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Geo-Environmental Ltd

Consulting Geo-Environmental Engineers

Phase 2 Geo-Environmental Assessment

Land South of Hanson Close,
Middleton, M24 2HD

Report Ref:
19060-PWAG-00-XX-RP-G-2000-P01

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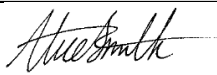
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Executive Summary

PWA Geo-Environmental Ltd (PWAG) was commissioned by Middleton Sheet Metal Co Ltd to undertake a Phase 2 Geo-Environmental Assessment for a proposed industrial development located at land south of Hanson Close, Middleton. A brief summary of salient geo-environmental issues is provided below. However, the full report must be read in its entirety.

Key Details	
Site	The site is a vacant and overgrown block of land with bunds of demolition material along the northern and eastern boundary. Japanese Knotweed was observed on site and requires eradication. There is a brick wall along the southern margin of the site beyond which levels fall down to the site boundary coincident with the River Irk.
History	The site comprised agricultural fields from the earliest map of 1848. By 1891 the site was developed with Spring Vale Works (dyeing and finishing) that cuts into the slope of the northern boundary. The western third of the site appeared to be a pit that was occupied by filter beds by 1907. By 1938 the mill had gone. By 1990 the site was identified as a depot with three small buildings and a sub-station. The cut slopes were no longer present, and the site had presumably been filled. By 2014 no buildings were shown on site.
Geology	The anticipated downward sequence comprises topsoil/ made ground over an unknown thickness of alluvium and/or glaciofluvial deposits. Bedrock comprises mudstone, siltstone and sandstone of the Pennine Lower Coal Measures Formation. The Lower Bent Mine coal seam is conjectured to subcrop beneath the south west corner of the site and dip in a south westerly direction.
Hydrology	The River Irk forms the southern boundary of the site and is classified as a main river.
Ground Gas Risk	A ground gas risk was identified. At the time of writing, gas monitoring was underway and will be reported once the monitoring programme is completed.

Geo-Environmental Findings	
Site Works	Investigations comprised the excavation of six trial pits to a maximum depth of 2.7 m and four cable percussive boreholes to a maximum depth of 21.2 m. Gas monitoring wells were installed in all four boreholes.
Ground Conditions	Made ground was encountered in every exploration location and proven to depths of 5.45 m and 7.3 m. This generally included three distinct layers: • Shallow variable made ground with anthropogenic fragments up to 1.15 m bgl; • Reworked natural made ground comprised of sandy clays and clayey sands between 0.85 and 3.2 m thick. • Deeper variable made ground with anthropogenic fragments between 1.45 and 4.20 m thick. Underlying natural strata comprised an interbedded sequence of loose to mostly medium dense coarse grained alluvium with subordinated soft and stiff fine grained alluvium. Mudstone and siltstone bedrock was encountered between 14.9 m and 20.5 m bgl.
Groundwater	Groundwater was recorded between 4.92 m and 5.76 m bgl in granular alluvium in BH01 and in made ground at BH3 and BH4. This appears to be at a similar level to the River Irk. Perched groundwater was also encountered during the investigation.
Contamination	Chemical testing identified asbestos in made ground in TP05 0.3-0.4 m. No other analytes exceeded the generic assessment criteria within made ground, reworked made ground or alluvium.
Remediation	Made ground should be contained under areas of proposed hardstanding (whether it be buildings or car parking/roadways) or beneath a suitable clean cover system in landscaped areas.
Foundations	Due to the depth of made ground, a piled foundation solution or ground improvement (such as controlled modulus columns (CMC)) should be considered for any buildings.
Floors	The floor design will be influenced by the preferred foundation solution. Where a piled solution is adopted the floor will be suspended. However, a ground improvement foundation solution can be designed to allow construction of a ground bearing floor slab.
Roads and Paved Areas	Untreated made ground should be assumed to have a CBR value of <2.5% unless proven otherwise by insitu testing. However, following suitable re-engineering of made ground, it is considered likely

	that a CBR value of at least 2.5% will be achievable across the majority of the site although this is subject to in-situ testing during construction.
Sulphate Class	A Design Sulphate Class of DS-1 and an ACEC Class of AC-1 should be used for buried concrete structures.
Slope Stability	Along the southern boundary is an approximately 6.0 m high slope leading down to the River Irk. We have assumed that no structures will surcharge the slope. If this is incorrect or there is any concern with the stability of this slope, then a stability assessment should be undertaken.

Contaminated Land Risk Assessment

Based on the information contained in this report, and with due regard to the proposed industrial development, the site represents a **medium** risk with respect to contaminated land liability issues in its current condition. Following limited remediation work (including on site containment of made ground beneath a clean cover system and gas protection measures) the site would represent a **very low** risk with respect to contaminated land liability issues.

Recommendations

- A remediation strategy is prepared setting out the approach to managing potential risks associated with made ground and any ground gas protection measures (to be determined following completion of gas monitoring programme).
- Water supply company be contacted to obtain written confirmation that the selected water supply pipes are acceptable.
- Whilst building foundation solutions require ground improvement or piling it is recommended that made ground outside of building footprints is re-engineered to provide a suitable foundation for concrete service yards.
- A working platform will be required for the ground improvement/ piling contractor. This should be designed in accordance with BRE publication BR470 Working platforms for tracked plant.
- Japanese Knotweed observed at the site requires eradication.
- Copies of this report should be submitted to regulators for comment and approval.

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Appendix A – Drawings

Drawing No.	Title
1936/01B	Scheme Layout
19060-PWAG-00-XX-G-DR-1000-P02	Exploratory Hole Location Plan

Appendix B – Exploratory Hole Logs

Appendix C – Chemical Test Results

Appendix D – Geotechnical Test Results

Appendix E – Risk Evaluation

1 FOREWORD

This report has been prepared for the sole use and reliance of Middleton Sheet Metal Co Ltd (the Client) and cannot be relied upon by any other parties without the express written authorisation of PWA Geo-Environmental Ltd. Any unauthorised third party relies on this report at their own risk and the authors owe them no duty of care.

The report presents observations and factual data obtained during our site walkover, along with information reviewed during the desk study and intrusive works and provides an assessment of geo-environmental issues with respect to information provided by the Client regarding the site. There may be other conditions on site not encountered during this investigation and which have not been examined. We cannot accept responsibility for any conditions not revealed by this investigation and confirmation of ground conditions between exploratory locations should be undertaken if considered necessary.

The report should be read in its entirety, including all associated drawings and appendices. PWA Geo-Environmental Ltd cannot be held responsible for any misinterpretations arising from the use of extracts that are taken out of context.

The findings and opinions conveyed in this report (including review of any third party reports) are based on information obtained from the sources listed, which PWA Geo-Environmental Ltd understands are reliable. All reasonable skill, care and diligence has been applied in examining the information obtained. However, PWA Geo-Environmental Ltd accepts no responsibility for inaccuracies in the data supplied or for opinions based on any such inaccurate data.

Where the report refers to the potential presence of invasive weeds such as Japanese Knotweed, or the presence of asbestos containing materials, it should be noted that the observations are for information only and should be verified by a suitably qualified expert.

PWA Geo-Environmental Ltd reserves the right to amend their conclusions and recommendations in the light of further information that may become available.

2 INTRODUCTION

2.1 The Commission and Brief

PWA Geo-Environmental Ltd (PWAG) was commissioned by Middleton Sheet Metal Co Ltd to undertake a Phase 2 Geo-Environmental Assessment for a proposed industrial development located at land south of Hanson Close, Middleton. The overall objectives were to:

- Investigate ground conditions to confirm the depth and characteristics of made ground, natural soils and bedrock;
- Provide preliminary geotechnical recommendations for developing the site; and
- Provide outline recommendations for further work where necessary.

This report presents the factual information collected during this assessment, interpretation of the data obtained and recommendations relevant to the commission and brief. General notes and limitations relevant to all PWA Geo-Environmental Ltd investigations are described in the Foreword. These should be read in conjunction with this report. The text of the report draws specific attention to any modification to these procedures and to any other special techniques employed.

2.2 The Proposed Development

It is understood that the development proposal for the site comprises an industrial unit with associated service yard and car parking, and the floor slab may be required to support loads of up to 100 kN/m². A

proposed development layout is included in **Appendix A**. Any changes to the proposed layout, site levels and/ or end use may require amendments to this report.

2.3 Geo-Environmental Assessment Methodology

Key aspects of this Phase 2 are summarised as follows:

- Undertake one day trial pitting and seven days cable percussive drilling to observe and test in-situ soils, collect samples and install ground gas monitoring wells.
- Assessment of anticipated ground conditions, including potential contaminants.
- Determine the potential risks posed by any ground contamination and ground gas, and provide appropriate recommendations or remedial measures.
- Assessment of anticipated foundation and engineering issues associated with the proposed development.
- Preparation of a conceptual site model and preliminary risk assessment including recommendations for further investigation, if required.

This review relied on published information and information provided by the client and other parties, including anecdotal information, during the given time period.

3 SITE LOCATION AND DETAILS

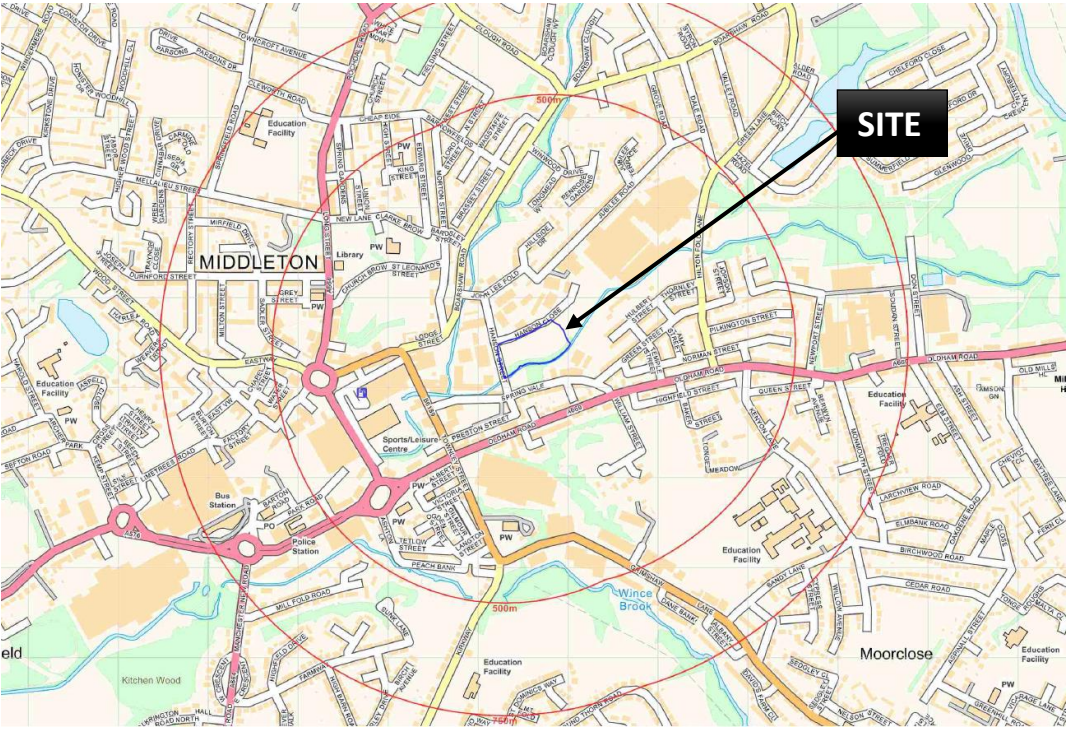
Table 1. Site Location and Details		
Address	Land south of Hanson Close, Middleton, Manchester, M24 2HD.	
National Grid Reference	Easting: 387518 Northing: 406084.	
Area	Approximately 1.1 hectares.	
Location	The site is located approximately 500 m north east of Middleton Town centre. Figure 1 (reproduced from the Groundsure Report) is included as a site location plan. 	
Ground Cover	Ground Cover	Estimated percentage
	Hardstanding and gravel fill	80%

Table 1. Site Location and Details		
	Overgrown riverbank and landscaped bank.	20%
Known services	In order to evaluate potential constraints associated with existing utility infrastructure, a Groundsure Premier Utilities report (Project No 606286) dated 10 th December 2019 was provided by the client.	
Current Use	The site is currently disused.	
Proposed Use¹	It is understood that the site will be redeveloped with an industrial unit.	

4 PREVIOUS REPORTS

Previous reports include:

- PWA Geo-Environmental – Phase 1 Environmental Risk Assessment (May 2019).

Relevant findings are summarised below:

Table 2. Summary of Phase 1 Report	
Site Description	The site is a vacant and overgrown block of land with bunds of demolition material along the northern and eastern boundary. Japanese Knotweed was observed at a number of locations on site and requires eradication. There is a brick wall along the southern margin of the site beyond which levels fall down to the site boundary coincident with the River Irk.
Historical Development	The site comprised agricultural fields from the earliest map of 1848. By 1891 the site was developed with Spring Vale Works (dyeing and finishing) that cuts into the slope of the northern boundary. The western third of the site appeared to be a pit that was occupied by filter beds by 1907. By 1938 the mill had gone. By 1990 the site was identified as a depot with three small buildings and a sub-station. The cut slopes were no longer present, and the site had presumably been filled. By 2014 no buildings were shown on site.
Geology	The anticipated downward sequence comprises topsoil/ made ground over an unknown thickness of alluvium and/or glaciofluvial deposits. Bedrock comprises mudstone, siltstone and sandstone of the Pennine Lower Coal Measures Formation. The Lower Bent Mine coal seam is conjectured to subcrop beneath the south west corner of the site and dip in a south westerly direction.
Mining	The risk to the proposed development from shallow unrecorded mine workings in the Lower Bent Mine is assessed as low. Given the depth of superficial deposits and proximity of the adjacent River Irk, it is expected that any historical workings would have needed to overcome potentially significant inflows of groundwater present in granular alluvium deposits. Therefore, it is considered unlikely that this coal seam has been worked to any significant extent. However, as a precautionary measure, if future building footprints extend on or close to the development high risk area then further assessment is considered necessary.
Hydrogeology	Both superficial strata and bedrock are classified as Secondary (A) aquifers.
Hydrology	The River Irk forms the southern boundary of the site and is classified as a main river.
Landfill and Ground Gas Risk	Natural alluvium could contain organic material and represent a potential source of ground gas. In addition, historical mapping identifies ponds, reservoirs and unspecified pits on site that have been infilled. The closest record of historical landfills is 27 m east and relates to a refuse tip shown on 1967 mapping. Therefore, based on a review of geological conditions, a moderate ground gas risk is considered to be associated with the site.
Radon	Radon protection measures are not considered necessary.

1. Different site uses may introduce changes to pollutant linkages that are not considered in this report.

Table 2. Summary of Phase 1 Report	
Potential Sources of Contamination	- Made ground associated with former industrial land use. Potential contaminants could include a range of metals, organics (hydrocarbons), inorganic substances, plus asbestos. Limited chemical testing completed in 2008 did not identify significant contamination. - Potential for made ground and natural organic material in alluvium to generate ground gases (methane and carbon dioxide).
Contaminated Land Risk Assessment	The site is considered to represent a medium risk with respect to contaminated land liability issues.

5 FIELDWORK

5.1 Scope of Fieldworks

Fieldwork was supervised by PWAG and comprised:

Table 3. Scope of Fieldworks			
Summary Investigations comprised the excavation of six trial pits to a maximum depth of 2.7 m and four cable percussive boreholes to a maximum depth of 21.2 m. Gas monitoring wells were installed in all four boreholes.			
Start date:		09/12/2019	End date: 18/12/2019
Technique	Exploratory Holes	Depths (m)	Comments
Trial pitting	TP01 to TP06	1.8 to 2.7	To characterize the shallow ground conditions, collect representative samples for laboratory testing and evaluate any signs of contamination or instability within the ground. Field hand vane results were recorded where appropriate.
Cable percussive boreholes	BH01 to BH04	5.45 to 21.2	To investigate the ground conditions across the site, prove the depth to bedrock, conduct standard penetration tests, collect representative samples for geotechnical and geochemical testing, and install shallow monitoring wells.

Descriptions of strata and groundwater observations made during investigation works, together with samples recovered and the results of all in situ field testing, are presented on the exploratory hole logs in **Appendix B**. Exploratory hole locations are shown on Drawing No 19060-PWAG-00-XX-DR-G-1000-P02 in **Appendix A**.

5.2 Sampling Strategy

The principal objectives were to understand the sub-surface conditions, provide a preliminary assessment for potential contamination and provide geotechnical recommendations and geotechnical design parameters for the proposed development. The site investigation was designed to investigate the location of the proposed development and provide general site coverage where access could be gained.

5.3 Chemical Laboratory Testing

Selected samples of the made ground and natural soils were tested for a range of potential contaminants under subcontract with a UKAS and MCERTS accredited laboratory. Chemical test reports, as received from the laboratory, are presented in **Appendix C**.

Based on the desk study and observations from the site walkover, it is likely that historical land use could have given rise to localised ground contamination. The potential contaminants of concern identified by the preliminary conceptual site model were selected as the analytes for the samples recovered from site and included:

Table 4. Chemical Laboratory Testing		
Type of sample	No. of samples	Determinands
Made Ground	4	Heavy metals suite, polycyclic aromatic hydrocarbons (PAH), total cyanide, free cyanide, soil organic matter, total phenol, sulphate and pH.
	3	Heavy metals suite, polycyclic aromatic hydrocarbons (PAH) and asbestos identification.
	2	Heavy metals suite, polycyclic aromatic hydrocarbons (PAH), total petroleum hydrocarbons (TPH) with aromatic aliphatic splits and asbestos identification.
	1	Asbestos.

5.4 Geotechnical Laboratory Testing

Geotechnical laboratory testing on selected samples was carried out under subcontract with a UKAS-accredited laboratory. Geotechnical test results are presented in **Appendix D**.

Table 5. Geotechnical Laboratory Testing		
Type of sample	No. of samples	Determinands
Made Ground	4	Determination of dry density/ moisture content relationship using 4.5kg rammer.
	4	Particle size distribution (PSD) using sieve wet.
	4	Water soluble sulphate and pH.
Alluvium	2	Water soluble sulphate and pH.
Bedrock	1	Water soluble sulphate and pH.

6 GROUND CONDITIONS AND MATERIAL PROPERTIES

6.1 Ground Conditions Encountered

Table 6. Summary of Ground Conditions Encountered		
Summary Made ground was encountered in every exploration location and proven to depths of 5.45 m and 7.3 m. This generally included three distinct layers: • Shallow variable made ground with anthropogenic fragments up to 1.15 m bgl; • Reworked natural made ground comprised of sandy clays and clayey sands between 0.85 and 3.2 m thick. • Deeper variable made ground with anthropogenic fragments between 1.45 and 4.20 m thick. Underlying natural strata comprised an interbedded sequence of loose to mostly medium dense coarse grained alluvium with subordinated soft and stiff fine grained alluvium. Mudstone and siltstone bedrock was encountered between 14.9 m and 20.5 m bgl.		
Strata	Depth Encountered (Thickness)	Description and Distribution
Hardstanding	Ground level (0.1 – 0.30 m)	Black tarmacadam and concrete hardstand was widely present across the site. Concrete was broken out for BH01 and asphalt was broken out at TP01 to TP06.
Made ground	Ground level – 0.30 m (5.45 – 7.30 m)	Variable composition including gravelly sandy clay, clayey sand, clayey gravelly sand and sandy gravel that was encountered in all locations. Gravel is angular to rounded fine to coarse brick, limestone ballast, sandstone and siltstone. Concrete and brick cobbles and boulders encountered in TP02.
Reworked natural made ground	0.30 – 1.15 m (0.85 – 3.20 m)	Variable composition from firm brown sandy clay to loose to dense brown sand. Encountered in all positions except TP05.

