos

TP06	
St Michael's Avenue, Barnsley	P18-01603

Photograph 11. Trial Pit 06.

Photograph 12. Trial Pit 06 - Arisings.

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Phone: 0113 200 8900

Trial Pit Log

TrialPit No: TP07
Sheet 1 of 1

Project Name: St Michael's Avenue, Barnsley	Project No. P18-01603	Co-ords: 436721.00 - 408666.00 Level: 76.00	Date 07/01/2019
Location: St Michael's Avenue, Barnsley, S71 2SD		Dimensions (m): 2.70 × 1.10 Depth 2.40	Scale 1:25
Client: NPS Property Consultants Ltd			Logged AEC

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
							Grass overlying dark brown slightly gravelly silty clay (TOPSOIL)
				0.30	75.70		Light orangeish brown slightly gravelly clayey SAND
	0.50	ES		0.60	75.40		Firm light orangish brown slightly gravelly silty CLAY. Gravel is subangular fine to medium mudstone and sandstone
				1.20	74.80		Light grey/ orange completely weathered mudstone recovered as clayey angular fine to medium mudstone GRAVEL
				1.70	74.30		Light and dark grey weathered MUDSTONE recovered as very thinly laminated angular fine to coarse mudstone gravel
				2.40	73.60		End of Pit at 2.40m

1
2
3
4
5

Remarks:

Stability:	Stable	Weather:	Dry and cold

Trial Pit Photos

TP07	
St Michael's Avenue, Barnsley	P18-01603

Photograph 13. Trial Pit 07.

Photograph 14. Trial Pit 07 - Arisings.

Shallow excavation in to earth mound in north east

APPENDIX IV

Soil Test Results

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

FINAL ANALYTICAL TEST REPORT

Envirolab Job Number: 19/00103
Issue Number: 1 **Date:** 24 January, 2019

Client:
MET Engineers Ltd
Southgate House
Pontefract Road
Leeds
LS10 1SW

Project Manager: Ami Cooper/Thomas White
Project Name: St Michael's Avenue
Project Ref: P18-01603
Order No: PO-02148
Date Samples Received: 08/01/19
Date Instructions Received: 09/01/19
Date Analysis Completed: 24/01/19

Prepared by:

Elisha Hartley
Admin Assistant

Approved by:

Richard Wong
Client Manager

Envirolab Job Number: 19/00103

Client Project Name: St Michael's Avenue

Client Project Ref: P18-01603

Lab Sample ID	19/00103/1	19/00103/2	19/00103/3	19/00103/4	19/00103/5	19/00103/6	19/00103/7	19/00103/8	Units	Method ref
Client Sample No										
Client Sample ID	TP01	WS01	WS02	TP03	TP05	TP06	TP07	WS04		
Depth to Top	0.20	0.60	0.30	0.50	0.30	0.50	0.50	0.20		
Depth To Bottom										
Date Sampled	07-Jan-19	07-Jan-19	07-Jan-19	07-Jan-19	07-Jan-19	07-Jan-19	07-Jan-19	07-Jan-19		
Sample Type	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES		
Sample Matrix Code	6AE	4A	6E	5	6AE	5	5	6E		
% Stones >10mm$_A$	<0.1	24.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	% w/w	A-T-044
Organic matter$_D^{M\#}$	4.7	2.0	2.6	0.6	4.6	1.9	0.7	4.9	% w/w	A-T-032 OM
Arsenic$_D^{M\#}$	12	10	14	5	8	2	7	8	mg/kg	A-T-024s
Cadmium$_D^{M\#}$	1.6	0.8	1.4	1.7	1.9	1.5	1.2	1.4	mg/kg	A-T-024s
Copper$_D^{M\#}$	22	13	25	33	22	17	5	19	mg/kg	A-T-024s
Chromium$_D^{M\#}$	22	11	18	34	27	22	12	20	mg/kg	A-T-024s
Chromium (hexavalent)$_D$	<1	<1	<1	<1	<1	<1	<1	<1	mg/kg	A-T-040s
Lead$_D^{M\#}$	45	27	49	25	48	23	9	38	mg/kg	A-T-024s
Mercury$_D$	<0.17	<0.17	<0.17	<0.17	<0.17	<0.17	<0.17	<0.17	mg/kg	A-T-024s
Nickel$_D^{M\#}$	24	14	22	42	28	24	12	22	mg/kg	A-T-024s
Selenium$_D^{\#}$	<1	<1	<1	<1	2	1	<1	<1	mg/kg	A-T-024s
Zinc$_D^{M\#}$	83	35	75	86	89	57	27	66	mg/kg	A-T-024s

Envirolab Job Number: 19/00103

Client Project Name: St Michael's Avenue

Client Project Ref: P18-01603

Lab Sample ID	19/00103/1	19/00103/2	19/00103/3	19/00103/4	19/00103/5	19/00103/6	19/00103/7	19/00103/8	Units	Method ref
Client Sample No										
Client Sample ID	TP01	WS01	WS02	TP03	TP05	TP06	TP07	WS04		
Depth to Top	0.20	0.60	0.30	0.50	0.30	0.50	0.50	0.20		
Depth To Bottom										
Date Sampled	07-Jan-19	07-Jan-19	07-Jan-19	07-Jan-19	07-Jan-19	07-Jan-19	07-Jan-19	07-Jan-19		
Sample Type	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES		
Sample Matrix Code	6AE	4A	6E	5	6AE	5	5	6E		
Asbestos in Soil (inc. matrix)										
Asbestos in soil$_A^{\#}$	NAD	NAD	NAD	NAD	NAD	NAD	NAD	NAD		A-T-045
Asbestos ACM - Suitable for Water Absorption Test?	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A		

Envirolab Job Number: 19/00103

Client Project Name: St Michael's Avenue

Client Project Ref: P18-01603

Lab Sample ID	19/00103/1	19/00103/2	19/00103/3	19/00103/4	19/00103/5	19/00103/6	19/00103/7	19/00103/8	Units	Method ref
Client Sample No										
Client Sample ID	TP01	WS01	WS02	TP03	TP05	TP06	TP07	WS04		
Depth to Top	0.20	0.60	0.30	0.50	0.30	0.50	0.50	0.20		
Depth To Bottom										
Date Sampled	07-Jan-19	07-Jan-19	07-Jan-19	07-Jan-19	07-Jan-19	07-Jan-19	07-Jan-19	07-Jan-19		
Sample Type	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES		
Sample Matrix Code	6AE	4A	6E	5	6AE	5	5	6E		
PAH-16MS										
Acenaphthene$_A^{M\#}$	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	A-T-019s
Acenaphthylene$_A^{M\#}$	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	A-T-019s
Anthracene$_A^{M\#}$	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	mg/kg	A-T-019s
Benzo(a)anthracene$_A^{M\#}$	0.09	0.07	0.10	<0.04	<0.04	<0.04	<0.04	<0.04	mg/kg	A-T-019s
Benzo(a)pyrene$_A^{M\#}$	0.10	0.05	0.10	<0.04	<0.04	<0.04	<0.04	<0.04	mg/kg	A-T-019s
Benzo(b)fluoranthene$_A^{M\#}$	0.13	0.07	0.13	<0.05	<0.05	<0.05	<0.05	<0.05	mg/kg	A-T-019s
Benzo(ghi)perylene$_A^{M\#}$	<0.05	<0.05	0.06	<0.05	<0.05	<0.05	<0.05	<0.05	mg/kg	A-T-019s
Benzo(k)fluoranthene$_A^{M\#}$	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	mg/kg	A-T-019s
Chrysene$_A^{M\#}$	0.12	0.08	0.13	<0.06	<0.06	<0.06	<0.06	<0.06	mg/kg	A-T-019s
Dibenzo(ah)anthracene$_A^{M\#}$	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	mg/kg	A-T-019s
Fluoranthene$_A^{M\#}$	0.17	0.13	0.19	<0.08	<0.08	<0.08	<0.08	<0.08	mg/kg	A-T-019s
Fluorene$_A^{M\#}$	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	A-T-019s
Indeno(123-cd)pyrene$_A^{M\#}$	0.06	0.03	0.07	<0.03	<0.03	<0.03	<0.03	<0.03	mg/kg	A-T-019s
Naphthalene$_A^{M\#}$	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	mg/kg	A-T-019s
Phenanthrene$_A^{M\#}$	0.07	0.06	0.08	<0.03	<0.03	<0.03	<0.03	<0.03	mg/kg	A-T-019s
Pyrene$_A^{M\#}$	0.15	0.11	0.17	<0.07	<0.07	<0.07	<0.07	<0.07	mg/kg	A-T-019s
Total PAH-16MS$_A^{M\#}$	0.89	0.60	1.03	<0.08	<0.08	<0.08	<0.08	<0.08	mg/kg	A-T-019s