Table 6. Summary of Ground Conditions Encountered		
		A black sand with no odour was encountered in BH03 (1.15 – 2.00 m).
Deeper made ground	2.00 – 4.00 m (1.45 – 4.2 m)	Variable composition including loose to medium dense brown slightly gravelly sand and soft brown slightly gravelly slightly sandy clay. Gravel is brick, coal, sandstone and limestone. Encountered in BH01 –BH04.
Alluvium	5.20 – 7.30 m (7.60 – 15.05 m)	Variable composition varying from soft to stiff brown silty sandy clay to occasionally loose, mostly dense brown fine to coarse sand. BH03 was more cohesive between 10.00 and 15.20 m bgl. Approximately 75% of the material observed is granular. CP02 was terminated at shallow target depth in alluvium.
Bedrock	14.9 to 20.5 m bgl	Grey siltstone and mudstone recovered as angular fine to coarse gravel.

6.2 Groundwater

Two rounds of groundwater monitoring, completed at the time of reporting, recorded stabilised groundwater between 4.92 m and 5.76 m bgl. Groundwater was present in granular alluvium in BH01 and in made ground at BH03 and BH04. This appears to be at a similar level to water in the River Irk.

Perched groundwater encountered during the investigation included:

- TP01 – fast seepage 0.0 – 0.45 m. Dry at base.
- TP02 – perched groundwater at 1.3 m. Dry at base.
- TP03 – perched groundwater between 0.4 – 0.65 m. Dry at base.
- TP04 – Fast seepage between 0.2 – 0.25 m. Dry at base.
- TP05 – 1.25 m perched water with hydrocarbon sheen.
- TP06 – Fast seepage at 0.8 m. Dry at base.

6.3 Obstructions

Parts of the site are covered by concrete and asphalt hardstand and generally the explorations were positioned to avoid these obstructions. During trial pitting, cobbles and boulders were encountered in TP02 and TP05.

However, based on a review of historical Ordnance Survey plans, a large number of underground obstructions not encountered by this investigation are likely to be present. Some of these, such as chimney bases, could be significant.

6.4 Ground Stability

Generally, trial pit excavations were stable for the short duration of the works. Some localised spalling was observed in TP05 between 0.2 and 1.8 m and TP06 between 0.2 and 0.5 m bgl

6.5 Material Properties

Table 7. Material Properties		
Strata	Testing	Description
Made ground	Standard penetration test (SPT)	Ten SPTs performed between 1.00 and 6.5 m bgl recorded corrected N60 values between 3 and 28. This indicates the material is very loose to medium dense. One test at BH03 recorded an anomalous N60 result of 97 at 5.0 m bgl that was attributed to a cobble.
	Particle Size Distribution (PSD)	The results of two particle size distribution tests reported: • TP01 0.20 to 0.30 m bgl slightly sandy slightly gravelly clay; and • BH03 2.0 m gravelly very clayey sand.

Table 7. Material Properties								
Strata	Testing	Description						
	Water soluble sulphate	Two samples (TP01 and CP03) tested between 0.30 and 2.00 m bgl revealed: - a pH of 7.8; and - sulphate concentration between 52 and 70 mg/l.						
	Compaction	One compaction test performed with a 4.5 kg rammer revealed:						
		Sample	Depth	Initial moisture content (%)	Maximum Dry Density (mg/m ³)	Optimum moisture content (%)	Material retained on 37.5 mm sieve (%)	Material retained on 20 mm sieve (%)
		TP01	0.20 – 0.30	19	1.81	16	0	6
Made Ground (Reworked)	SPT	Ten SPTs performed between 1.00 and 4.1 m bgl recorded corrected N60 values between 1 and 11 indicating the material to be very loose to medium dense.						
	PSD	The results of two PSD tests reported: - TP02 1.4 – 1.5 m gravelly very clayey sand; and - TP04 1.1 – 1.2 m gravelly very clayey sand. These were in general accordance with the field description.						
	Water soluble sulphate	Two samples (TP02 and TP04) tested between 1.10 and 1.50 m bgl revealed: - a pH of 7.1 and 7.8; and - sulphate concentration between 51 and 58 mg/l.						
	Compaction	Three compaction tests performed with a 4.5kg rammer revealed:						
		Sample	Depth	Initial moisture content (%)	Maximum Dry Density (mg/m ³)	Optimum moisture content (%)	Material retained on 37.5 mm sieve (%)	Material Retained on 20 mm sieve (%)
		TP02	1.40 – 1.50	19	2.05	10	0	7
		TP04	1.10– 1.20	12	1.97	10	0	0
		CP03	2.0	18	1.99	10	4	3
Alluvium (Cohesive)	SPT	Seven SPTs performed between 9.95 and 16.7m bgl recorded corrected N60 values between 17 and 50 indicating the material to be stiff to very stiff.						
	Hand Shear Vanes	Three hand shear vanes readings between 0.50 and 2.70 m bgl recorded undrained shear strength between 55 and 88kN/m ² indicating the material to vary between medium and high strength.						
Alluvium (Granular)	Water soluble sulphate	Two samples tested between 8.00 and 15.00 m bgl revealed: - pH of 8.0; and - sulphate concentration between 68 and 75 mg/l.						
	SPT	Fifteen SPTs performed between 6.50 and 19.00 m bgl recorded corrected N60 values ranging from self-weight penetration to 74 indicative of very loose to very dense material.						
Bedrock	SPT	Four SPTs performed between 14.90 and 21.00m bgl recorded corrected N60 values ranging from 62 to 913 indicative of weak to strong bedrock.						
	Water soluble sulphate	One sample (CP03) was tested at 19.00 m bgl revealed: - pH of 8; and - Sulphate concentration of 22 mg/l.						

6.6 Visual and Olfactory Evidence of Contamination

Visual and olfactory evidence of contamination was noted in:

- CP02 – faint hydrocarbon odour and sheen between 4.0 and 4.5 m bgl.
- CP03 – black gravel had a faint hydrocarbon odour between 2.0 and 2.5 m bgl.
- TP02 – groundwater with a hydrocarbon sheen.
- TP05 – faint hydrocarbon odour between 0.2 and 0.8 m bgl and hydrocarbon sheen on perched groundwater at 1.25m bgl.
- TP05 – a faint odour of sulphur was noted between 0.30 and 0.40m.

7 RESULTS OF CHEMICAL TESTING

7.1 Assessment Criteria

All laboratory test data were reviewed for completeness and consistency. Those determinants that indicate potential contamination were subject to further evaluation.

For each potential contaminant of concern, analytical data for soil samples were compared to the relevant Generic Assessment Criteria (GAC), taking account of the Soil Organic Matter (SOM) content. For this site, measured values were conservatively compared to GAC derived for a commercial end use assuming 1% SOM. In the cases where all the samples tested for a given substance were below the GAC, no further consideration is necessary for that substance.

Usually statistical analysis of the results is undertaken in accordance with CL:AIRE statistics guidance. The purpose is to determine whether there is enough evidence that the true mean concentration of each determinant is less than the relevant GAC for that substance. On this occasion, statistical analysis has not been carried out due to the small data set.

7.2 Chemical Analysis

The chemical analysis results have been subdivided into the following material types:

- Made ground (6 samples); and
- Made ground reworked (3 samples).

Comparison of recorded values with the GAC are summarised in the screening tables presented in **Appendix C**.

7.2.1 Made Ground

Metals and inorganic analytes

No metals, metalloids or other inorganic results exceeded the relevant GAC in the samples analysed.

Potentially phytotoxic concentrations of copper were recorded in TP05 0.3-0.4 m. No other results were considered phytotoxic to plants.

Organics

All PAH compounds, benzene, ethylbenzene, toluene, xylene and phenols were below the relevant GAC. All total petroleum hydrocarbons were below the relevant GAC. However, GAC are not available for:

- TPH Aliphatic >C16-C21 9.16 and 490 mg/kg;
- TPH Aliphatic >C21-C35 29.8 and 1100 mg/kg;
- TPH Aliphatic >C8-C40 44.7 and 1810 mg/kg; and
- TPH Aromatic >C8-C40 72.1 and 1130 mg/kg.

Nonetheless, given the low concentrations and the industrial land use, these values are not considered to represent a significant risk to human health or controlled water.

Total petroleum hydrocarbon results were also compared with United Utilities threshold for PE pipes. An exceedance was recorded in TP05 0.3-0.4 m of the threshold for EC10-16 (aliphatic and aromatic) hydrocarbons and EC16-40 (aliphatic and aromatic) hydrocarbons.

Asbestos

Chrysotile and crocidolite in the form of cement and loose insulation were observed in TP05 0.3-0.4 m.

No asbestos fibres were detected in the other four samples analysed.

7.2.2 Made Ground Reworked

Metals and inorganic analytes

No metals, metalloids or other inorganic results exceeded the relevant GAC in the samples analysed.

In addition, no results were considered phytotoxic to plants.

Organics

All PAH compounds and phenols were below the relevant GAC.

Asbestos

No asbestos fibres were detected in the sample analysed.

8 RISK ASSESSMENT AND REVISED CONCEPTUAL MODEL

8.1 Introduction

The preliminary conceptual site model has been revised in light of the ground investigation and associated chemical analysis results. This updates our understanding of surface and sub-surface features, the potential contaminant sources, transport pathways and receptors.

Table 8. Source, Pathway and Receptors		
Potential Sources of Contamination	Potential Transport Pathways and Pollutant Linkages	Potential Receptors
On-site sources - Made ground containing asbestos, phytotoxic concentrations of copper and total petroleum hydrocarbons above water utility threshold values. - Potential for made ground and natural organic material in alluvium to generate ground gases (methane and carbon dioxide). Off-site sources - Made ground associated with surrounding industrial land use. Potential contaminants could include a range of metals, organics (hydrocarbons), inorganic substances, plus asbestos.	- Direct exposure to potentially contaminated soils (direct contact, ingestion and dust inhalation). - Inhalation/ accumulation of ground gases. - Direct contact with conditions potentially aggressive to building materials and underground services (e.g. sulphates and hydrocarbons).	- Current site users. - Future site users. - Construction workers during redevelopment works. - Neighbouring land users. - Underground services.

8.2 Qualitative Risk Assessment and Revised Conceptual Site Model

A qualitative risk assessment has been undertaken for these potential source-pathway-receptor linkages following the guidance presented in **Appendix E**. This is based on consideration of both:

- The likelihood of an event (probability – considers both the presence of the hazard and receptor and the integrity of the pathway); and
- The severity of the potential consequence (considers both the potential severity of the hazard and the sensitivity of the receptor).

The risk assessment detailed in Table 9 has been based on redevelopment of the site with a proposed industrial unit.

Table 9. Revised Environmental Risk Assessment						
Source	Pollutant / Hazard	Receptors	Pathways to Receptor	Associated Hazard [Potential severity]	Likelihood of Occurrence/ Potential Mitigation	Potential Risk
On-site: Made ground.	Copper, hydrocarbons and asbestos.	Current site users. Neighbouring land users.	Direct contact, ingestion and dust inhalation.	Effect on human health [Minor]	Low: Any made ground will be isolated beneath a cover system to minimise risks to future site users. Any risks can be mitigated by appropriate site management during construction and use of suitable PPE during construction stage.	Very low
		Future site users (workers). Construction workers during redevelopment works.				Very low
		New in ground services and construction materials.	Direct contact	Degradation [Minor]	Low Any potential risks can be mitigated by use of appropriate construction materials, chemical resistant supply pipes and use of oversized service trenches and clean fill.	Very low
On site: Made ground and natural organic material.	Ground gases (methane and carbon dioxide).	Future site occupiers.	Inhalation of gases/ accumulation in confined spaces	Asphyxiation [Severe]/ explosion [Severe]	High Accumulation of gases in confined spaces and migration into future buildings is plausible.	Very high
		Construction workers.	Accumulation in confined spaces			Very high
Off-site: Made ground.	Heavy metals, hydrocarbons, inorganic substances and asbestos.	Controlled waters – ground water.	Leaching and infiltration into groundwater	Pollution of controlled waters [Minor]	Low The underlying Secondary A Aquifer is considered vulnerable to site derived contamination.	Very low
		Controlled waters – surface water.	Lateral migration in groundwater		Low The River Irk is considered vulnerable to site derived contamination.	Very low

9 ENVIRONMENTAL RISK ASSESSMENT AND RECOMMENDATIONS

The revised conceptual site model indicates that potential pollutant linkages exist for human health, plant life and construction materials. These potential risks are discussed in the following sections.

9.1 Human Health

Chemical testing identified asbestos in made ground in TP05 0.3-0.4 m. No other exceedances were recorded within the made ground, reworked made ground or alluvium.

Made ground should be separated from future site users beneath a containment layer discussed in Section 9.7. Construction workers involved with ground works during site redevelopment are at a higher risk from exposure to made ground. However, these risks are relatively short duration and can be controlled by good working practices, good levels of personal hygiene and wearing appropriate PPE.

Although no other sources of gross contamination were encountered during the site investigation this does not rule out the possibility of encountering unexpected findings during enabling works. If any additional contamination, buried tanks or drums, oily, odorous, brightly coloured, fibrous materials and such like are encountered during redevelopment then further advice should be sought in line with Section 9.10.

9.2 Controlled Waters

Given the absence of any significant contamination, the site is not considered to pose a significant risk to controlled waters.

9.3 Plant life

Chemical testing identified the presence of copper at concentrations that may be considered harmful to plant life within made ground at TP05 0.3-0.4 m. Made ground should be contained beneath a clean cover system in landscape areas to provide a clean growing medium for any proposed planting. However, further advice should be sought from a landscape architect with regards to the required depth of growing medium and risks to plant life (especially trees and deep rooting species).

9.4 Construction Workers

There is a potential risk that construction workers involved in the redevelopment works could be exposed to contamination from made ground including asbestos fibres. Where possible, the ground works should be designed and planned to minimise the exposure of workers to contaminated soil. This should be considered in the Health and Safety plan under the CDM regulations. Where risks cannot be removed entirely at the planning stage, mitigation measures should include the use of personal protective clothing (PPE) including gloves. Dust suppression measures should also be incorporated into the works to reduce ingestion and inhalation of contaminated dust and possible asbestos fibres.

9.5 Ground Gas

A programme of ground gas monitoring is underway and will be reported separately once complete. Subject to the findings of this ground gas monitoring programme it is likely that any risk can be mitigated by appropriate control measures.

9.6 New Utilities and Water Supply Pipes

Water supply pipes should be specified and laid in accordance with the regional water supply company's specifications and should be confirmed with the service provider. Made ground was encountered throughout the site and localised visual and olfactory organic contamination was observed. In addition, there was a single exceedance of United Utilities total petroleum hydrocarbon threshold (500 mg/kg) for PE pipes at TP05 0.3-0.4 m where 963 mg/kg was recorded.

The use of 'standard' polyethylene water supply pipes may be acceptable, subject to suitable controls such as placing in clean backfill, although this must be discussed with the water supply company before development starts.

9.7 Outline Remediation Requirements

In view of the asbestos and texturally unsuitable material, made ground will require management. Off-site disposal is not considered necessary nor a sustainable solution and therefore on site containment is recommended. This includes containing made ground under areas of proposed hardstanding (whether it be buildings or car parking/roadways) or beneath a suitable clean cover system in landscaped areas.

A subsoil/ topsoil 'clean cover system' will be required in areas of landscaping where made ground underlies the development. At this stage, it is recommended that the cover system comprises 0.45 m of 'clean' topsoil/subsoil over 0.15 m hard to dig layer. Subject to further testing of made ground to demonstrate that asbestos detected to date is not widespread, it may be possible to remove the hard to dig layer. The design of any capping layer is subject to regulatory consultation.

Any works undertaken which are likely to disturb asbestos within made ground should be undertaken in accordance with the Control of Asbestos Regulations (CAR)2012 regulations and associated CL:AIRE 2016 Industry Guidance on managing and working with asbestos in soil, construction and demolition materials.

It is possible, that areas of more significant contamination, not identified to date, may be encountered on site during excavation and construction works. If any areas of noxious, odorous, brightly coloured, fibrous, liquid etc contamination are encountered, further advice should be sought from a suitably qualified consultant. A contingency should be included for disposal/treatment of any, as yet, unproven contamination.

Unless further unexpected organic contamination is discovered during redevelopment, it is considered that no specific remedial works are required to protect controlled waters. However, we recommend that confirmation is obtained that local regulators agree with this strategy. This conclusion may need to be revised if during enabling works any visual or olfactory evidence of gross contamination in the soils or groundwater is detected.

In order to demonstrate that the remediation works have been carried out, it will be necessary to produce a verification report for submission to the local regulatory authorities.

The above recommendations comprise a general outline of possible or likely works. A remediation strategy report should be produced and agreed with the regulatory authorities prior to commencement of remediation. This will also include the scope of gas protection measures that will be determined following completion of the gas monitoring programme.

9.8 Waste Management

The handling, re-use or disposal of waste is regulated by the Environment Agency. Any material excavated on-site may be classified as waste and it is the responsibility of the holder of a material to form their own view on whether or not it is waste. One of the ways this can be achieved is set out in the Definition of Waste: Development Industry Code of Practice (DoWCoP). This builds on the Environment Agency guidance document Definition of waste: developing greenfield and brownfield sites (2006). The Agency will consider the use of the DoWCoP in deciding whether to regulate materials as waste. If materials are dealt with in accordance with the DoWCoP, the Agency considers that those materials are unlikely to be waste at the point when they are to be used for the purpose of land development.

Good practice has three basic elements:

- Ensuring that an adequate Materials Management Plan (MMP) is in place, covering the use of materials on a specific site.
- Ensuring that the MMP is based on an appropriate risk assessment, concluding that the objectives of preventing harm to human health and pollution of the environment will be met if materials are used in the proposed manner.
- Ensuring that the requirements of the MMP are met.

All material proposed for off-site disposal (e.g. during future construction works) should be given a proper description and waste classification as required by the Environmental Protection Duty of Care Regulations, and in accordance with WM3 and the Environment Agency Technical Guidance on the assessment and classification of Hazardous Waste. Advice on the classification of wastes containing asbestos is provided in Chapter 3 of Environment Agency document 'Guidance on the classification and assessment of waste Technical Guidance WM3'.

9.9 Reuse of Site Won Material

Made ground contains asbestos and texturally unsuitable material. On this basis, made ground will need to be managed to ensure it is sealed beneath the hardcover of the development or a clean cover system.