Envirolab Job Number: 19/00103

Client Project Name: St Michael's Avenue

Client Project Ref: P18-01603

Lab Sample ID	19/00103/1	19/00103/2	19/00103/3	19/00103/4	19/00103/5	19/00103/6	19/00103/7	19/00103/8	Units	Method ref
Client Sample No										
Client Sample ID	TP01	WS01	WS02	TP03	TP05	TP06	TP07	WS04		
Depth to Top	0.20	0.60	0.30	0.50	0.30	0.50	0.50	0.20		
Depth To Bottom										
Date Sampled	07-Jan-19	07-Jan-19	07-Jan-19	07-Jan-19	07-Jan-19	07-Jan-19	07-Jan-19	07-Jan-19		
Sample Type	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES		
Sample Matrix Code	6AE	4A	6E	5	6AE	5	5	6E		
TPH CWG										
Ali >C5-C6$_A^{\#}$	-	<0.01	-	<0.01	<0.01	<0.01	-	-	mg/kg	A-T-022s
Ali >C6-C8$_A^{\#}$	-	<0.01	-	<0.01	<0.01	<0.01	-	-	mg/kg	A-T-022s
Ali >C8-C10$_A^{\#}$	-	<0.01	-	<0.01	<0.01	<0.01	-	-	mg/kg	A-T-022s
Ali >C10-C12$_A^{\#}$	-	<0.1	-	<0.1	<0.1	<0.1	-	-	mg/kg	A-T-023s
Ali >C12-C16$_A^{\#}$	-	<0.1	-	<0.1	<0.1	<0.1	-	-	mg/kg	A-T-023s
Ali >C16-C21$_A^{\#}$	-	<0.1	-	<0.1	<0.1	<0.1	-	-	mg/kg	A-T-023s
Ali >C21-C35$_A^{\#}$	-	<0.1	-	<0.1	<0.1	<0.1	-	-	mg/kg	A-T-023s
Total Aliphatics$_A$	-	<0.1	-	<0.1	<0.1	<0.1	-	-	mg/kg	A-T-023s
Aro >C5-C7$_A^{\#}$	-	<0.01	-	<0.01	<0.01	<0.01	-	-	mg/kg	A-T-022s
Aro >C7-C8$_A^{\#}$	-	<0.01	-	<0.01	<0.01	<0.01	-	-	mg/kg	A-T-022s
Aro >C8-C9$_A^{\#}$	-	<0.01	-	<0.01	<0.01	<0.01	-	-	mg/kg	A-T-022s
Aro >C9-C10$_A^{\#}$	-	<0.01	-	<0.01	<0.01	<0.01	-	-	mg/kg	A-T-022s
Aro >C10-C12$_A^{\#}$	-	<0.1	-	<0.1	<0.1	<0.1	-	-	mg/kg	A-T-023s
Aro >C12-C16$_A^{\#}$	-	<0.1	-	<0.1	<0.1	<0.1	-	-	mg/kg	A-T-023s
Aro >C16-C21$_A^{\#}$	-	<0.1	-	<0.1	<0.1	<0.1	-	-	mg/kg	A-T-023s
Aro >C21-C35$_A^{\#}$	-	0.7	-	<0.1	<0.1	<0.1	-	-	mg/kg	A-T-023s
Total Aromatics$_A$	-	0.7	-	<0.1	<0.1	<0.1	-	-	mg/kg	A-T-023s
TPH (Ali & Aro)$_A$	-	0.7	-	<0.1	<0.1	<0.1	-	-	mg/kg	A-T-023s
BTEX - Benzene$_A^{\#}$	-	<0.01	-	<0.01	<0.01	<0.01	-	-	mg/kg	A-T-022s
BTEX - Toluene$_A^{\#}$	-	<0.01	-	<0.01	<0.01	<0.01	-	-	mg/kg	A-T-022s
BTEX - Ethyl Benzene$_A^{\#}$	-	<0.01	-	<0.01	<0.01	<0.01	-	-	mg/kg	A-T-022s
BTEX - m & p Xylene$_A^{\#}$	-	<0.01	-	<0.01	<0.01	<0.01	-	-	mg/kg	A-T-022s
BTEX - o Xylene$_A^{\#}$	-	<0.01	-	<0.01	<0.01	<0.01	-	-	mg/kg	A-T-022s
MTBE$_A^{\#}$	-	<0.01	-	<0.01	<0.01	<0.01	-	-	mg/kg	A-T-022s