This project is likely to require the reuse of made ground on site as part of the proposed earthworks. Therefore, the contractor will need to prepare a Materials Management Plan (MMP) in accordance with the CL:AIRE Code of Practice (v2, March 2011).

The MMP will document how all of the materials to be excavated during the proposed site preparatory earthworks are to be dealt with. The MMP should also detail how materials will be tracked throughout the earthworks in order that the subsequent Verification Report can provide an auditable trail. Finally, the MMP will have to set out a Verification Plan that identifies how the placement of materials is to be recorded and the quantities of material to be used. It will contain a statement on how the use of the materials relate to the remediation or design objectives.

In the event that materials from this site are required to be transferred to other locations, or material is imported for landscaping, the MMP will assist with verification for regulatory authorities.

Once completed, the MMP will need to be reviewed by a Qualified Person (QP), who will sign a Declaration for submission to CL:AIRE and send a copy to the Client.

9.10 Unexpected finding protocol

If unexpected potentially contaminated materials (such as those with an unusual colour, odour or containing drums, chemicals or asbestos, etc) are encountered at any time during redevelopment then work should stop, and a suitably qualified environmental consultant contacted to provide advice on the appropriate course of action.

10 GEOTECHNICAL CONCLUSIONS AND RECOMMENDATIONS

This Phase 2 Geo-Environmental Assessment has been performed for land off Hanson Close, Middleton. It is understood that consideration is being given to development of the site for industrial end use, including car parking and landscaped areas. For the purpose of this report we have assumed that proposed levels will not vary significantly from those existing. If any of these assumptions are incorrect then the conclusions in this report may require reassessment.

10.1 Geotechnical Categorisation of the Proposed Development

Eurocode 7, Section 2 advocates the use of geotechnical categorization of the proposed structure(s) to establish the design requirements. Initial categorisation can be made before site investigation and can be used to define the scope and extent of geotechnical investigation required. For the purposes of this investigation, the proposed structures have been classed as Geotechnical Category 1.

10.2 Mining

The risk to the proposed development from shallow unrecorded mine workings in the Lower Bent Mine is assessed as low. Given the proximity of the adjacent River Irk, it is expected that any historical workings would have needed to overcome potentially significant inflows of groundwater present in granular alluvium deposits. Therefore, it is considered unlikely that this coal seam has been worked to any significant extent. However, if additional certainty is required then further assessment should be undertaken.

10.3 Site Preparation and Groundworks

Typically, groundwater was recorded in the monitoring wells between 5.0 m and 6.0 m bgl. As such, it is envisaged that at shallow depths (<2.00 m) for a large portion of the site any groundwater seepages will be minor and may be controlled by sump pumping methods. However, below 2.00 m significant groundwater ingress may be encountered and if present, a specialist dewatering contractor may be required. Groundwater should be controlled in accordance with CIRIA report 113 Control of Groundwater for Temporary Works.

It should be noted that groundwater levels may vary from those at the time of the investigation, for example in response to seasonal fluctuations. Furthermore, we understand that the site is crossed by a culverted stream and mill race. We assume that these will be appropriately diverted/ protected as part of the proposed development.

On the basis of observed ground conditions, shallow excavations from existing ground level should be suitable for standard plant.

Nobody should enter any excavation unless there is adequate support, and this has been risk assessed by a competent person. Reference to CIRIA report 97 (1983) should be made to establish suitable means of support or battering of excavation sides.

10.4 Preliminary Foundation and Floor Recommendations

It is understood that the development will comprise of a large industrial unit with associated service yard and car parking. The floor slab will be required to support loads of up to 100 kN/m². The finished floor levels are still to be confirmed so it has been assumed that floor levels are likely to be similar to existing.

Made ground and alluvial deposits in its current condition is considered unsuitable to support structural loads associated with this development owing to the possibility of bearing capacity failure and excessive total/ differential settlements.

Due to the anticipated depth of made ground, a piled foundation solution or ground improvement technique (such as controlled modulus columns (CMC)) should be considered for any building foundations.

In order to achieve a suitable carrying capacity, piles will need to be extended, into the underlying competent strata likely to be bedrock at a depth of between 14.90 and 21.20 m bgl (66.8 to 72.8 m AOD). Settlement of made ground and alluvium may give rise to negative skin friction forces on the piles and due allowance should be made in the design of pile sections. Piling contractors have their own proprietary methods of installation and therefore should be contacted at an early stage to obtain advice with regard to the final design of piled foundations. Alternatively, ground improvement could be undertaken on the made ground and weaker alluvial deposits to increase the bearing capacity.

The floor design will be influenced by the preferred foundation solution. Where a piled solution is adopted the floor will be suspended. However, a ground improvement foundation solution can be designed to allow construction of a ground bearing floor slab.

Any construction works should be designed to minimize risk to controlled waters and given the proximity of the River Irk may require approval from the Environment Agency.

Where foundations are within the influence of trees and are deeper than 1.50m bgl, a suitable compressible material or void former will be required.

Foundations should be taken below a lined drawn up at 45° from the base of existing or proposed services.

Excavations for foundations should be inspected by a competent geotechnical engineer. Any sub-formation materials deemed as unsuitable such as desiccated, soft or loose zones should be excavated and replaced with well compacted suitable granular fill or lean mix concrete.

Foundation excavations should be protected from water and inclement weather including frost and any water should be removed by pumping from a sump in the base of the excavation.

10.5 Roads and Pavements

Given the variable depth and nature of made ground, it is considered that traditional pavement construction techniques could incur significant unacceptable distortion and settlement due to future consolidation of the underlying made ground. As such, the serviceability of the sub-grade may be

unsuitable for both the trafficking of plant and as support for a permanent foundation, without improvement works being undertaken. This is expected to be achieved by turning over the upper 1.0 m of made ground and breaking out obstructions to at least 1.0 m depth. Following suitable compaction of made ground, it is considered likely that a CBR value of at least 2.5% will be achievable across the majority of the site although this is subject to in-situ testing during construction.

Prior to the placement of the founding materials and the construction of the road pavement, the sub-formation and formation will need to be inspected and checked in accordance with a suitable Specification, to ensure the ground conditions are as expected. All testing should be carried out in accordance with DMRB IAN 73/06 and confirm that the ground conditions at the time of construction are consistent with the previous design parameters.

All road designs should be discussed with the relevant local authority if highways are to be subject to a Section 38 agreement.

10.6 Buried Concrete

Based on the samples tested, and in accordance with BRE Special Digest 1 (2005), a Design Sulphate Class of DS-1 and an ACEC Class of AC-1 should be used for buried concrete structures.

10.7 Slope Stability Assessment

Along the southern boundary is a steep slope leading down to the River Irk that is approximately 6.0 m high and has not been subject to stability assessment. In preparing this report we have assumed that no structures will be constructed that could result in additional surcharge of the slope. If this assumption is incorrect or there is any concern with the stability of this slope, then a slope stability assessment should be undertaken.

11 RECOMMENDATIONS FOR FUTURE WORKS

It is recommended that:

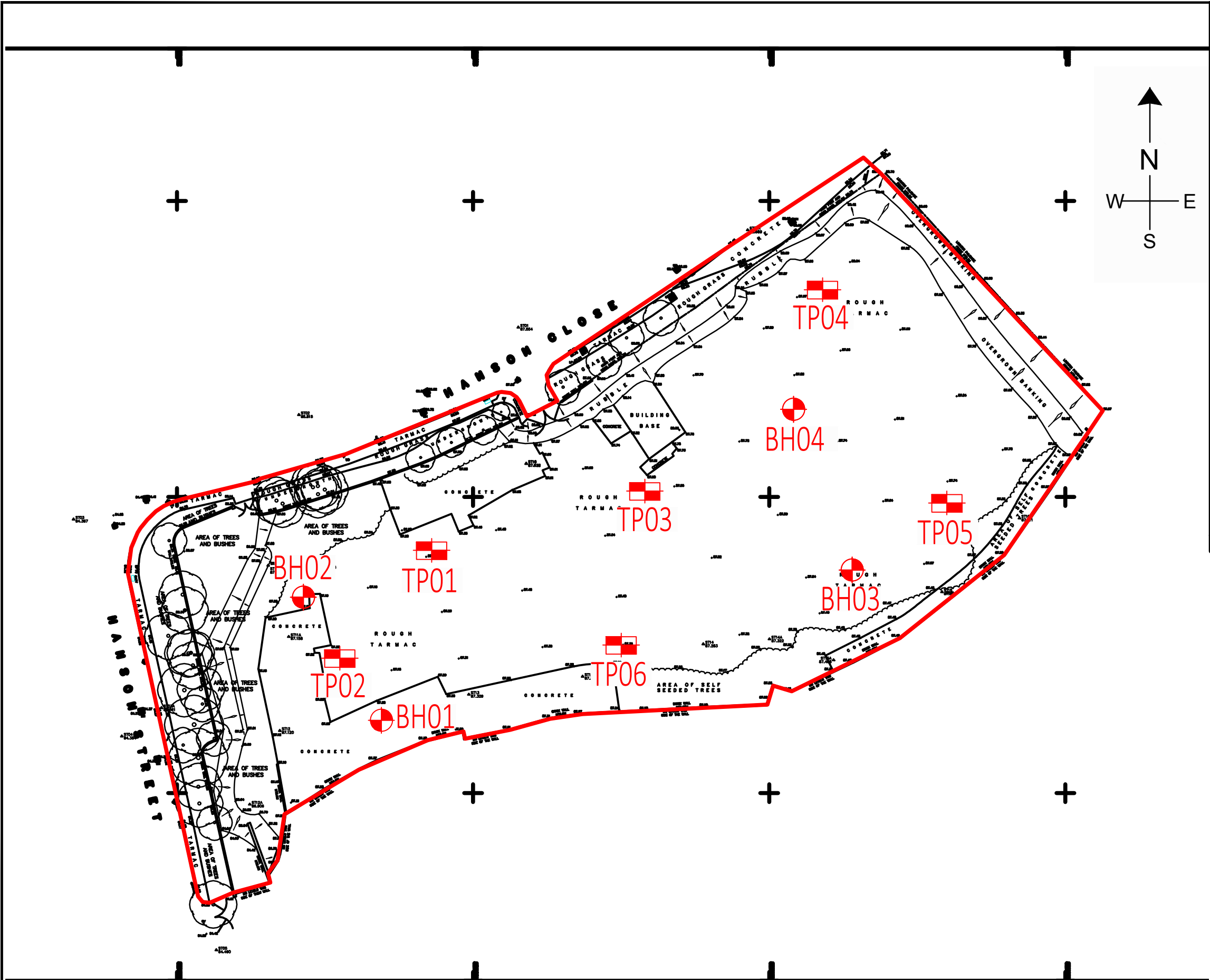
- A remediation strategy is prepared setting out the approach to managing potential risks associated with made ground and any ground gas protection measures (to be determined following completion of gas monitoring programme).
- The water supply company be contacted to obtain written confirmation whether 'standard' polyethylene water supply pipes are acceptable.
- Whilst foundation solutions require ground improvement or piling it is important that made ground outside of building footprints is re-engineered to remove hard spots and provide a suitable foundation for concrete service yard.
- A working platform will be required for the ground improvement contractor. This should be designed in accordance with BRE publication BR470 Working platforms for tracked plant.
- Japanese Knotweed was observed at a number of locations on site and requires eradication.

12 REGULATORY APPROVALS

The conclusions and recommendations presented in this report are considered reasonable based on the information that was available. However, these are not guaranteed to gain approval from regulatory authorities. Therefore, we recommend that copies of this report are passed to the appropriate regulator for review and comment before undertaking any additional work.

Appendix A

Drawings



NOTES:

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KEY:

- TRIAL PIT LOCATION
- BOREHOLE LOCATION
- INDICATIVE SITE BOUNDARY

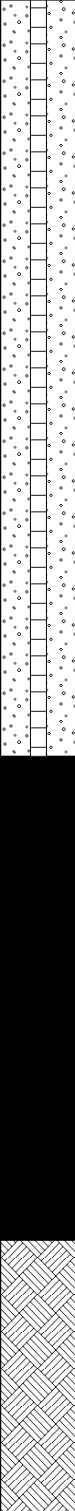
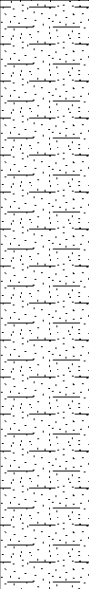
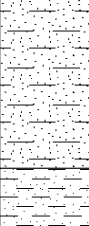
Rev	Date	Remarks	Drawn	Chk'd			
Consulting Civil , Structural & Geo-Environmental Engineers Summit House, Riparian Way, The Crossings, Crosshills, Keighley, BD20 7BW T - 01535 633350 E-Mail: info@pwaite.co.uk www.pwaite.co.uk							
Client		MIDDLETON SHEET METALS CO. LTD					
Project		LAND OFF HANSON CLOSE MIDDLETON M24 2YP					
Title		EXPLORATORY HOLE PLAN					
Size	Scale	Designed	Checked	Date			
A3	NTS	DJJA	IMP	DEC 19			
Drawing Status		PRELIMINARY					
Job Number	Originator	Volume	Level	Type	Role	Drawing No.	Rev
19060 -PWAG - 00 - XX - DR - G - 1000							P02

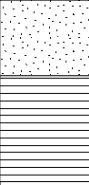
Appendix B

Exploratory Hole Logs

Project Name:		MSM Middleton				Project Number: 19060		Elevation: 87.30		Hole Type: CP	
Project Location:		Hanson Close, Middleton, M24 2HS				Coordinates: E387485, N406062				Scale: 1:50	
Client Name:		Middleton Sheet Metal Co. Ltd.				Dates: 09/12/2019 - 18/12/2019				Logged By: AAS	
Install.	Water Strike	Samples and In Situ Tests			Depth (m)	Legend	Stratum Description	Scale			
		Depth (m)	Type	Results							
		0.40	B		0.40		CONCRETE. MADE GROUND	1			
		1.00	SPT(S)	N=11 (1,1/1,2,4,4)	1.00		Soft brown gravelly CLAY. Gravel is angular to sub-angular fine to coarse mixed lithology including brick.				
		1.00	D					MADE GROUND	2		
		1.10	B		1.45	Firm grey slightly gravelly sandy CLAY. Gravel is angular and sub-angular fine to coarse brick.					
		2.00	SPT(S)	N=12 (2,3/4,3,3,2)				REWORKED MADE GROUND	3		
		2.00	D			Firm brown sandy CLAY with bands of light brown medium and coarse sand.					
		2.00	B		2.60	REWORKED MADE GROUND					
		3.00	SPT(S)	N=6 (1,2/1,2,2,1)				REWORKED MADE GROUND	4		
		3.00	D			Dark brown clayey fine and medium SAND.					
		4.00	SPT(S)	N=17 (6,4/6,4,3,4)	4.00		Brown very sandy angular and sub-angular fine to coarse brick and concrete GRAVEL.	5			
		4.00	D				MADE GROUND				
		4.00	B		4.70	Dark grey clayey gravelly fine and medium SAND. Gravel is angular and sub-angular fine to coarse brick.					
		5.00	SPT(S)	N=8 (2,2/3,2,2,1)				MADE GROUND	6		
		5.00	D			Brown very clayey fine and medium SAND. Locally very soft sandy clay.					
		5.50	B		5.45	GRANULAR ALLUVIUM					
		6.50	SPT(S)	N=0 (0,0/0,0,0,0)	6.50		Very loose brown clayey fine and medium SAND.	7			
		6.50	D				GRANULAR ALLUVIUM				
		8.00	SPT(S)	N=11 (1,2/2,2,3,4)	8.10		Medium dense brown sandy angular to sub-rounded fine to coarse sandstone, siltstone and quartz GRAVEL.	8			
		8.00	D				GRANULAR ALLUVIUM				
		8.10	B								
9.00	D						9				
9.50	SPT(S)	N=50	9.50	Dense brown clayey fine and medium SAND.							
9.50	B	(6,11/12,11,14,13)			GRANULAR ALLUVIUM	10					

Remarks: Borehole terminated in bedrock. No visual or olfactory evidence of contamination. Groundwater not recorded. On completion, borehole collapsed back from 21.20 to 18.20 m. Bentonite seal 18.20 - 15.00 m. A slotted standpipe (50 mm) was installed to 15.00 m, granular response zone 15.00 - 6.00 m, bentonite seal 6.00 - 0.20 m and concrete with flush cover 0.20 - 0.00 m.	ES - Environmental sample B - Bulk sample D - Disturbed sample SPT - Std. Penetration Test
	Approved by: DA

		PWA Geo-Environmental Ltd Summit House, Riparian Way BD20 7BW		BOREHOLE LOG			Borehole ID: CP01 Sheet 2 of 3			
Project Name:		MSM Middleton			Project Number: 19060		Elevation: 87.30		Hole Type: CP	
Project Location:		Hanson Close, Middleton, M24 2HS			Coordinates: E387485, N406062				Scale: 1:50	
Client Name:		Middleton Sheet Metal Co. Ltd.			Dates: 09/12/2019 - 18/12/2019				Logged By: AAS	
Install.	Water Strike	Samples and In Situ Tests			Depth (m)	Legend	Stratum Description	Scale		
		Depth (m)	Type	Results						
		11.00	SPT(C)	N=50 (3,5/5,15,15,15)			Dense brown clayey fine and medium SAND. GRANULAR ALLUVIUM	11		
		12.00 12.00	SPT(C) D	N=34 (7,10/8,8,8,10)				12		
		14.00 14.00	SPT(S) D	N=17 (3,2/4,5,4,4)			14.00 - 14.45 m: Locally stiff brown sandy clay.	14		
		15.00 15.00	SPT(S) D	N=16 (2,2/2,3,5,6)	15.00		Firm tending stiff brown sandy CLAY. COHESIVE ALLUVIUM	15		
					15.45		Medium dense brown medium and coarse SAND. GRANULAR ALLUVIUM	16		
		17.00 17.00	SPT(S) D	N=13 (4,3/3,3,4,3)				17		
			19.00 19.00	SPT(S) D	N=15 (1,2/3,3,4,5)			19		
							20			
Remarks: Borehole terminated in bedrock. No visual or olfactory evidence of contamination. Groundwater not recorded. On completion, borehole collapsed back from 21.20 to 18.20 m. Bentonite seal 18.20 - 15.00 m. A slotted standpipe (50 mm) was installed to 15.00 m, granular response zone 15.00 - 6.00 m, bentonite seal 6.00 - 0.20 m and concrete with flush cover 0.20 - 0.00 m.									ES - Environmental sample B - Bulk sample D - Disturbed sample SPT - Std. Penetration Test Approved by: DA	

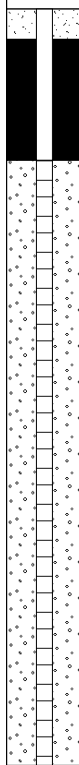
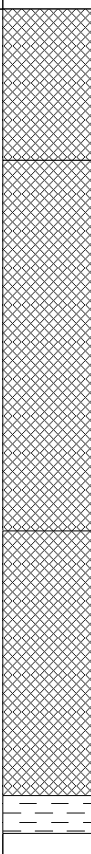
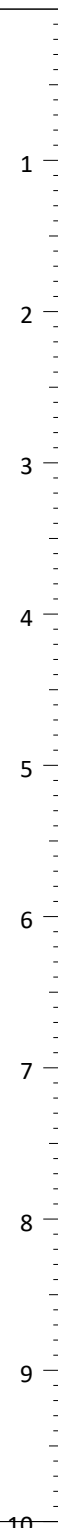
		PWA Geo-Environmental Ltd Summit House, Riparian Way BD20 7BW		BOREHOLE LOG			Borehole ID: CP01 Sheet 3 of 3			
Project Name:		MSM Middleton			Project Number: 19060		Elevation: 87.30		Hole Type: CP	
Project Location:		Hanson Close, Middleton, M24 2HS			Coordinates: E387485, N406062			Scale: 1:50		
Client Name:		Middleton Sheet Metal Co. Ltd.			Dates: 09/12/2019 - 18/12/2019			Logged By: AAS		
Install.	Water Strike	Samples and In Situ Tests			Depth (m)	Legend	Stratum Description	Scale		
		Depth (m)	Type	Results						
		20.50	B	50 (25 for 50mm/50 for 30mm)	20.50		Medium dense brown medium and coarse SAND. GRANULAR ALLUVIUM Grey weak MUDSTONE recovered as angular fine to coarse gravel. MUDSTONE	21		
		21.00	SPT(S)		21.00			21		
		21.00	D		21.20			21		
								22		
								23		
								24		
								25		
								26		
								27		
								28		
								29		
								30		

Remarks:
Borehole terminated in bedrock.
No visual or olfactory evidence of contamination.
Groundwater not recorded.
On completion, borehole collapsed back from 21.20 to 18.20 m.
Bentonite seal 18.20 - 15.00 m. A slotted standpipe (50 mm) was installed to 15.00 m, granular response zone 15.00 - 6.00 m, bentonite seal 6.00 - 0.20 m and concrete with flush cover 0.20 - 0.00 m.