Envirolab Job Number: 19/00103

Client Project Name: St Michael's Avenue

Client Project Ref: P18-01603

Lab Sample ID	19/00103/9	19/00103/10	19/00103/11						Units	Method ref
Client Sample No										
Client Sample ID	WS01	WS02	WS04							
Depth to Top	1.80	0.70	0.60							
Depth To Bottom	2.00	1.00	1.00							
Date Sampled	07-Jan-19	07-Jan-19	07-Jan-19							
Sample Type	Soil - D	Soil - D	Soil - D							
Sample Matrix Code	5	5	5							
% Stones >10mm$_A$	<0.1	<0.1	<0.1						% w/w	A-T-044
pH$_D$$^{M\#}$	5.39	7.14	7.28						pH	A-T-031s
Sulphate (water sol 2:1)$_D$$^{M\#}$	0.04	0.03	0.05						g/l	A-T-026s
Sulphate (acid soluble)$_D$$^{M\#}$	<200	<200	<200						mg/kg	A-T-028s
1.02 Atterburg 4Pt BS1377 1990 pt2 cl4.4,5.3+5.4$_A$$^{\#}$	Appended	Appended	Appended							Subcon SS
1.01 % Moisture BS1377 1990 pt2 cl3.2$_A$$^{\#}$	Appended	Appended	Appended							Subcon SS

REPORT NOTES

General:
This report shall not be reproduced, except in full, without written approval from Envirolab.
All samples contained within this report, and any received with the same delivery, will be disposed of one month after the date of this report.
Analytical results reflect the quality of the sample at the time of analysis only.
Opinions and interpretations expressed are outside the scope of our accreditation.
If results are in italic font they are associated with an AQC failure, these are not accredited and are unreliable.
A deviating samples report is appended and will indicate if samples or tests have been found to be deviating. Any test results affected may not be an accurate record of the concentration at the time of sampling and, as a result, may be invalid.

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

TPH analysis of water by method A-T-007:
Free and visible oils are excluded from the sample used for analysis so that the reported result represents the dissolved phase only.

Electrical Conductivity of water by Method A-T-037:
Results greater than 12900µS/cm @ 25°C / 11550µS/cm @ 20°C fall outside the calibration range and as such are unaccredited.

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

Predominant Matrix Codes:
1 = SAND, 2 = LOAM, 3 = CLAY, 4 = LOAM/SAND, 5 = SAND/CLAY, 6 = CLAY/LOAM, 7 = OTHER, 8 = Asbestos bulk ID sample.
Samples with Matrix Code 7 & 8 are not predominantly a SAND/LOAM/CLAY mix and are not covered by our BSEN 17025 or MCERTS accreditations, with the exception of bulk asbestos which are BSEN 17025 accredited.
Secondary Matrix Codes:
A = contains stones, B = contains construction rubble, C = contains visible hydrocarbons, D = contains glass/metal,
E = contains roots/twigs.

Key:
IS indicates Insufficient Sample for analysis.
US indicates Unsuitable Sample for analysis.
NDP indicates No Determination Possible.
NAD indicates No Asbestos Detected.
N/A indicates Not Applicable.
Superscript # indicates method accredited to ISO 17025.
Superscript "M" indicates method accredited to MCERTS.
Subscript "A" indicates analysis performed on the sample as received.
Subscript "D" indicates analysis performed on the dried sample, crushed to pass a 2mm sieve

Please contact us if you need any further information.

STRUCTURAL SOILS LTD

TEST REPORT

Report No. 783614 R1

1774

Date 17-January-2019 Contract 19/00103

Client Envirolab Ltd
Address Units 7 & 8 Sandpits Business Park
Mottram Road
Hyde
SK14 3AR

For the Attention of Iain Haslock

Samples submitted by client	09/01/2019	Client Reference	19/00103
Testing Started	10/01/2019	Client Order No.	P0739893
Testing Completed	17/01/2019	Instruction Type	Written

Tests marked 'Not UKAS Accredited' in this report are not included in the UKAS Accreditation Schedule for our Laboratory.