ES - Environmental sample
B - Bulk sample
D - Disturbed sample
SPT - Std. Penetration Test

Approved by: DA

BOREHOLE LOG

Project Name:		MSM Middleton				Project Number: 19060		Elevation: 87.20		Hole Type: CP	
Project Location:		Hanson Close, Middleton, M24 2HS				Coordinates: E387471, N406083				Scale: 1:50	
Client Name:		Middleton Sheet Metal Co. Ltd.				Dates: 09/12/2019 - 18/12/2019				Logged By: AAS	
Install.	Water Strike	Samples and In Situ Tests			Depth (m)	Legend	Stratum Description	Scale			
		Depth (m)	Type	Results							
							Brick, concrete, rubble, slab BOULDERS. (Drillers description) MADE GROUND				
		1.00 1.00	SPT(S) D	N=5 (1,1/2,0,1,2)	1.00		Loose brown slightly clayey slightly gravelly silty SAND. Gravel is sub-angular to rounded fine to coarse sandstone and siltstone. REWORKED MADE GROUND				
		2.00 2.00	SPT(S) D	N=9 (1,1/2,2,1,4)			2.00 - 2.45 m: Rare organic material (up to 3 mm diam).				
		3.00 3.00	SPT(S) D	N=6 (1,0/1,1,2,2)	3.45		Brown sandy gravelly SILT. Gravel is angular to sub-rounded fine to coarse siltstone, sandstone, brick and slag. Slag has hydrocarbon sheen. MADE GROUND				
		4.00 4.00	SPT(S) D	N=1 (1,0/0,1,0,0)			4.00 - 4.45 m: Pockets (up to 20 mm) of black sandy gravelly silt. Gavel is angular and sub-angular fine and medium coal. Faint hydrocarbon odour. SPT indicates very loose.				
		5.00 5.00	SPT(S) D	N=8 (4,1/2,2,2,2)	5.20 5.45		Firm brown CLAY. (Drillers description) COHESIVE ALLUVIUM				

Remarks: Borehole terminated at target depth within made ground.
Hydrocarbon odours and sheens between 3.45 and 5.45 m.
Groundwater not recorded.
On completion, a 50 mm slotted standpipe was installed to 5.00m, granular response zone 5.00 - 1.00 m, bentonite seal 1.00 - 0.20 m, concrete and flush cover 0.20 - 0.00 m.

ES - Environmental sample
B - Bulk sample
D - Disturbed sample
SPT - Std. Penetration Test

Approved by: DA

BOREHOLE LOG

Project Name:	MSM Middleton	Project Number: 19060	Elevation: 87.50	Hole Type: CP
Project Location:	Hanson Close, Middleton, M24 2HS	Coordinates: E387564, N406088	Scale: 1:50	
Client Name:	Middleton Sheet Metal Co. Ltd.	Dates: 09/12/2019 - 18/12/2019	Logged By: AAS	

Install.	Water Strike	Samples and In Situ Tests			Depth (m)	Legend	Stratum Description	Scale
		Depth (m)	Type	Results				
		1.00	SPT(S)	N=7 (5,2/0,1,3,3)	1.00		Brick, concrete rubble and slab BOULDERS. MADE GROUND	
		1.00	D		1.15		Medium dense brown sandy SILT. MADE GROUND	1
		2.00	SPT(S)	N=3 (2,1/0,1,1,1)	2.00		Medium dense black gravelly SAND. Gravel is sub-angular medium sandstone and brick. REWORKED MADE GROUND	2
		2.00	D				Very soft brown slightly gravelly sandy CLAY. Gravel is sub-angular and sub-rounded fine to coarse brick and coal fragments. Coal has a faint hydrocarbon odour.	
		2.00	B		2.80		MADE GROUND	3
		3.00	SPT(S)	N=3 (0,1/0,1,1,1)			Very loose brown slightly gravelly silty SAND. Gravel is fine to coarse sub-angular and sub-rounded sandstone and brick.	
		3.00	D		3.60		MADE GROUND	4
		4.00	SPT(S)	N=5 (1,1/1,1,1,2)			Loose brown slightly clayey slightly sandy slightly gravelly SILT. Gravel is fine and medium angular and sub-angular sandstone, siltstone and coal. Rare plant stems (up to 5mm diam).	
		4.00	D		4.80		MADE GROUND	5
		5.00	SPT(S)	50 (25 for 40mm/50 for 160mm)			Recovered as grey circular disk coarse siltstone gravel with rare black inclusions (up to 3mm). Pockets (up to 15 mm) of dark brown silt.	
		5.00	D		6.20		MADE GROUND	6
		6.50	D				Soft brown slightly gravelly clayey SAND to sandy CLAY. Gravel is sub-angular coarse sandstone. Rare relic roots (up to 4mm diam).	
		6.95	SPT(S)	N=5 (1,3/2,1,1,1)	7.30		GRANULAR ALLUVIUM	7
		8.00	D				Brown fine to coarse SAND. GRANULAR ALLUVIUM	8
		8.45	SPT(S)	N=26 (3,5/5,7,6,8)			8.00 - 8.45 m: SPT indicates medium dense.	9
		9.50	D				9.50 - 9.95 m: SPT indicates dense.	
		9.95	SPT(S)	N=43	10.00			10
				(3,7/10,10,11,12)				

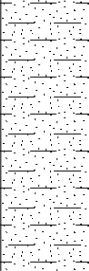
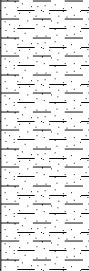
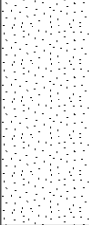
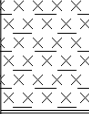
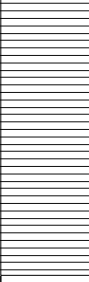
Remarks:

Borehole terminated in bedrock.
Faint hydrocarbon odour between 2.00 and 2.90 m.
Groundwater not recorded.
On completion borehole backfilled with bentonite pellets 19.41 - 5.00 m. A slotted standpipe 50 mm was installed to 5.00 m, granular response zone 5.00 - 1.00 m, bentonite seal 1.00 - 0.20 m, concrete and flush cover 0.20 - 0.00 m.

ES - Environmental sample
B - Bulk sample
D - Disturbed sample
SPT - Std. Penetration Test

Approved by: DA

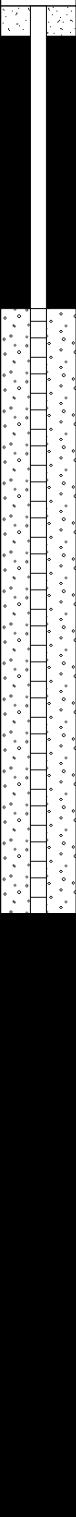
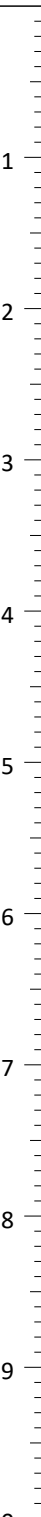
BOREHOLE LOG

Project Name:		MSM Middleton				Project Number: 19060		Elevation: 87.50		Hole Type: CP	
Project Location:		Hanson Close, Middleton, M24 2HS				Coordinates: E387564, N406088				Scale: 1:50	
Client Name:		Middleton Sheet Metal Co. Ltd.				Dates: 09/12/2019 - 18/12/2019				Logged By: AAS	
Install.	Water Strike	Samples and In Situ Tests			Depth (m)	Legend	Stratum Description	Scale			
		Depth (m)	Type	Results							
		11.00 11.00	SPT(S) D	N=22 (5,6/6,4,6,6)	11.45		Stiff brown friable slightly clayey SILT. COHESIVE ALLUVIUM	11			
		12.50 12.50					SPT(S) D	N=28 (4,5/6,7,7,8)	13.30		Medium dense brown clayey SAND with pockets of brown silty sand. COHESIVE ALLUVIUM
		14.00 14.00	SPT(S) D	N=17 (4,4/4,4,4,5)	15.20						Firm brown slightly sandy CLAY. COHESIVE ALLUVIUM
		15.50 15.50					SPT(S) D	N=9 (1,1/1,2,2,4)	16.70		Loose brown and orange fine and medium SAND. GRANULAR ALLUVIUM
		16.70 16.70	SPT(S) D	N=23 (5,4/3,5,6,9)	17.50						Stiff grey mottled brown clayey SILT with occasional angular fine gravel sized mudstone lithorelics. COHESIVE ALLUVIUM
		17.50					D		19.41		Extremely weak grey MUDSTONE recovered as angular coarse gravel. MUDSTONE
		18.50 18.50	SPT(S) D	50 (6,8/50 for 295mm)	19.00 19.00	SPT(S) D	50 (5,10/50 for 230mm)				17
										19	
										20	

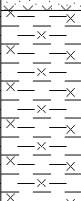
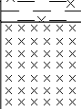
Remarks: Borehole terminated in bedrock.
Faint hydrocarbon odour between 2.00 and 2.90 m.
Groundwater not recorded.
On completion borehole backfilled with bentonite pellets 19.41 - 5.00 m. A slotted standpipe 50 mm was installed to 5.00 m, granular response zone 5.00 - 1.00 m, bentonite seal 1.00 - 0.20 m, concrete and flush cover 0.20 - 0.00 m.

ES - Environmental sample
B - Bulk sample
D - Disturbed sample
SPT - Std. Penetration Test

Approved by: DA

		PWA Geo-Environmental Ltd Summit House, Riparian Way BD20 7BW		BOREHOLE LOG			Borehole ID: CP04 Sheet 1 of 2			
Project Name:		MSM Middleton			Project Number: 19060		Elevation: 87.70		Hole Type: CP	
Project Location:		Hanson Close, Middleton, M24 2HS			Coordinates: E387554, N406115				Scale: 1:50	
Client Name:		Middleton Sheet Metal Co. Ltd.			Dates: 09/12/2019 - 18/12/2019				Logged By: AAS	
Install.	Water Strike	Samples and In Situ Tests			Depth (m)	Legend	Stratum Description	Scale		
		Depth (m)	Type	Results						
						Limestone hardcore GRAVEL. MADE GROUND				
		0.50				Loose brown very clayey SAND with rare angular fine gravel. REWORKED MADE GROUND				
		1.00	SPT(S)	N=5 (2,1/2,1,1,1)						
		1.00	D							
		1.70								
		2.00	SPT(S)	N=3 (0,1/1,0,1,1)						
		2.00	D							
		3.00	SPT(S)	N=8 (1,1/1,2,3,2)						
		3.00	D							
		3.70				3.00 - 3.45 m: SPT indicates firm to stiff. 3.10 - 3.20 m: Band of dark brown clayey fine and medium sand. 3.30 - 3.40 m: Band of firm brown slightly sandy slightly gravelly clay. Medium dense dark brown silty gravelly SAND. Gravel is angular and sub-angular fine to coarse brick, sandstone and coal. MADE GROUND				
	4.00	SPT(S)	N=12 (2,1/2,3,3,4)							
	4.00	D								
	5.00	SPT(S)	N=8 (1,1/1,2,2,3)							
	5.00	D								
	6.30					5.00 - 5.45 m: Occasional relic rootlets. SPT indicates loose. Medium dense brown angular to sub-rounded fine to coarse limestone, sandstone, limestone ballast and brick GRAVEL. Possible fines washed away. MADE GROUND				
	6.50	SPT(C)	N=24 (6,6/4,6,6,8)							
	6.50	D								
	7.30	D								
	7.30					Medium dense brown fine to coarse SAND. GRANULAR ALLUVIUM				
	8.00	SPT(S)	N=25 (2,3/4,5,8,8)							
	8.00	D								
	9.50	SPT(S)	N=36 (3,4/6,10,10,10)							
	9.50	D								
						9.50 - 9.95 m: Pockets of fine sand. SPT indicates dense.				
							10			
Remarks: Borehole terminated in bedrock. No visual or olfactory evidence of contamination. Groundwater not recorded. On completion borehole backfilled with bentonite pellets 15.55 - 6.00 m. A slotted standpipe 50 mm was installed to 6.00 m, granular response zone 6.00 - 2.00 m, bentonite seal 2.00 - 0.20 m, concrete and flush cover 0.20 - 0.00 m.								ES - Environmental sample B - Bulk sample D - Disturbed sample SPT - Std. Penetration Test		
								Approved by: DA		

BOREHOLE LOG

Project Name:		MSM Middleton				Project Number: 19060		Elevation: 87.70		Hole Type: CP	
Project Location:		Hanson Close, Middleton, M24 2HS				Coordinates: E387554, N406115				Scale: 1:50	
Client Name:		Middleton Sheet Metal Co. Ltd.				Dates: 09/12/2019 - 18/12/2019				Logged By: AAS	
Install.	Water Strike	Samples and In Situ Tests			Depth (m)	Legend	Stratum Description	Scale			
		Depth (m)	Type	Results							
		11.00 11.00	SPT(S) D	49 (3,7/49 for 245mm)	11.00		Medium dense brown fine to coarse SAND. GRANULAR ALLUVIUM	11			
							Dense brown very silty SAND. GRANULAR ALLUVIUM				
		12.50 12.50	SPT(S) D	N=40 (5,6/7,11,11,11)	12.10		Dense brown very sandy SILT. GRANULAR ALLUVIUM	12			
						13.50		Stiff brown silty CLAY locally clayey silt. COHESIVE ALLUVIUM	14		
		14.00 14.00	SPT(S) D	N=14 (1,2/2,3,4,5)	14.90					Siltstone bedrock recovered as angular medium to coarse siltstone gravel. SILTSTONE	15
		14.90	SPT(S)	50 (25 for 110mm/50 for 20mm)		15.50					
									16		
									17		
									18		
									19		
							20				

Remarks: Borehole terminated in bedrock.
No visual or olfactory evidence of contamination.
Groundwater not recorded.
On completion borehole backfilled with bentonite pellets 15.55 - 6.00 m. A slotted standpipe 50 mm was installed to 6.00 m, granular response zone 6.00 - 2.00 m, bentonite seal 2.00 - 0.20 m, concrete and flush cover 0.20 - 0.00 m.

ES - Environmental sample
B - Bulk sample
D - Disturbed sample
SPT - Std. Penetration Test

Approved by: DA

TRIAL PIT LOG

Project Name:	MSM Middleton	Project ID:	19060	Date:	09/12/2019	Depth:	2.30
Location:	Hanson Close, Middleton, M24 2HS	Coordinates:	E387493, N406091	Width:	0.80		
Client:	Middleton Sheet Metal Co. Ltd.	Elevation:	87.23	Logged By:	AAS	Scale:	1:25
						Length:	2.00

Water Strike	Samples and In Situ Testing			Depth (m)	Legend	Stratum Description	Scale
	Depth (m)	Type	Results				
	0.3 - 0.4	B	67 kPa	0.20		Black TARMACADAM. MADE GROUND	1
	0.50	HSV		0.45		Brown silty sandy angular and sub-angular fine to coarse brick, concrete and limestone ballast GRAVEL. Low concrete cobble content. Occasional wood fragments. MADE GROUND	
	0.5 - 0.6	B				Firm brown slightly silty slightly gravelly sandy CLAY. Gravel is angular fine siltstone. Rare relic rootlets. REWORKED MADE GROUND	
	1.2 - 1.3	D	88 kPa	1.20		1.10 - 2.20 m: Pockets of light brown gravelly fine and medium sand. Gravel is sub-rounded and rounded fine to coarse quartz and sandstone.	2
	1.50	HSV				Firm slightly gravelly sandy CLAY. Gravel is sub-angular to rounded fine to coarse quartz sandstone and siltstone.	
	1.8 - 1.9	B		1.70		REWORKED MADE GROUND 1.50 m: Locally stiff.	
	2.1 - 2.2	ES		2.30		Brown clayey very gravelly fine and medium SAND. Gravel is sub-rounded and rounded fine to coarse quartz and sandstone. REWORKED MADE GROUND 2.20 - 2.30 m: Occasional stiff brown pockets up to 100mm.	
							3
							4

Remarks: Trial pit terminated in reworked made ground at 2.30 m.
Fast seepage between 0.00 and 0.45 m. Dry at base.
No visual or ofactory evidence of contamination.

ES - Environmental sample
B - Bulk sample
D - Disturbed sample
HSV - Hand shear vane

Stability: Trial pit spooling between 0.00 and 0.20 m.