UKAS Accredited Tests Undertaken

Moisture Content (oven drying method) BS1377:Part 2:1990,clause 3.2
Liquid Limit (four point method) BS1377:Part 2:1990,clause 4.3
Plastic Limit BS1377:Part 2:1990,clause 5.3
Plasticity Index Derivation BS1377:Part 2:1990,clause 5.4

* This clause of BS1377 is no longer the most up to date method due to the publication of ISO17892

Please Note: Remaining samples will be retained for a period of one month from today and will then be disposed of.
Test were undertaken on samples 'as received' unless otherwise stated.
Opinions and interpretations expressed in this report are outside the scope of accreditation for this laboratory.

Structural Soils Ltd, The Potteries, Pottery Street, Castleford, WF10 1NJ Tel.01977 552255. E-mail mark.athorne@soils.co.uk

SUMMARY OF SOIL CLASSIFICATION TESTS

In accordance with clauses 3.2,4.3,4.4,5.3,5.4,7.2,8.2,8.3 of BS1377:Part 2:1990

Exploratory Position ID	Sample Ref	Sample Type	Depth (m)	Moisture Content %	Liquid Limit %	Plastic Limit %	Plasticity Index	% <425um	Description of Sample
WS01	19/00103/9	D	1.80	22	54	25	29	100	Brown mottled slightly sandy CLAY
WS02	19/00103/10	D	0.70	30	66	28	38	92	Brown mottled slightly gravelly CLAY
WS04	19/00103/11	D	0.60	18	45	21	24	82	Brown mottled slightly sandy slightly gravelly CLAY