Plant used: JCB 3CX

Approved by: DA

TRIAL PIT LOG

Project Name:	MSM Middleton	Project ID: 19060	Date: 09/12/2019	Depth: 1.80
Location:	Hanson Close, Middleton, M24 2HS	Coordinates: E387475, N406079		Width: 0.80
Client:	Middleton Sheet Metal Co. Ltd.	Elevation: 87.23	Logged By: DA	Scale: 1:25
				Length: 1.80

Water Strike	Samples and In Situ Testing			Depth (m)	Legend	Stratum Description	Scale
	Depth (m)	Type	Results				
	0.3 - 0.4	ES		0.20		Black TARMACADAM. MADE GROUND	
				0.40		Stiff grey slightly sandy gravelly CLAY. Gravel is angular to sub-rounded fine to coarse brick concrete and quartz. MADE GROUND	
	0.7 - 0.8	ES		0.70		0.20 - 0.30 m: Greyish brown silty sandy angular and sub-angular fine to coarse limestone ballast GRAVEL.	
	1.0 - 1.1	D		0.95		Grey sub-angular concrete and brick COBBLES and BOULDERS with much silty angular and sub-angular fine to coarse brick, quartz and concrete gravel. Rare plastic and wood fragments (up to 400 mm). Rare roots (up to 10 mm). MADE GROUND	1
	1.0 - 1.1	ES				Grey slightly clayey sandy angular and sub-angular fine to coarse brick, concrete and quartz GRAVEL. MADE GROUND	
	1.4 - 1.5	B		1.80		Firm dark brown and light brown sandy CLAY with rare angular fine and medium siltstone gravel. REWORKED MADE GROUND 1.30 - 1.50 m: Light brown gravelly fine and medium SAND. Gravel is sub-rounded and rounded fine to coarse sandstone and quartz. 1.50 - 1.80 m: Firm brown sandy clay.	2
							3
							4

Remarks: Trial pit terminated in reworked made ground at 1.80 m due to water ingress.
Perched groundwater at 1.30 m. Dry at base.
Groundwater had a faint hydrocarbon sheen.

ES - Environmental sample
B - Bulk sample
D - Disturbed sample
HSV - Hand shear vane

Stability: Trial pit sides remained stable and upright.

Plant used: JCB 3CX

Approved by: DA

TRIAL PIT LOG

Project Name:	MSM Middleton	Project ID: 19060	Date: 09/12/2019	Depth: 2.30
Location:	Hanson Close, Middleton, M24 2HS	Coordinates: E387529, N406101		Width: 0.80
Client:	Middleton Sheet Metal Co. Ltd.	Elevation: 87.55	Logged By: DA	Scale: 1:25
				Length: 2.30

Water Strike	Samples and In Situ Testing			Depth (m)	Legend	Stratum Description	Scale
	Depth (m)	Type	Results				
	0.0 - 0.1	ES		0.10		Grey silty angular and sub-angular fine to coarse limestone ballast.	1
				0.20		MADE GROUND	
	0.4 - 0.5	ES				Black TARMACADAM.	1
						MADE GROUND	
	0.7 - 0.8	D		0.65		Grey silty sandy angular to rounded fine to coarse brick, concrete and rare sandstone GRAVEL.	1
	0.7 - 0.8	ES		0.80		MADE GROUND	
						<i>0.30 m: Grey sub-angular concrete boulder.</i>	1
						<i>0.50 - 0.65 m: Frequent plastic fragments (up to 400 mm) on eastern edge of trial pit.</i>	
	1.0 - 1.1	B		1.10		Firm brown slightly gravelly sandy CLAY. Gravel is sub-angular and sub-rounded fine quartz and sandstone.	1
	1.3 - 1.4	B				REWORKED MADE GROUND	
						Light brown gravelly fine and medium SAND. Gravel is sub-rounded and rounded fine to coarse sandstone and quartz.	2
						REWORKED MADE GROUND	
	1.9 - 2.0	D		1.80		Light brown and dark brown slightly clayey very gravelly fine and medium SAND with occasional pockets (up to 100 mm) of firm brown sandy CLAY.	2
				2.10		Gravel is sub-rounded and rounded fine to coarse sandstone and quartz.	
				2.30		REWORKED MADE GROUND	3
						Firm brown slightly sandy slightly gravelly CLAY. Gravel is sub-angular to rounded fine to coarse quartz.	
						REWORKED MADE GROUND	3
						Light brown and dark brown very gravelly fine and medium SAND. Gravel is sub-angular fine to coarse sandstone and quartz.	
						REWORKED MADE GROUND	4

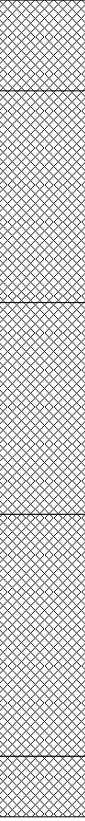
Remarks: Trial pit terminated in reworked made ground at 2.30 m.
Perched groundwater between 0.45 and 0.65 m. Dry at base.
No visual or olfactory evidence of contamination.

ES - Environmental sample
B - Bulk sample
D - Disturbed sample
HSV - Hand shear vane

Stability: Trial pit sides remained stable and upright

Plant used: JCB 3CX

Approved by: DA

		PWA Geo-Environmental Ltd Summit House, Riparian Way, BD20 7BW		TRIAL PIT LOG			Trial Pit ID: TP04 Sheet 1 of 1					
Project Name:		MSM Middleton			Project ID: 19060		Date: 09/12/2019		Depth: 2.70			
Location:		Hanson Close, Middleton, M24 2HS			Coordinates: E387559, N406135				Width: 0.60			
Client:		Middleton Sheet Metal Co. Ltd.			Elevation: 88.00		Logged By: DA		Scale: 1:25		Length: 2.70	
Water Strike	Samples and In Situ Testing			Depth (m)	Legend	Stratum Description	Scale					
	Depth (m)	Type	Results									
	0.4 - 0.5	D	55 kPa	0.30		Black TARMACADAM. MADE GROUND						
	0.4 - 0.5	ES				Stiff brown sandy CLAY with rare sub-rounded fine quartz gravel. REWORKED MADE GROUND <i>0.55 - 0.60 m: Brown gravelly fine and medium sand. Gravel is sub-rounded and rounded fine to coarse quartz.</i>						
	1.1 - 1.2	B		1.00		Brown gravelly fine and medium SAND with frequent pockets (up to 150 mm) of stiff brown sandy clay. Gravel is sub-rounded and rounded fine to coarse sandstone and quartz REWORKED MADE GROUND						
	1.8 - 1.9	B		1.70		Brown gravelly slightly clayey fine and medium SAND with frequent pockets (up to 150 mm) of stiff brown sandy clay. Gravel is sub-rounded and rounded fine to coarse sandstone and quartz REWORKED MADE GROUND						
	2.6 - 2.7 2.70	D HSV		2.50 2.70		Firm brown slightly gravelly slightly sandy CLAY. Gravel is sub-angular and sub-rounded fine siltstone. REWORKED MADE GROUND						
Remarks: Trial pit terminated in reworked made ground at 2.70 m. Fast seepage in made ground between 0.20 and 0.25 m. Dry at base. No visual or olfactory evidence of contamination.								ES - Environmental sample B - Bulk sample D - Disturbed sample HSV - Hand shear vane				
Stability: Trial pit sides remained stable and upright								Plant used: JCB 3CX		Approved by: DA		

TRIAL PIT LOG

Project Name:	MSM Middleton	Project ID: 19060	Date: 09/12/2019	Depth: 2.00
Location:	Hanson Close, Middleton, M24 2HS	Coordinates: E387580, N406099		Width: 1.00
Client:	Middleton Sheet Metal Co. Ltd.	Elevation: 87.60	Logged By: DA	Scale: 1:25
				Length: 2.00

Water Strike	Samples and In Situ Testing			Depth (m)	Legend	Stratum Description	Scale
	Depth (m)	Type	Results				
	0.3 - 0.4	ES		0.10 0.20	Black TARMACADAM. MADE GROUND	Greyish brown silty sandy sub-angular fine to coarse limestone ballast GRAVEL. MADE GROUND Dark grey gravelly SILT with rare wood and metal fragments (up to 200 mm). Gravel is fine to coarse brick and cement. Faint hydrocarbon odour. MADE GROUND Light brown locally greyish brown gravelly fine and medium SAND. Gravel is angular to rounded fine to coarse brick and quartz. High sub-angular brick cobble content. MADE GROUND <u>0.80 m: Grey sub-angular concrete boulder (600 mm).</u> Grey sub-angular concrete and brick COBBLES and BOULDERS with much very clayey angular and sub-angular fine to coarse brick and concrete GRAVEL. Rare cloth fragments (up to 200 mm). MADE GROUND <u>1.80 m: Old bicycle wheel.</u>	1
	0.8 - 0.9	ES		0.80			
	1.5 - 1.6	ES		1.20			
				2.00			
							2
							3
							4

Remarks: Trial pit terminated in reworked made ground at 2.00 m.
Perched groundwater at 1.25 m. Hydrocarbon sheen.
Faint sulphurous odour between 0.30 and 0.40 m and hydrocarbon odour between 0.2 and 0.80 m.
No visual or olfactory evidence of contamination.

ES - Environmental sample
B - Bulk sample
D - Disturbed sample
HSV - Hand shear vane

Stability: Excessive spooling between 0.20 and 1.80 m.

Plant used: JCB 3CX

Approved by: DA

TRIAL PIT LOG

Project Name:	MSM Middleton	Project ID: 19060	Date: 09/12/2019	Depth: 2.50
Location:	Hanson Close, Middleton, M24 2HS	Coordinates: E387525, N406075		Width: 0.70
Client:	Middleton Sheet Metal Co. Ltd.	Elevation: 87.36	Logged By: DA	Scale: 1:25
				Length: 2.10

Water Strike	Samples and In Situ Testing			Depth (m)	Legend	Stratum Description	Scale
	Depth (m)	Type	Results				
	0.4 - 0.5	ES		0.20		Black TARMACADAM. MADE GROUND	
	0.7 - 0.8	ES		0.90		Soft brown gravelly CLAY. Gravel is angular and sub-angular fine to coarse brick and concrete. High sub-angular brick and concrete cobble content. MADE GROUND <i>0.50 - 0.70 m: Sub-angular brick and concrete cobbles and boulders with much silty fine and medium sand.</i>	1
	1.1 - 1.2 1.1 - 1.2	D ES		1.80		Stiff brown slightly gravelly sandy CLAY. Gravel is sub-rounded and rounded fine to coarse quartz sandstone and siltstone. Rare relic rootlets. REWORKED MADE GROUND <i>1.70 - 1.80 m: Firm brown sandy clay.</i>	2
	1.9 - 2.0	B		2.50		Brown clayey fine and medium SAND REWORKED MADE GROUND	3
							4

Remarks: Trial pit terminated in reworked made ground at 2.50 m.
Fast seepage at 0.80 m. Dry at base.
No visual or olfactory evidence of contamination.

ES - Environmental sample
B - Bulk sample
D - Disturbed sample
HSV - Hand shear vane

Stability: Slight spooling between 0.00 and 0.50 m.

Plant used: JCB 3CX

Approved by: DA

Appendix C

Chemical Test Results

Assessment of Chemicals of Potential Concern to Human Health

All values in mg/kg unless otherwise stated								Soil Type	MG	MG	MG-R	MG	MG-R	MG	MG	MG-R	MG	
								Location & Depth	TP01	TP02	TP02	TP03	TP04	TP05	TP05	TP06	CP01	
Chemical of Potential Concern	Lab. RL	No. Samples	Min. Value	Max. Value	No. Samples > or = GAC	GAC	US ₉₅	Result of Significance Test	0.3-0.4	0.7-0.8	1.0-1.1	0.4-0.5	0.4-0.5	0.3-0.4	0.8-0.9	1.1-1.2	5.0-5.45	
Arsenic	1.0	9	6.1	17.8	0	635	13.85759	POTENTIALLY SUITABLE FOR USE	7.1	9.5	6.2	7.46	7	17.8	6.1	7	8.9	
Beryllium	1.0	0	0	0	0	14												
Boron	0.40	3	0.5	1	0	190000	1.366001	POTENTIALLY SUITABLE FOR USE			0.5	1				0.6	<0.5	
Cadmium	0.10	5	0.24	1.37	0	410	1.534771	POTENTIALLY SUITABLE FOR USE	0.33	0.24	<0.2	0.39	<0.19	1.37	<0.2	<0.2	0.79	
Chromium (III)	5.0	0	0	0	0	208000												
Chromium (VI)	0.50	0	0	0	0	49		POTENTIALLY SUITABLE FOR USE			<0.1	<0.1				<0.1	<0.1	
Copper	0.50	9	17.6	284.7	0	106000	182.0569	POTENTIALLY SUITABLE FOR USE	50.6	32	17.6	23.17	18	284.7	26.7	21.9	38.4	
Lead	0.50	9	10	488	0	2310	325.8319	POTENTIALLY SUITABLE FOR USE	67.7	46.7	10.6	51.46	10	488	166	16.6	91.8	
Mercury, inorganic	0.10	1	0.66	0.66	0	3600		POTENTIALLY SUITABLE FOR USE	<0.5	<0.5	<0.5	<0.56	<0.5	0.66	<0.5	<0.5	<0.52	
Nickel	0.50	9	11.2	32.2	0	1770	29.67815	POTENTIALLY SUITABLE FOR USE	15.5	23.4	19.8	15.04	21.7	32.2	11.2	24.3	22.8	
Selenium	0.20	0	0	0	0	13000		POTENTIALLY SUITABLE FOR USE	<0.5	<0.5	<0.5	<0.56	<0.5	<0.5	<0.5	<0.5	<0.5	
Vanadium	5.0	0			0	7490												
Zinc	0.50	9	45	251.9	0	1100000	221.5695	POTENTIALLY SUITABLE FOR USE	251.9	74.6	45	65.6	47	234.1	49.5	56.3	104.4	
Cyanide (free)	0.50	0	0	0	0	373		POTENTIALLY SUITABLE FOR USE			<0.6	<0.65				<0.6	<0.6	
Phenol (total)	0.30	0	0	0	0	685		POTENTIALLY SUITABLE FOR USE			<0.6	<0.65				<0.6	<0.6	
Acenaphthene	0.1	5	0.25	5.92	0	83600	6.976835	POTENTIALLY SUITABLE FOR USE	0.25	1.87	<0.09	3.779	<0.09	1.81	<0.09	<0.09	5.92	
Acenaphthylene	0.10	2	0.35	0.506	0	76.3		POTENTIALLY SUITABLE FOR USE	<0.09	<0.1	<0.09	0.506	<0.09	0.35	<0.09	<0.09	<0.1	
Anthracene	0.1	5	0.39	5.77	0	535000	7.334211	POTENTIALLY SUITABLE FOR USE	0.39	1.62	<0.09	4.74	<0.09	2.57	<0.09	<0.09	5.77	
Benz(a)anthracene	0.10	6	0.1	10.48	0	76.3	11.46924	POTENTIALLY SUITABLE FOR USE	0.91	3.48	<0.09	10.48	0.1	5.89	<0.09	<0.09	6.55	
Benzo(a)pyrene	0.10	6	0.25	9.468	0	0.87	10.22534	POTENTIALLY SUITABLE FOR USE	1.37	3.6	<0.09	9.468	0.25	5.29	<0.09	<0.09	5.81	
Benzo(b)fluoranthene	0.10	6	0.25	11.052	0	76.3	11.95998	POTENTIALLY SUITABLE FOR USE	1.43	4.19	<0.09	11.052	0.25	6.32	<0.09	<0.09	6.62	
Benzo(ghi)perylene	0.10	6	0.4	5.026	0	76.3	5.112728	POTENTIALLY SUITABLE FOR USE	1.77	2.08	<0.09	5.026	0.4	2.82	<0.09	<0.09	2.33	
Benzo(k)fluoranthene	0.10	5	0.47	3.662	0	76.3	4.307053	POTENTIALLY SUITABLE FOR USE	0.47	1.43	<0.09	3.662	<0.09	2.15	<0.09	<0.09	2.33	
Chrysene	0.10	6	0.11	8.987	0	76.3	10.04217	POTENTIALLY SUITABLE FOR USE	0.96	3.14	<0.09	8.987	0.11	5.26	<0.09	<0.09	6.09	
Dibenz(a,h)anthracene	0.10	5	0.29	6.09	0	76.3	6.529622	POTENTIALLY SUITABLE FOR USE	0.29	0.48	<0.09	1.234	<0.09	0.72	<0.09	<0.09	6.09	
Fluoranthene	0.10	7	0.11	21.3	0	72200	22.82088	POTENTIALLY SUITABLE FOR USE	1.7	8.77	0.12	21.3	0.11	12.3	<0.09	<0.09	17	
Fluorene	0.10	5	0.22	4.43	0	66500	5.251223	POTENTIALLY SUITABLE FOR USE	0.22	0.91	<0.09	2.87	<0.09	1.17	<0.09	<0.09	4.43	
Indeno(1,2,3,cd)pyrene	0.10	6	0.39	6.532	0	76.3	6.85557	POTENTIALLY SUITABLE FOR USE	1.83	2.63	<0.09	6.532	0.39	3.66	<0.09	<0.09	3.81	
Naphthalene	0.10	6	0.4	5.16	0	90.1		POTENTIALLY SUITABLE FOR USE	0.4	0.57	<0.09	2.805	<0.09	0.58	<0.09	1.61	5.16	
Phenanthrene	0.10	5	1.36	21.4	0	76.3	26.15592	POTENTIALLY SUITABLE FOR USE	1.36	3.81	<0.09	15.45	<0.09	5.42	<0.09	<0.09	21.4	
Pyrene	0.10	7	0.1	18.7	0	54100	19.80632	POTENTIALLY SUITABLE FOR USE	1.65	7.74	0.1	18.7	0.12	11.06	<0.09	<0.09	14.2	
Mean																		
FOC (dimensionless)																		
SOM (calculated)	3.84%										1.36%	5.99%				2.07%	5.95%	
pH (su)	8.5										8.7	8.2				8.4	8.7	
Risk parameter: Human health - commercial (1%SOM) Data set: Made ground Client: MSM Site: Middleton Job no: 19060 Legend: Values in blue are at or below the laboratory reporting limit (where a single value is indicated) and are considered as being at the detection limit for the purposes of statistical analysis, as a conservative estimate. Values in red are equal to, or greater than, the generic assessment criterion (GAC). MG denotes Made Ground NAT denotes natural ground																		

Assessment of Chemicals of Potential Concern to Plant Life

All values in mg/kg unless otherwise stated								Soil Type	MG	MG	MG-R	MG	MG-R	MG	MG	MG-R	MG	MG
								Location & Depth	TP01	TP02	TP02	TP03	TP04	TP05	TP05	TP06	CP01	
Chemical of Potential Concern	Lab. RL	No. Samples	Min. Value	Max. Value	No. Samples > or = GAC	GAC	US ₉₅	Result of Significance Test	0.3-0.4	0.7-0.8	1.0-1.1	0.4-0.5	0.4-0.5	0.3-0.4	0.8-0.9	1.1-1.2	5.0-5.45	
Arsenic	1.0	9	6.1	17.8	0	250	13.85759	POTENTIALLY SUITABLE FOR USE	7.1	9.5	6.2	7.46	7	17.8	6.1	7	8.9	
Boron	0.40	3	0.5	1	0	3	1.366001	POTENTIALLY SUITABLE FOR USE			0.5	1				0.6	<0.5	
Chromium (III)	5.0	0	0	0	0	400												
Chromium (VI)	0.50	0	0	0	0	25					<0.1	<0.1				<0.1	<0.1	
Copper	0.50	9	17.6	284.7	1	135	182.0569	FURTHER ASSESSMENT REQUIRED	50.6	32	17.6	23.17	18	284.7	26.7	21.9	38.4	
Nickel	0.50	9	11.2	32.2	0	75	29.67815	POTENTIALLY SUITABLE FOR USE	15.5	23.4	19.8	15.04	21.7	32.2	11.2	24.3	22.8	
Zinc	0.50	9	45	251.9	0	300	221.5695	POTENTIALLY SUITABLE FOR USE	251.9	74.6	45	65.6	47	234.1	49.5	56.3	104.4	
	Mean																	
pH (su)	8.5										8.7	8.2				8.4	8.7	
Risk parameter: Plant life pH 7 Data set: Made ground Client: MSM Site: Middleton Job no: 19060 Legend: Values in blue are at or below the laboratory reporting limit (where a single value is indicated) and are considered as being at the detection limit for the purposes of statistical analysis, as a conservative estimate. Values in red are equal to, or greater than, the generic assessment criterion (GAC). MG denotes Made Ground NAT denotes natural ground																		

Our Ref: EFS/204321M (Ver. 1)

Your Ref: 19060

January 8, 2020



Environmental Chemistry

SOCOTEC UK Limited

Bretby Business Park

Ashby Road

Burton-on-Trent

Staffordshire

DE15 0YZ

Telephone: 01283 554400

Facsimile: 01283 554422

David Allen
PWA Geo Environmental
Summit House
Riparian Way
The Crossings
Cross Hills
Keighley
BD20 7BW

For the attention of David Allen

Dear David Allen

Sample Analysis - 19060 - MSM Middleton

Samples from the above site have been analysed in accordance with the schedule supplied.

The sample details and the results of analyses for these samples are given in the appended report.

An invoice for this work will follow under a separate cover.

Where appropriate the samples will be kept until 25/01/20 when they will be discarded. Please call 01283 554400 for an extension of this date.

Please be aware that our policy for the retention of paper based laboratory records and analysis reports is 6 years.

The work was carried out in accordance with SOCOTEC UK Limited (Laboratory and Analytical) Standard Terms and Conditions of Contract.

If I can be of any further assistance please do not hesitate to contact me.

Yours sincerely

for SOCOTEC UK Limited

A handwritten signature in black ink, appearing to read 'M Palmer'.

M Palmer
Project Co-ordinator
01283 554400

TEST REPORT



Report No. EFS/204321M (Ver. 1)

PWA Geo Environmental
PWA Geo Environmental
Summit House
Riparian Way
The Crossings
Cross Hills
Keighley
BD20 7BW

Site: 19060 - MSM Middleton

The 9 samples described in this report were registered for analysis by SOCOTEC UK Limited on 14-Dec-2019. This report supersedes any versions previously issued by the laboratory.

The analysis was completed by: 08-Jan-2020

Tests where the accreditation is set to N or No, and any individual data items marked with a * are not UKAS or MCERTS accredited. Any opinions or interpretations expressed herein are outside the scope of any UKAS accreditation held by SOCOTEC UK Limited.

The following tables are contained in this report:

Table 1 Main Analysis Results (Pages 2 to 6)
Subcontracted Analysis Reports (Pages 7 to 8)
The accreditation status of subcontracted analysis is displayed on the appended subcontracted analysis reports.
Analytical and Deviating Sample Overview (Pages 9 to 10)
Table of Method Descriptions (Page 11)
Table of Report Notes (Page 12)
Table of Sample Descriptions (Appendix A Page 1 of 1)

On behalf of
SOCOTEC UK Lim
Becky Batham

Operations Manager
Energy & Waste Services

Date of Issue: 08-Jan-2020

Accreditation Codes: **N** (Not Accredited), **U** (UKAS), **UM** (UKAS & MCERTS)

Tests marked 'A' have been subcontracted to another laboratory.

(NVM) - denotes the sample matrix is dissimilar to matrices upon which the MCERTS validation was based, and is therefore not accredited for MCERTS.

All results are reported on a dry weight basis at 105°C unless otherwise stated. (except QC samples)

SOCOTEC UK Limited accepts no responsibility for any sampling not carried out by our personnel.

CERTIFICATE OF ANALYSIS

ANALYSIS REQUESTED BY: SOCOTEC UK Ltd
Environmental Chemistry
PO Box 100
Burton upon Trent
Staffordshire
DE15 0XD

CONTRACT NO: S10211-3

DATE OF ISSUE: 24.12.19

DATE SAMPLES RECEIVED: 18.12.19

DATE SAMPLES ANALYSED: 24.12.19

DESCRIPTION: Six soil/loose aggregate samples.

ANALYSIS REQUESTED: Qualitative analysis of samples for determination of presence/type of asbestos.

METHODS:

Our method involves initial examination of the samples followed by detailed analysis of representative sub-samples. The sub-samples are analysed qualitatively for asbestos by polarised light and dispersion staining as described by the Health and Safety Executive in HSG 248.

RESULTS:

Initial Screening

Asbestos was detected in one of the soil samples by stereo-binocular and polarised light microscopy.

A summary of the results is given in Table 1.





CONTRACT NO: S10211-3
DATE OF ISSUE: 24.12.19

RESULTS: (cont.)

Table 1: Qualitative Results

SOCOTEC Job I.D: S204321

IOM sample number	Client sample number	ACM type detected	PLM result
S69517	S1981409 TP01 0.30-0.40	-	No Asbestos Detected
S69518	S1981410 TP02 0.70-0.80	-	No Asbestos Detected
S69519	S1981412 TP03 0.40-0.50	-	No Asbestos Detected
S69520	S1981413 TP04 0.40-0.50	-	No Asbestos Detected
S69521	S1981414 TP05 0.30-0.40	Cement ¹ & Loose Insulation ²	Chrysotile & Crocidolite
S69522	S1981415 TP05 0.80-0.90	-	No Asbestos Detected

Our detection limit for this method is 0.001%.

COMMENTS:

¹ ACM was visible during initial examination of the sample.

² ACM was detected during microscopic examination of the sample.

IOM Consulting cannot accept responsibility for samples that have been incorrectly collected or despatched by external clients.

Any opinions and interpretations expressed herein are out with the scope of our UKAS accreditation.

AUTHORISED BY:

S Clark
Mineralogy Section Manager

CustomerPWA Geo Environmental

Site19060 - MSM Middleton

Report NoS204321M

Consignment NoS90497

Date Logged14-Dec-2019

In-House Report Due20-Dec-2019

Please note the results for any subcontracted analysis (identified with a '^') is likely to take up to an additional five working days.

ID Number	Description	MethodID	CustServ	FOCS	GROHSA	ICPACIDS	ICPBOR	ICPMSS	ICPWSS	KONECR	MCerts	PAHMSUS	PHSOIL	SFAP1	SFAS	Sub020
		Sampled		S.O.M. % (Calc)	GRO (AA) by HSA GC-FID	SO4-- (acid sol)	Boron (H2O Soluble)	Arsenic (MS)		Chromium vi:	MCerts Analysis	PAH (16) by GCMS	pH units (AR)	Cyanide(Free) (AR)		^Asbestos ID (Stage 1)
			REPORT A													
					✓	✓	✓	✓	✓		✓	✓	✓	✓		✓
CL/1981409	TP01 0.30-0.40	09/10/19										E				
CL/1981410	TP02 0.70-0.80	09/10/19										E				
CL/1981411	TP02 1.00-1.10	09/10/19					E					E	E	E	E	
CL/1981412	TP03 0.40-0.50	09/10/19					E					E	E	E	E	
CL/1981413	TP04 0.40-0.50	09/10/19										E				
CL/1981414	TP05 0.30-0.40	09/10/19			E							E				
CL/1981415	TP05 0.80-0.90	09/10/19			E							E				
CL/1981416	TP06 1.10-1.20	09/10/19					E					E	E	E	E	
CL/1981417	CP01 5.00-5.45	09/10/19					E					E	E	E	E	

Note: We will endeavour to prioritise samples to complete analysis within holding time; however any delay could result in samples becoming deviant whilst being processed in the laboratory.

If sampling dates are missing or matrices unclassified then results will not be ISO 17025 accredited. Please contact us as soon as possible to provide missing information in order to reinstate accreditation.

Deviating Sample Key

A

The sample was received in an inappropriate container for this analysis

B

The sample was received without the correct preservation for this analysis

C

Headspace present in the sample container

D

The sampling date was not supplied so holding time may be compromised - applicable to all analysis

E

Sample processing did not commence within the appropriate holding time

F

Sample processing did not commence within the appropriate handling time

Requested Analysis Key

Analysis Required

Analysis dependant upon trigger result - Note: due date may be affected if triggered

No analysis scheduled

^

Analysis Subcontracted - Note: due date may vary

CustomerPWA Geo Environmental

Site19060 - MSM Middleton

Report NoS204321M

Consignment NoS90497

Date Logged14-Dec-2019

In-House Report Due20-Dec-2019

Please note the results for any subcontracted analysis (identified with a '^') is likely to take up to an additional five working days.

ID Number	Description	MethodID	TMSS	TPHUSI											WS/LM59	
				Sampled	Tot.Moisture @ 105C	TPH Ali Band >C10-C12	TPH Ali Band >C16-C21	TPH Ali Band >C21-C35	TPH Ali Band >C8-C10	TPH Ali Band >C8-C40	TPH Aro Band >C10-C12	TPH Aro Band >C12-C16	TPH Aro Band >C16-C21	TPH Aro Band >C21-C35	TPH Aro Band >C8-C10	TPH Aro Band >C8-C40
			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CL/1981409	TP01 0.30-0.40	09/10/19	E													
CL/1981410	TP02 0.70-0.80	09/10/19	E													
CL/1981411	TP02 1.00-1.10	09/10/19	E													E
CL/1981412	TP03 0.40-0.50	09/10/19	E													E
CL/1981413	TP04 0.40-0.50	09/10/19	E													
CL/1981414	TP05 0.30-0.40	09/10/19	E	E	E	E	E	E	E	E	E	E	E	E	E	
CL/1981415	TP05 0.80-0.90	09/10/19	E	E	E	E	E	E	E	E	E	E	E	E	E	
CL/1981416	TP06 1.10-1.20	09/10/19	E													E
CL/1981417	CP01 5.00-5.45	09/10/19	E													E

Note: We will endeavour to prioritise samples to complete analysis within holding time; however any delay could result in samples becoming deviant whilst being processed in the laboratory.

If sampling dates are missing or matrices unclassified then results will not be ISO 17025 accredited. Please contact us as soon as possible to provide missing information in order to reinstate accreditation.

Deviating Sample Key

A

The sample was received in an inappropriate container for this analysis

B

The sample was received without the correct preservation for this analysis

C

Headspace present in the sample container

D

The sampling date was not supplied so holding time may be compromised - applicable to all analysis

E

Sample processing did not commence within the appropriate holding time

F

Sample processing did not commence within the appropriate handling time

Requested Analysis Key

Analysis Required

Analysis dependant upon trigger result - Note: due date may be affected if triggered

No analysis scheduled

^

Analysis Subcontracted - Note: due date may vary

Method Descriptions

Matrix	MethodID	Analysis Basis	Method Description
Soil	BTEXHSA	As Received	Determination of Benzene, Toluene, Ethyl benzene and Xylenes (BTEX) by Headspace GCFID
Soil	FOCS	Oven Dried @ < 35°C	Calculation of Soil Organic Matter content from Organic Carbon content of soil samples
Soil	GROHSA	As Received	Determination of Total Gasoline Range Organics Hydrocarbons (GRO) by Headspace GCFID
Soil	ICPACIDS	Oven Dried @ < 35°C	Determination of Total Sulphate in soil samples by Hydrochloric Acid extraction followed by ICPOES detection
Soil	ICPBOR	Oven Dried @ < 35°C	Determination of Boron in soil samples by hot water extraction followed by ICPOES detection
Soil	ICPMSS	Oven Dried @ < 35°C	Determination of Metals in Marine Sediments and Soil samples by aqua regia digestion followed by ICPMS detection
Soil	ICPWSS	Oven Dried @ < 35°C	Determination of Water Soluble Sulphate in soil samples by water extraction followed by ICPOES detection
Soil	KONECR	Oven Dried @ < 35°C	Determination of Chromium vi in soil samples by water extraction followed by colorimetric detection
Soil	PAHMSUS	As Received	Determination of Polycyclic Aromatic Hydrocarbons (PAH) by hexane/acetone extraction followed by GCMS detection
Soil	PHSOIL	As Received	Determination of pH of 2.5:1 deionised water to soil extracts using pH probe.
Soil	SFAPI	As Received	Segmented flow analysis with colorimetric detection
Soil	SFAS	As Received	Segmented flow analysis with colorimetric detection
Soil	SubCon*	*	Contact Laboratory for details of the methodology used by the sub-contractor.
Soil	TMSS	As Received	Determination of the Total Moisture content at 105°C by loss on oven drying gravimetric analysis (% based upon wet weight)
Soil	TPHUSSI	As Received	Determination of hexane/acetone extractable Hydrocarbons in soil with GCFID detection including quantitation of Aromatic and Aliphatic fractions.
Soil	WSLM59	Oven Dried @ < 35°C	Determination of Organic Carbon in soil using sulphurous Acid digestion followed by high temperature combustion and IR detection

Report Notes

Generic Notes

Soil/Solid Analysis

Unless stated otherwise,

- Results expressed as mg/kg have been calculated on the basis indicated in the Method Description table.
All results on MCERTS reports are reported on a 105°C dry weight basis with the exception of pH and conductivity.
- Sulphate analysis not conducted in accordance with BS1377
- Water Soluble Sulphate is on a 2:1 water:soil extract

Waters Analysis

Unless stated otherwise results are expressed as mg/l

Nil: Where "Nil" has been entered against Total Alkalinity or Total Acidity this indicates that a measurement was not required due to the inherent pH of the sample.

Oil analysis specific

Unless stated otherwise,

- Results are expressed as mg/kg
- SG is expressed as g/cm³@ 15°C

Gas (Tedlar bag) Analysis

Unless stated otherwise, results are expressed as ug/l

Asbestos Analysis

CH Denotes Chrysotile

TR Denotes Tremolite

CR Denotes Crocidolite

AC Denotes Actinolite

AM Denotes Amosite

AN Denotes Anthophyllite

NAIIS No Asbestos Identified in Sample

NADIS No Asbestos Detected In Sample

Symbol Reference

^ Sub-contracted analysis.

\$\$ Unable to analyse due to the nature of the sample

¶ Samples submitted for this analyte were not preserved on site in accordance with laboratory protocols.

This may have resulted in deterioration of the sample(s) during transit to the laboratory.

Consequently the reported data may not represent the concentration of the target analyte present in the sample at the time of sampling

¥ Results for guidance only due to possible interference

& Blank corrected result

I.S Insufficient sample to complete requested analysis

I.S(g) Insufficient sample to re-analyse, results for guidance only

Intf Unable to analyse due to interferences

N.D Not determined

N.Det Not detected

N.F No Flow

NS Information Not Supplied

Req Analysis requested, see attached sheets for results

▮ Raised detection limit due to nature of the sample

* All accreditation has been removed by the laboratory for this result

‡ MCERTS accreditation has been removed for this result

§ accreditation has been removed for this result as it is a non-accredited matrix

Note: The Laboratory may only claim that data is accredited when all of the requirements of our Quality System have been met. Where these requirements have not been met the laboratory may elect to include the data in its final report and remove the accreditation from individual data items if it believes that the validity of the data has not been affected. If further details are required of the circumstances which have led to the removal of accreditation then please do not hesitate to contact the laboratory.

Sample Descriptions

Client : PWA Geo Environmental
Site : 19060 - MSM Middleton
Report Number : S20_4321

Note: major constituent in upper case

[illegible]

Appendix D

Geotechnical Test Results



LABORATORY REPORT



4043

Contract Number: PSL20/0117

Report Date: 22 January 2020
Client's Reference: 19060/222/20
Client Name: PWA Geoenvironmental
Summit House
Riparian Way
Cross Hills
Keighley
BD20 7BW

For the attention of: Dave Allen

Contract Title: MSM Middleton
Date Received: 9/1/2020
Date Commenced: 9/1/2020
Date Completed: 22/1/2020

Notes: Opinions and Interpretations are outside the UKAS Accreditation

A copy of the Laboratory Schedule of accredited tests as issued by UKAS is attached to this report. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced other than in full, without the prior written approval of the laboratory.

Checked and Approved Signatories:

R Gunson
(Director)

L Knight
(Senior Technician)

A Watkins
(Director)

S Eyre
(Senior Technician)

R Berriman
(Quality Manager)

S Royle
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Page 1 of

SUMMARY OF LABORATORY SOIL DESCRIPTIONS

[illegible]

4043

PSL
Professional Soils Laboratory

MSM Middleton

Contract No:

PSL20/0117

Client Ref:

19060/222/20

PARTICLE SIZE DISTRIBUTION TEST

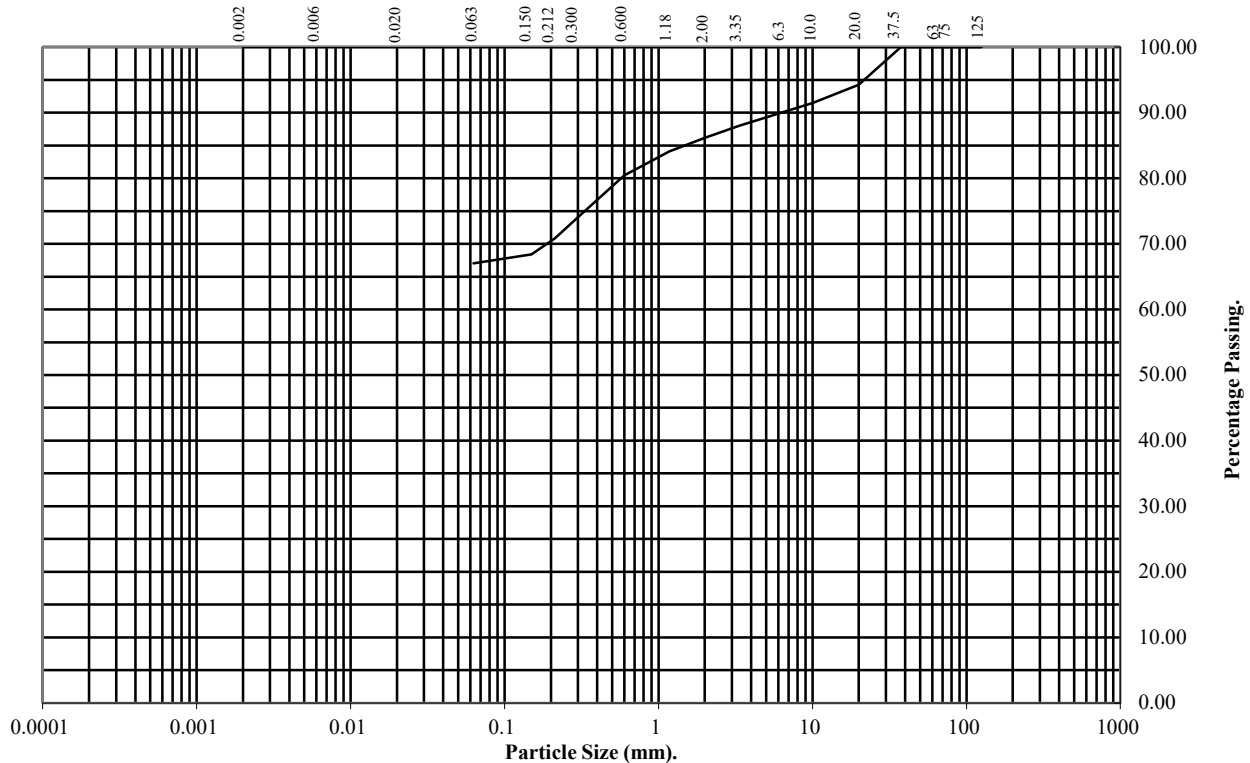
BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number: TP01 Top Depth (m): 0.20