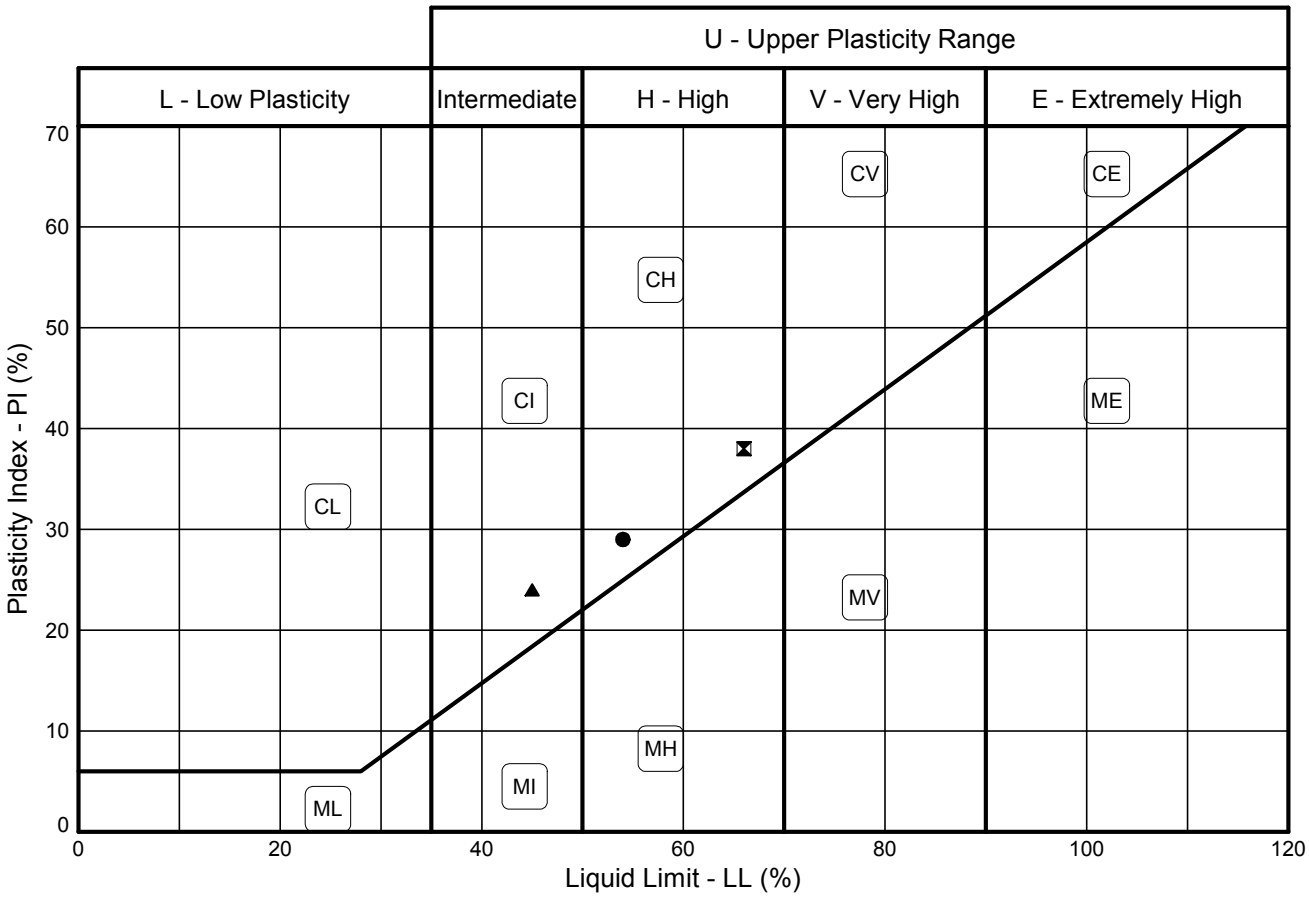
STRUCTURAL SOILS LTD

Contract: **19/00103**

Contract Ref: **783614**

PLASTICITY CHART - PI Vs LL

In accordance with BS5930:2015
Testing in accordance with BS1377-2:1990



Sample Identification				BS Test Method #	Preparation Method +	MC %	LL %	PL %	PI %	<425um %	Lab location
	Exploratory Position ID	Sample	Depth (m)								
●	WS01	19/00103/9D	1.80	3.2/4.3/5.3/5.4	4.2.3	22	54	25	29	100	C
⊠	WS02	19/00103/10D	0.70	3.2/4.3/5.3/5.4	4.2.4	30	66	28	38	92	C
▲	WS04	19/00103/11D	0.60	3.2/4.3/5.3/5.4	4.2.4	18	45	21	24	82	C

Tested in accordance with the following clauses of BS1377-2:1990.

3.2 - Moisture Content
4.3 - Cone Penetrometer Method
4.4 - One Point Cone Penetrometer Method
4.6 - One Point Casagrande Method
5.3 - Plastic Limit Method
5.4 - Plasticity Index

+ Tested in accordance with the following clauses of BS1377-2:1990.

4.2.3 - Natural State
4.2.4 - Wet Sieved

Key: * = Non-standard test, NP = Non plastic.

Lab location: B = Bristol (BS3 4AG), C = Castleford (WF10 1NJ), H = Hemel Hempstead (HP3 9RT), T = Tonbridge (TN11 9HU)

STRUCTURAL SOILS
The Potteries
Pottery Street
Castleford
W. Yorkshire WF10 1NJ

Compiled By		Date
C Cole	CATHERINE COLE	17/01/19

Contract	Contract Ref:
19/00103	783614

TESTING VERIFICATION CERTIFICATE

1774

The test results included in this report are certified as:-

ISSUE STATUS: **FINAL**

In accordance with the Structural Soils Ltd Laboratory Quality Management System, results sheets and summaries of results issued by the laboratory are checked by an approved signatory. The integrity of the test data and results are ensured by control of the computer system employed by the laboratory as part of the Software Verification Program as detailed in the Laboratory Quality Manual.

This testing verification certificate covers all testing compiled on or before the following datetime: **18/01/2019 13:52:16**.

Testing reported after this date is not covered by this Verification Certificate.

Approved Signatory
Mark Athorne (Laboratory Manager)

(Head Office)
Bristol Laboratory
Unit 1A, Princess Street
Bedminster
Bristol
BS3 4AG

Castleford Laboratory
The Potteries, Pottery Street
Castleford
West Yorkshire
WF10 1NJ

Hemel Laboratory
18 Frogmore Road
Hemel Hempstead
Hertfordshire
HP3 9RT

Tonbridge Laboratory
Anerley Court, Half Moon Lane
Hildenborough
Tonbridge
TN11 9HU

STRUCTURAL SOILS LTD	Contract: **19/00103**	Job No: **783614**

Envirolab Deviating Samples Report

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

Client: MET Engineers Ltd, Southgate House, Pontefract Road, Leeds, LS10 1SW

Project No: 19/00103

Date Instructions Received: 09/01/2019 (am)

Project: St Michael's Avenue

Cool Box Temperatures (°C): 6.2, 6.4

Clients Project No: P18-01603

NO DEVIATIONS IDENTIFIED

If, at any point before reaching the laboratory, the temperature of the samples has breached those set in published standards, e.g. BS-EN 5667-3, ISO 18400-102:2017, then the concentration of any affected analytes may differ from that at the time of sampling.

APPENDIX V

Gas Monitoring Results and Gas Monitor Calibration Certificate

MET Engineers Ltd
Southgate House, Pontefract Road,
Leeds, W.Yorkshire, LS10 1SW
Tel: 0113 200 8900 Fax: 0113 200 8901
Web: www.metengineers.com

Gas Monitoring Record

Client	Barnsley Metropolitan Borough Council
Project No.	P18-01603
Project Title:	St Michael's Avenue
Borehole No:	WS01
Response Zone:	0.5-3mbgl
Grid Reference:	436818, 408703
Equipment:	Geo Tech GA5000

Date	Time	Weather	CH_4 (%)	CO_2 (%)	O_2 (%)	H_2S (%)	CO (ppm)	Balance (%)	Atmospheric Pressure (mb)	Relative Pressure (mb)	Pressure Trend*	Flow (l/h)	Water (mBGL)	BH Depth (mBGL)
23.01.19	12.46	Dry/Cold	0.1	2.1	19.2	0	0	78.6	996	0.17	↑	0.1	Dry	3

* Pressure trend taken from nearest Met Office observation point.

MET Engineers Ltd
Southgate House, Pontefract Road,
Leeds, W.Yorkshire, LS10 1SW
Tel: 0113 200 8900 Fax: 0113 200 8901
Web: www.metengineers.com

Gas Monitoring Record

Client	Barnsley Metropolitan Borough Council
Project No.	P18-01603
Project Title:	St Michael's Avenue
Borehole No:	WS02
Response Zone:	0.5-3mbgl
Grid Reference:	436736, 408767
Equipment:	Geo Tech GA5000

Date	Time	Weather	CH_4 (%)	CO_2 (%)	O_2 (%)	H_2S (%)	CO (ppm)	Balance (%)	Atmospheric Pressure (mb)	Relative Pressure (mb)	Pressure Trend*	Flow (l/h)	Water (mBGL)	BH Depth (mBGL)
23.01.19	12.30	Dry/Cold	0.1	0.4	20.9	0	0	78.7	996	0.02	↑	0.2	1.45	3

* Pressure trend taken from nearest Met Office observation point.

MET Engineers Ltd
Southgate House, Pontefract Road,
Leeds, W.Yorkshire, LS10 1SW
Tel: 0113 200 8900 Fax: 0113 200 8901
Web: www.metengineers.com

Gas Monitoring Record

Client	Barnsley Metropolitan Borough Council
Project No.	P18-01603
Project Title:	St Michael's Avenue
Borehole No:	WS04
Response Zone:	0.5-3mbgl
Grid Reference:	436688, 408714
Equipment:	Geo Tech GA5000

Date	Time	Weather	CH_4 (%)	CO_2 (%)	O_2 (%)	H_2S (%)	CO (ppm)	Balance (%)	Atmospheric Pressure (mb)	Relative Pressure (mb)	Pressure Trend*	Flow (l/h)	Water (mBGL)	BH Depth (mBGL)
23.01.19	12.36	Dry/Cold	0.1	0.3	20.1	0	0	79.5	996	-2.1	↑	0	0.75	2.6

* Pressure trend taken from nearest Met Office observation point.

CERTIFICATION OF CALIBRATION

4533

Date Of Calibration: 13-Nov-2018

Certificate Number: G500155_1/21846

Issued by: QED Environmental Systems Ltd.

Customer: **Met Engineers**
Southgate House Pontefract Road LEEDS
LS10 1SW UNITED KINGDOM

Description: Gas Analyser

Model: GA5000

Serial Number: G500155

UKAS Accredited results:

Results after adjustment :

Methane (CH_4)		
Certified Gas (%)	Instrument Reading (%)	Uncertainty (%)
5.0	4.9	0.41
15.0	14.9	0.64
49.9	49.2	0.94

Carbon Dioxide (CO_2)		
Certified Gas (%)	Instrument Reading (%)	Uncertainty (%)
5.0	4.9	0.43
15.0	14.9	0.70
50.1	50.1	1.1

Oxygen (O_2)		
Certified Gas (%)	Instrument Reading (%)	Uncertainty (%)
21.1	21.2	0.31

The inwards assessment was carried out 06-Nov-2018.
The maximum adjustment is larger than the inwards assessment uncertainty.
Inwards assessment data is available if requested.