Sample Number: 1 Base Depth(m): 0.30

Sample Type: B



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	100
20	94
10	91
6.3	90
3.35	88
2	86
1.18	84
0.6	80
0.3	74
0.212	71
0.15	68
0.063	67

Soil Fraction	Total Percentage
Cobbles	0
Gravel	14
Sand	19
Silt/Clay	67

Remarks:

See Summary of Soil Descriptions



PSL
Professional Soils Laboratory

MSM Middleton

Contract No:
PSL20/0117
Client Ref:
19060/222/20

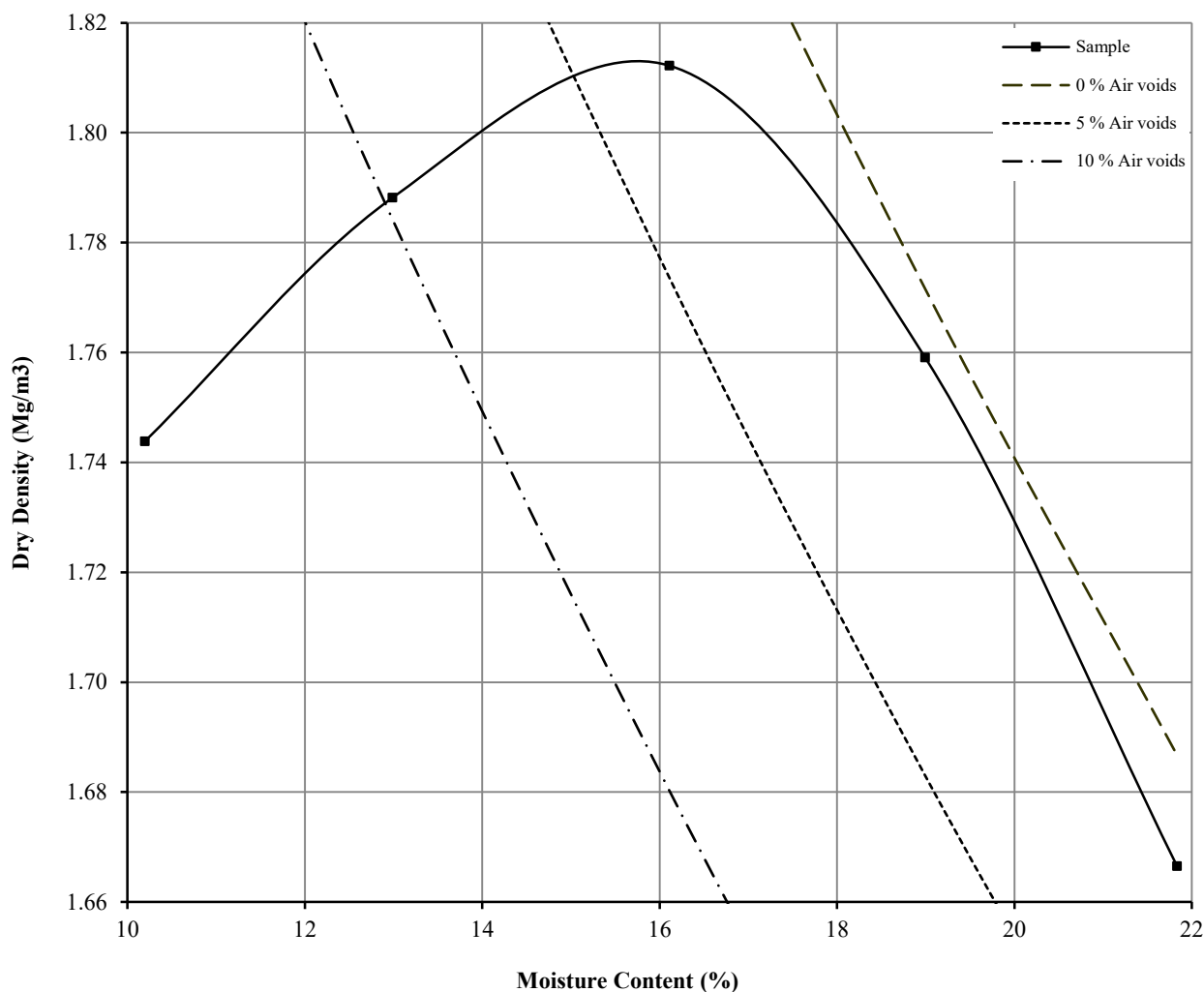
DRY DENSITY / MOISTURE CONTENT RELATIONSHIP

BS 1377 : Part 4 : Clause 3.6 : 1990

Hole Number: TP01 Top Depth (m) : 0.20

Sample Number: 1 Base Depth (m) : 0.30

Sample Type: B



Initial Moisture Content:	19	Method of Compaction:	4.5kg	Separate Samples
Particle Density (Mg/m ³):	2.67	Assumed	Material Retained on 37.5 mm Test Sieve (%):	0
Maximum Dry Density (Mg/m ³):	1.81		Material Retained on 20.0 mm Test Sieve (%):	6
Optimum Moisture Content (%):	16			
Remarks				
See summary of soil descriptions.				

		MSM Middleton	Contract
			PSL20/0117
			Client Ref
			19060/222/20

PARTICLE SIZE DISTRIBUTION TEST

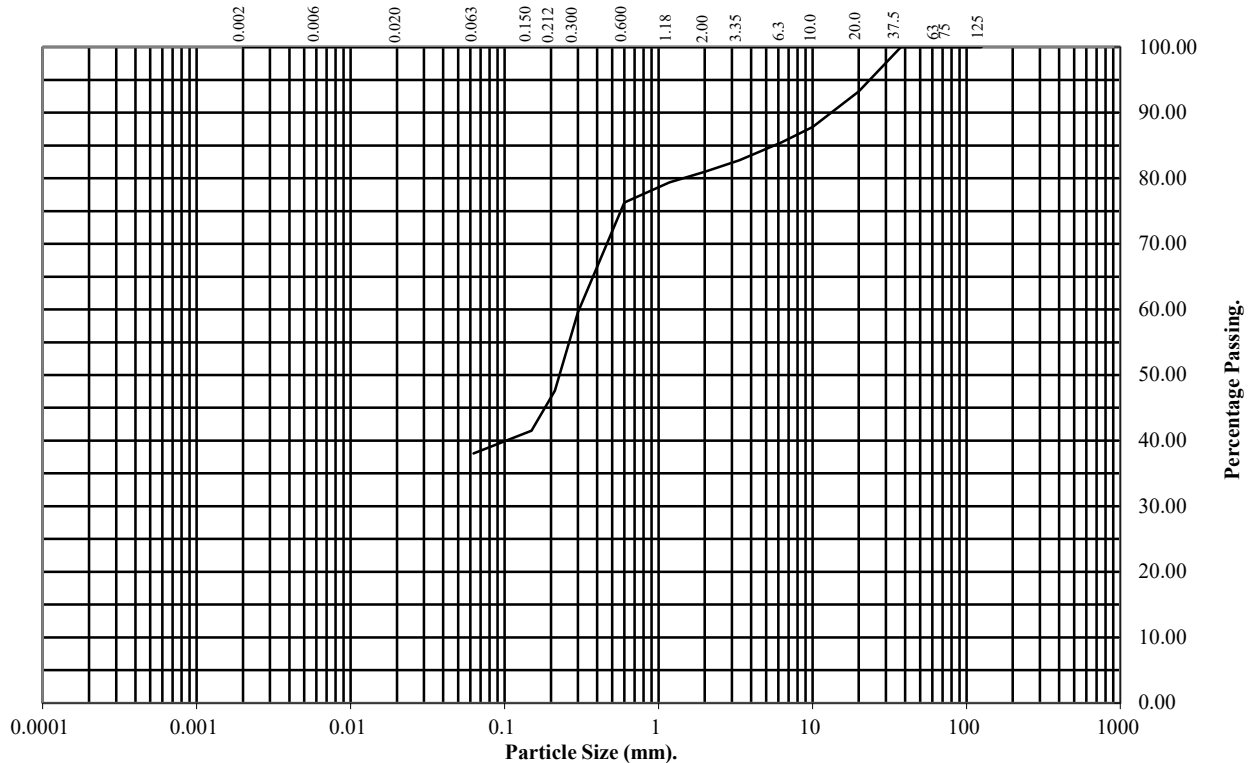
BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number: TP02 Top Depth (m): 1.40

Sample Number: 1 Base Depth(m): 1.50

Sample Type: B



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	100
20	93
10	88
6.3	85
3.35	83
2	81
1.18	79
0.6	76
0.3	60
0.212	48
0.15	41
0.063	38

Soil Fraction	Total Percentage
Cobbles	0
Gravel	19
Sand	43
Silt/Clay	38

Remarks:

See Summary of Soil Descriptions



PSL
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MSM Middleton

Contract No:
PSL20/0117
Client Ref:
19060/222/20

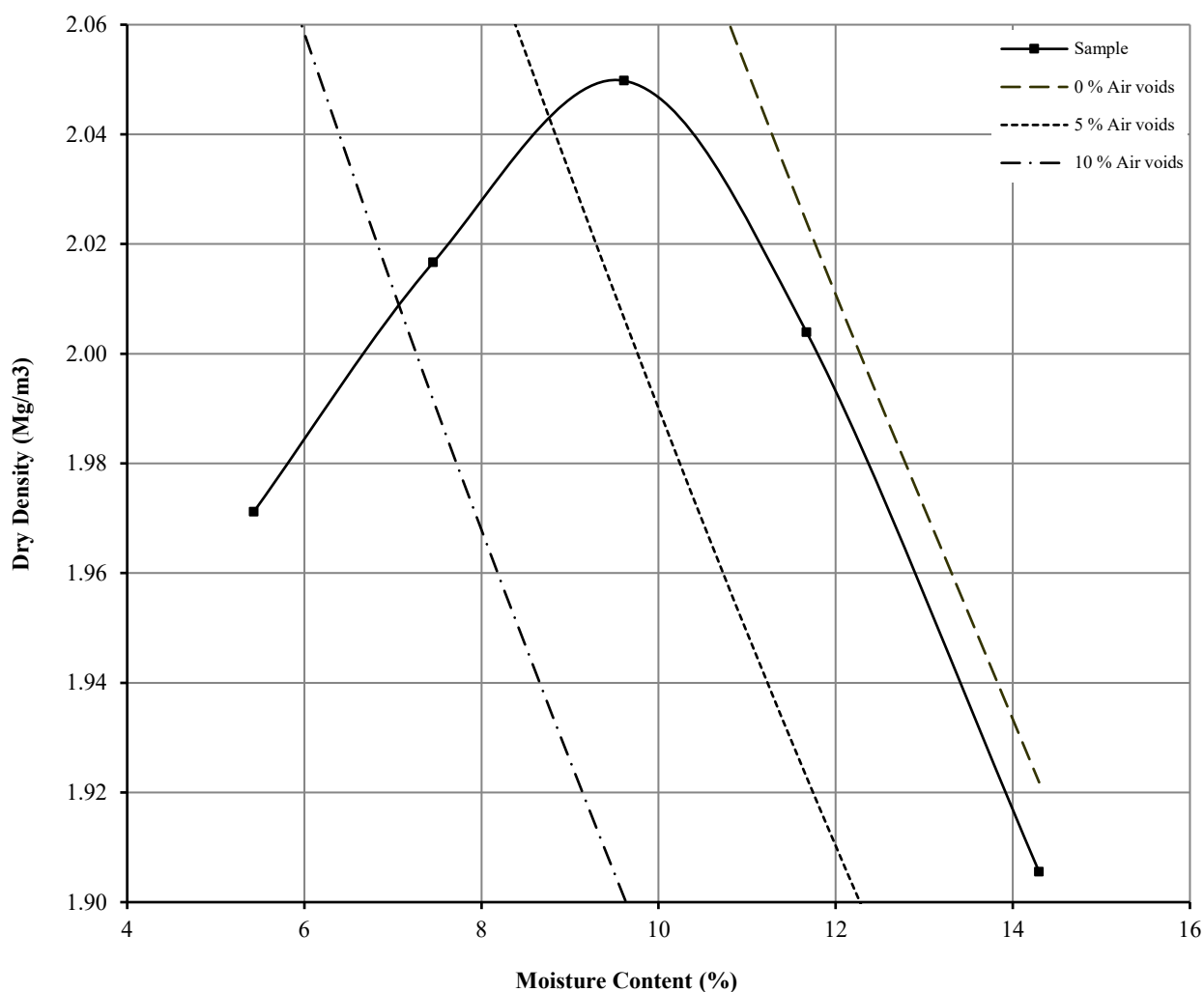
DRY DENSITY / MOISTURE CONTENT RELATIONSHIP

BS 1377 : Part 4 : Clause 3.6 : 1990

Hole Number: TP02 Top Depth (m) : 1.40

Sample Number: 1 Base Depth (m) : 1.50

Sample Type: B



Initial Moisture Content:	19	Method of Compaction:	4.5kg	Separate Samples
Particle Density (Mg/m3):	2.65	Assumed	Material Retained on 37.5 mm Test Sieve (%):	0
Maximum Dry Density (Mg/m3):	2.05		Material Retained on 20.0 mm Test Sieve (%):	7
Optimum Moisture Content (%):	10			
Remarks				
See summary of soil descriptions.				



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Contract
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PARTICLE SIZE DISTRIBUTION TEST

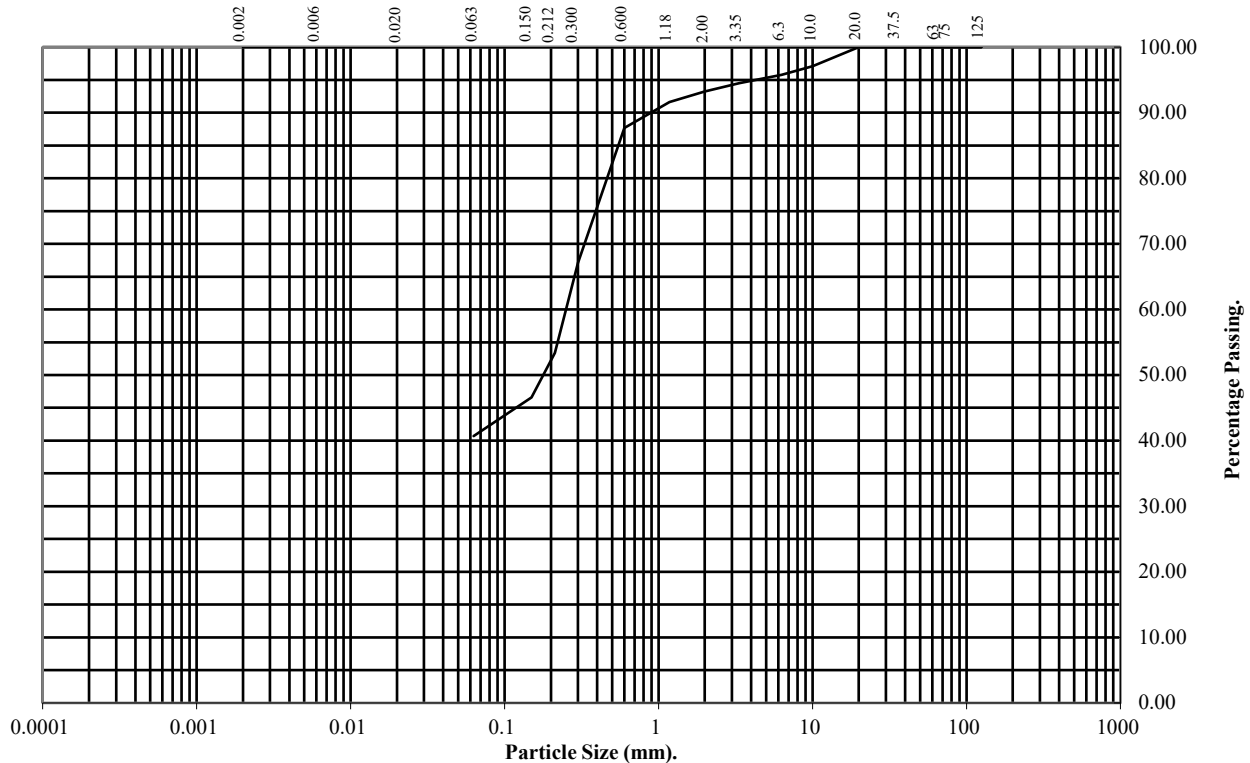
BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

Hole Number: TP04 Top Depth (m): 1.10

Sample Number: 1 Base Depth(m): 1.20

Sample Type: B



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	100
20	100
10	97
6.3	96
3.35	94
2	93
1.18	92
0.6	88
0.3	67
0.212	53
0.15	47
0.063	41

Soil Fraction	Total Percentage
Cobbles	0
Gravel	7
Sand	52
Silt/Clay	41

Remarks:

See Summary of Soil Descriptions



PSL
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MSM Middleton

Contract No:
PSL20/0117
Client Ref:
19060/222/20

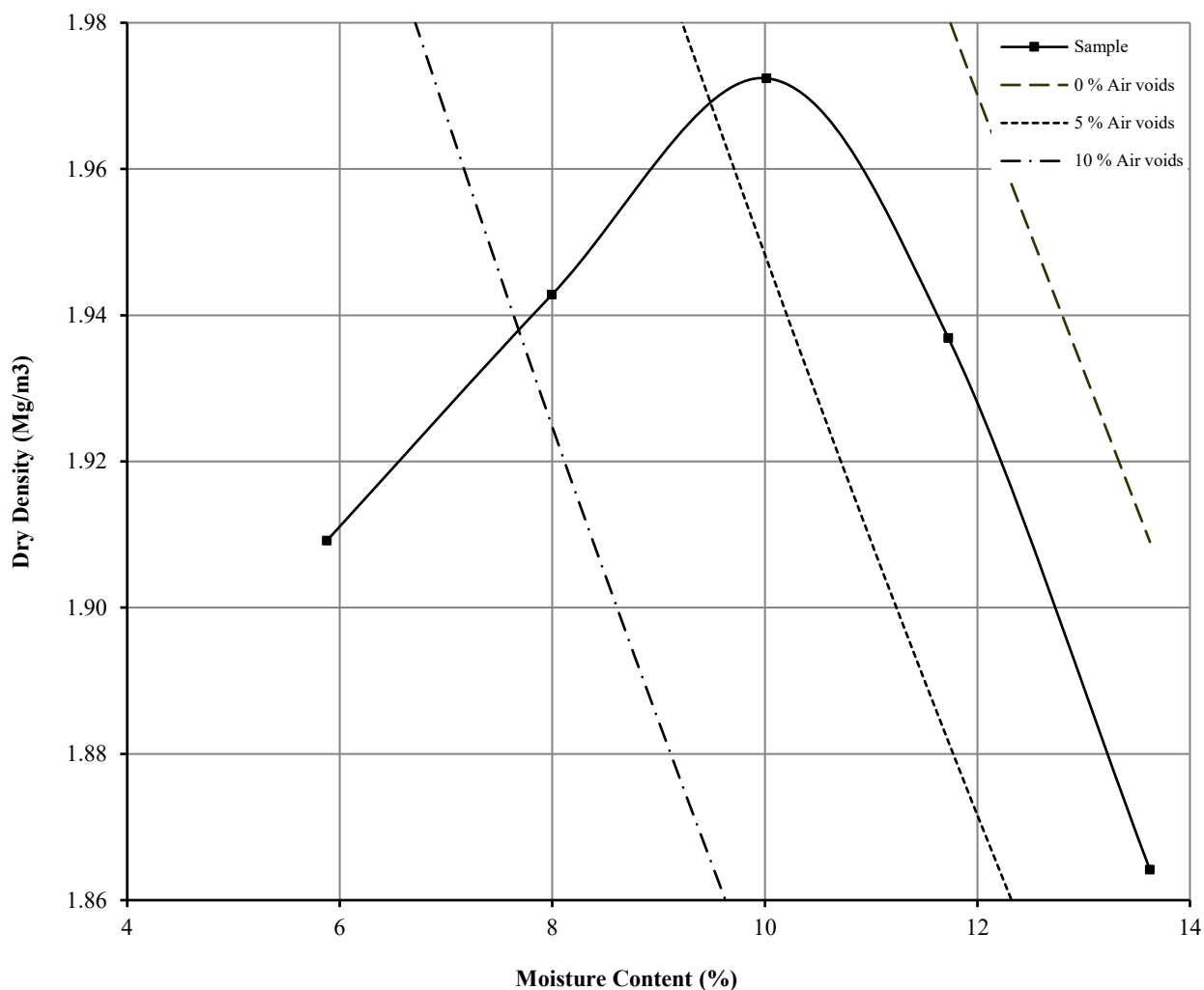
DRY DENSITY / MOISTURE CONTENT RELATIONSHIP

BS 1377 : Part 4 : Clause 3.5 : 1990

Hole Number: TP04 Top Depth (m) : 1.10

Sample Number: 1 Base Depth (m) : 1.20

Sample Type: B



Initial Moisture Content:	12	Method of Compaction:	4.5kg	Separate Samples
Particle Density (Mg/m ³):	2.58	Assumed	Material Retained on 37.5 mm Test Sieve (%):	0
Maximum Dry Density (Mg/m ³):	1.97		Material Retained on 20.0 mm Test Sieve (%):	0
Optimum Moisture Content (%):	10			
Remarks				
See summary of soil descriptions.				