All concentrations are molar.

CH_4, CO_2 readings recorded at : 31.5 °C ± 2.5 °C

O2 readings recorded at : 21.6 °C ± 2.5 °C

Barometric Pressure : 1008 mbar ± 4 mbar

Method of Test : The analyser is calibrated in a temperature controlled chamber using a series of reference gases, in compliance with procedure LP004.

Calibration Instance:99 IGC Instance:99

www.qedenv.com +44 (0) 333 800 0088 sales@qedenv.co.uk

QED Environmental Systems Ltd. Cyan Park - Unit 3, Jimmy Hill Way, Coventry, CV2 4QP, UNITED KINGDOM

Registered in England and Wales 1898734

CERTIFICATION OF CALIBRATION

4533

Date Of Calibration: 13-Nov-2018

Certificate Number: G500155_1/21846

Issued by: QED Environmental Systems Ltd.

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor of k=2, providing a level of confidence of approximately 95%. The uncertainty evaluation has been carried out in accordance with UKAS requirements.

Calibrations marked 'Non-UKAS Accredited results' on this certificate have been included for completeness.

Non-UKAS accredited results after adjustment:

Barometer (mbar)	
Reference	**Instrument Reading**
1008	1008

Additional Gas Cells		
Gas	**Certified Gas (ppm)**	**Instrument Reading (ppm)**
H_2S	257	257
CO	497	497

Internal Flow	
Applied (l/hr)	**Instrument Reading (l/hr)**
5	5.2
10	10.1

Date of Issue : 15-Nov-2018

Approved by Signatory

Jeremy Dunn

Laboratory Inspection

Calibration Instance:99 IGC Instance:99

www.qedenv.com +44 (0) 333 800 0088 sales@qedenv.co.uk

QED Environmental Systems Ltd. Cyan Park - Unit 3, Jimmy Hill Way, Coventry, CV2 4QP, UNITED KINGDOM

Registered in England and Wales 1898734

SERVICE REPORT

Issued by: QED Environmental Systems Ltd.

Customer Name: Met Engineers

Model:	GA5000	**Date of Service:**	15-Nov-2018
Part Number:	GA5KA0F0-101	**Service Engineer:**	Ricky Cottrill
Serial Number:	G500155	**Calibration Engineer:**	Suk Balrey

Verification / Approved By: Jeremy Dunn **Signature:**

Reason for Return (inc. Customer Comments):

Returned for full service and calibration. No documentation received from the client

Service Comments/Feedback:

Thank you for returning your gas analyser to the Geotech Service Centre for full service and calibration. We are pleased to inform you that the analyser was received and fully assessed by one of our experienced Service Engineers and no significant faults or issues were observed during the assessment. Our extensive service was carried out, and any necessary components replaced. The analyser has successfully passed all of our rigorous testing and quality checks and has been calibrated using our bespoke, state of the art calibration facility. For further information about how to get the best use from your instrument please visit our YouTube channel http://www.youtube.com/GeotechTV and on our Website http://www.geotechuk.com We have replaced the battery because it is over 2 years old. This is in accordance to the battery cell manufacturer's recommendation.The O2 electrochemical sensor has been replaced due to it being over 3 years old in accordance with the manufacturer's recommendations, and also as a proactive measure based on our experience of the typical lifetime of this type of sensor.

If you require any further assistance with your instrument please email our Technical Support Team at technical@geotech.co.uk or call us on +44 1926 338111 (Monday to Thursday 08.30 - 17.00 & Friday 08.30 - 15.30) UK time zone.

Next Service Due: 13-May-2019

SERVICE REPORT

Issued by: QED Environmental Systems Ltd.

17025	5	50	65	7,384	340	25
Our ISO accreditation for our customised auto-calibration facilities	Number of days we aim to complete your service within	Number of checks instruments are subject to when serviced	Number of countries from which we service instruments / accessories each year	Number of calibration completed in last 12 months	Minimum number of service instruments we process each month	Cost in £'s of fully insured analyser collection for our UK customer

www.qedenv.com **+44 (0) 333 800 0088** **sales@qedenv.co.uk**

QED Environmental Systems Ltd. Cyan Park - Unit 3, Jimmy Hill Way, Coventry, CV2 4QP, UNITED KINGDOM

Registered in England and Wales 1898734