		MSM Middleton	Contract
			PSL20/0117
			Client Ref
			19060/222/20

PARTICLE SIZE DISTRIBUTION TEST

BS1377 : Part 2 : 1990

Wet Sieve, Clause 9.2

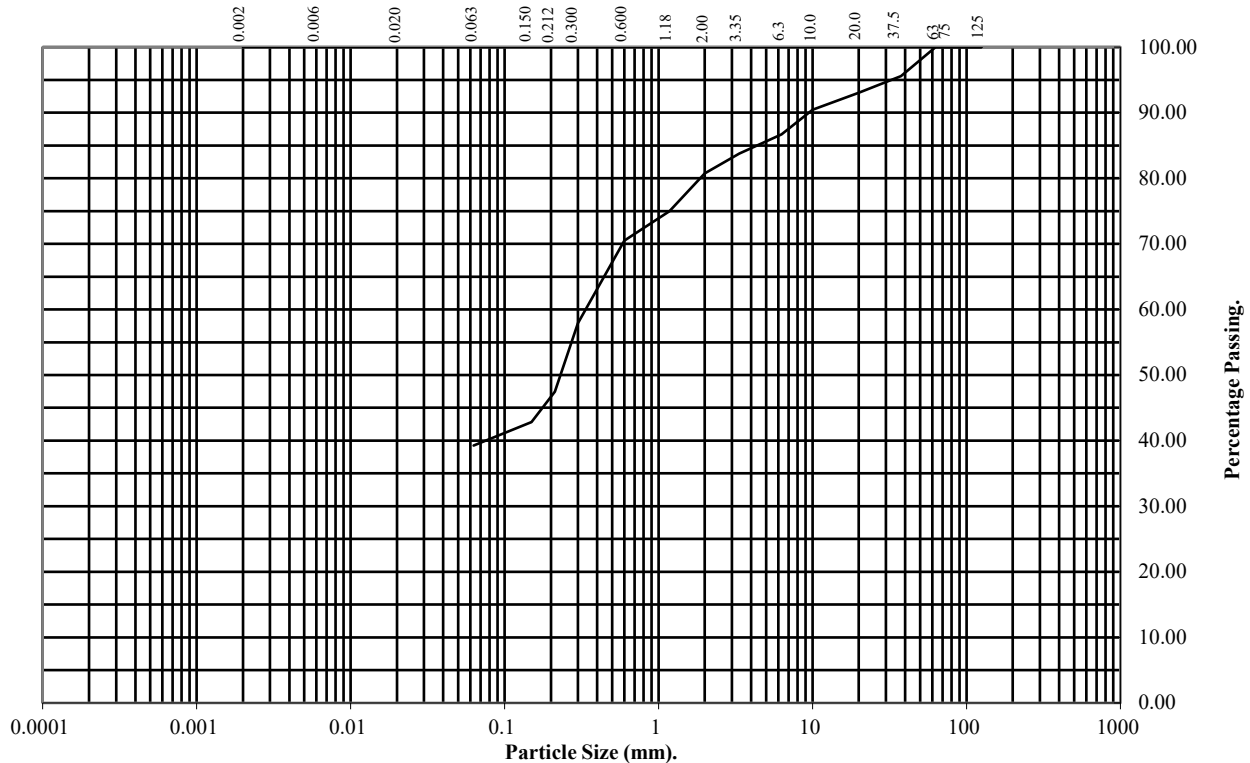
Hole Number: CP03

Top Depth (m): 2.00

Sample Number: 1

Base Depth(m):

Sample Type: B



BS Test Sieve (mm)	Percentage Passing
125	100
75	100
63	100
37.5	96
20	93
10	90
6.3	87
3.35	84
2	81
1.18	75
0.6	71
0.3	58
0.212	47
0.15	43
0.063	39

Soil Fraction	Total Percentage
Cobbles	0
Gravel	19
Sand	42
Silt/Clay	39

Remarks:

See Summary of Soil Descriptions



PSL
Professional Soils Laboratory

MSM Middleton

Contract No:
PSL20/0117
Client Ref:
19060/222/20

DRY DENSITY / MOISTURE CONTENT RELATIONSHIP

BS 1377 : Part 4 : Clause 3.6 : 1990

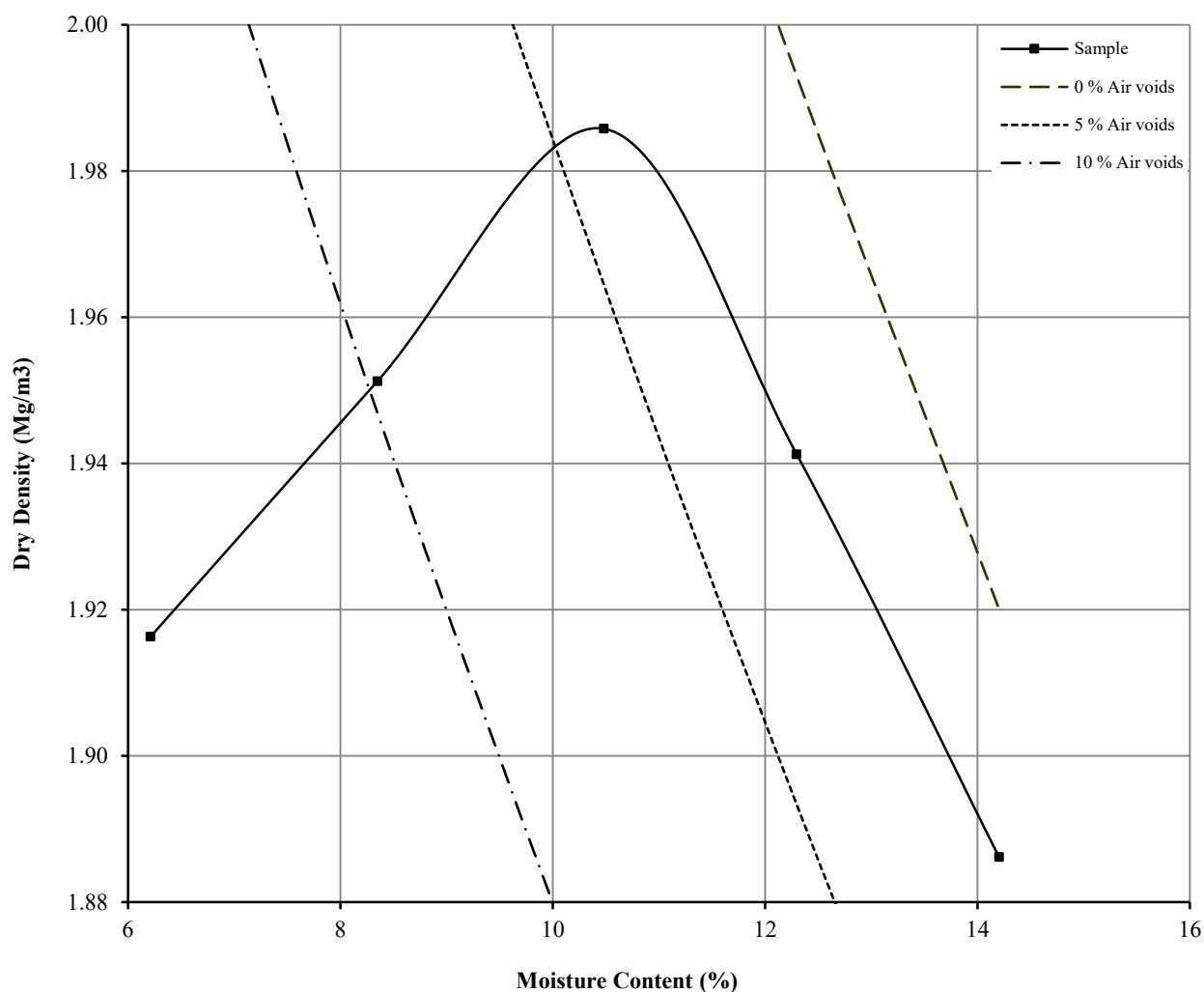
Hole Number: CP03

Top Depth (m) : 2.00

Sample Number: 1

Base Depth (m) :

Sample Type: B



Initial Moisture Content:	18	Method of Compaction:	4.5kg	Separate Samples
Particle Density (Mg/m ³):	2.64	Assumed	Material Retained on 37.5 mm Test Sieve (%):	4
Maximum Dry Density (Mg/m ³):	1.99		Material Retained on 20.0 mm Test Sieve (%):	3
Optimum Moisture Content (%):	10			
Remarks				
See summary of soil descriptions.				



PSL
Professional Soils Laboratory

MSM Middleton

Contract
PSL20/0117
Client Ref
19060/222/20



Certificate of Analysis

Certificate Number 20-00585

17-Jan-20

Client Professional Soils Laboratory Ltd
5/7 Hexthorpe Road
Hexthorpe
DN4 0AR

Our Reference 20-00585

Client Reference PSL20/0117

Order No (not supplied)

Contract Title MSM Middleton

Description 7 Soil samples.

Date Received 14-Jan-20

Date Started 14-Jan-20

Date Completed 17-Jan-20

Test Procedures Identified by prefix DETSn (details on request).

Notes Opinions and interpretations are outside the laboratory's scope of ISO 17025 accreditation. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.

Approved By

Adam Fenwick
Contracts Manager



Summary of Chemical Analysis

Soil Samples

Our Ref 20-00585

Client Ref PSL20/0117

Contract Title MSM Middleton

Lab No	1622884	1622885	1622886	1622887	1622888	1622889
Sample ID	TP01	TP02	TP04	CP03	CP04	CP03
Depth	0.30-0.40	1.40-1.50	1.10-1.20	2.00	8.00	19.00
Other ID						
Sample Type	B	B	B	B	D	D
Sampling Date	n/s	n/s	n/s	n/s	n/s	n/s
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units						
Inorganics									
pH	DETSC 2008#		pH	7.8	7.8	7.1	7.8	8.0	8.5
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l	70	51	58	52	68	22

Summary of Chemical Analysis

Soil Samples

Our Ref 20-00585
 Client Ref PSL20/0117
 Contract Title MSM Middleton

Lab No	1622890
Sample ID	CP01
Depth	15.00
Other ID	
Sample Type	D
Sampling Date	n/s
Sampling Time	n/s

Test	Method	LOD	Units
Inorganics			
pH	DETSC 2008#		pH 8.0
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l 75

Information in Support of the Analytical Results

Our Ref 20-00585
 Client Ref PSL20/0117
 Contract MSM Middleton

Containers Received & Deviating Samples

Lab No	Sample ID	Date Sampled	Containers Received	Holding time exceeded for tests	Inappropriate container for tests
1622884	TP01 0.30-0.40 SOIL		PT 500ml	Sample date not supplied, Anions 2:1 (365 days), pH + Conductivity (7 days)	
1622885	TP02 1.40-1.50 SOIL		PT 500ml	Sample date not supplied, Anions 2:1 (365 days), pH + Conductivity (7 days)	
1622886	TP04 1.10-1.20 SOIL		PT 500ml	Sample date not supplied, Anions 2:1 (365 days), pH + Conductivity (7 days)	
1622887	CP03 2.00 SOIL		PT 500ml	Sample date not supplied, Anions 2:1 (365 days), pH + Conductivity (7 days)	
1622888	CP04 8.00 SOIL		PT 1L	Sample date not supplied, Anions 2:1 (365 days), pH + Conductivity (7 days)	
1622889	CP03 19.00 SOIL		PT 1L	Sample date not supplied, Anions 2:1 (365 days), pH + Conductivity (7 days)	
1622890	CP01 15.00 SOIL		PT 1L	Sample date not supplied, Anions 2:1 (365 days), pH + Conductivity (7 days)	

Key: P-Plastic T-Tub

DETS cannot be held responsible for the integrity of samples received whereby the laboratory did not undertake the sampling. In this instance samples received may be deviating. Deviating Sample criteria are based on British and International standards and laboratory trials in conjunction with the UKAS note 'Guidance on Deviating Samples'. All samples received are listed above. However, those samples that have additional comments in relation to hold time, inappropriate containers etc are deviating due to the reasons stated. This means that the analysis is accredited where applicable, but results may be compromised due to sample deviations. If no sampled date (soils) or date+time (waters) has been supplied then samples are deviating. However, if you are able to supply a sampled date (and time for waters) this will prevent samples being reported as deviating where specific hold times are not exceeded and where the container supplied is suitable.

Soil Analysis Notes

Inorganic soil analysis was carried out on a dried sample, crushed to pass a 425µm sieve, in accordance with BS1377.

Organic soil analysis was carried out on an 'as received' sample. Organics results are corrected for moisture and expressed on a dry weight basis.

The Loss on Drying, used to express organics analysis on an air dried basis, is carried out at a temperature of 28°C +/- 2°C.

Disposal

From the issue date of this test certificate, samples will be held for the following times prior to disposal :-

Soils - 1 month, Liquids - 2 weeks, Asbestos (test portion) - 6 months

Appendix E

Risk Evaluation

Risk Evaluation

To ensure consistency in our qualitative method for risk evaluation we have used the classification scheme presented CIRIA C552 Contaminated Land Risk Assessment – A Guide to Good Practice, 2001. The overall risk rating for any potential pollutant linkage is set out in **Table I** and based upon a combination of the:

- Magnitude of the potential consequence (severity) of risk occurring (defined in **Table II**); and
- Magnitude of the probability (likelihood) of the risk occurring (defined in **Table III**).

The definition of the overall risk rating and likely action required is defined in **Table IV**.

Table I: Comparison of consequence against likelihood

		Consequence (severity)			
		Severe	Medium	Mild	Minor
Probability	High likelihood	Very high risk	High risk	Moderate risk	Moderate/ low risk
	Likely	High risk	Moderate risk	Moderate/ low risk	Low risk
	Low likelihood	Moderate risk	Moderate/ low risk	Low risk	Very low risk
	Unlikely	Moderate/ low risk	Low risk	Very low risk	Very low risk

Table II: Classification of Consequence (Severity)

Class ⁿ	Definition	Examples
Severe	Short-term (acute) risk to human health likely to result in significant harm. Short term risk of pollution of sensitive water resource. Catastrophic damage to buildings/property. A short term risk to a particular ecosystem, or organism forming part of such ecosystem.	• High concentrations of cyanide on the surface of an informal recreation area. • Major spillage of contaminants into controlled water. • Explosion, causing building collapse (can also equate to a short term human health risk if buildings are occupied).
Medium	Chronic damage to human health. Pollution of sensitive water resources. A significant change in a particular ecosystem, or organism forming part of such an ecosystem.	• Concentrations of a contaminant from site exceed the generic, or site specific assessment criteria. • Leaching of contaminants from site to an aquifer. • Death of a species within a designated nature reserve.
Mild	Pollution of non-sensitive water resources. Significant damage to crops, buildings, structures and services. Damage to sensitive buildings/ structures/ services or the environment.	• Pollution of non-classified groundwater. • Damage to building rendering it unsafe to occupy (e.g. foundation damage resulting in instability).
Minor	Harm, although not necessarily significant harm, which may result in a financial loss, or expenditure to resolve. Non-permanent health effects to human health (easily prevented by PPE). Easily repairable effects of damage to buildings, structures and services.	• The presence of contaminants at such concentrations that PPE is required during site works. • The loss of plants in a landscaping scheme. • Discoloration of concrete.

Table III: Classification of Likelihood (Probability)

Class ⁿ	Definition
High likelihood	There is a pollution linkage and an event that either appears very likely in the short term and almost inevitable over the long term, or there is evidence at the receptor of harm or pollution.
Likely	There is a pollution linkage and all the elements are in the right place, which means that it is probable that an event will occur.
Low likelihood	There is a pollution linkage and circumstances are possible under which an event could occur. However, it is by no means certain that even over longer period such event would take place and is less likely in the shorter term.
Unlikely	There is a pollution linkage but circumstances are such that it is improbable that an event would occur even in the very long term.

Table IV: Classification of risks and likely action required

Class ⁿ	Definition
Very high risk	There is a high probability that severe harm could arise to a designated receptor from an identified hazard, OR, there is evidence that severe harm to a designated receptor is currently happening. This risk, if realized, is likely to result in a substantial liability. Urgent investigation and remediation works are likely to be required.
High risk	Harm is likely to arise to a receptor from an identified hazard. Realisation of the risk is likely to present a substantial liability. Urgent investigation is required and remedial works may be necessary in the short term and are likely over the longer term.
Moderate risk	It is possible that harm could arise to a designated receptor from an identified hazard. However, it is either relatively unlikely that any such harm would be severe, or if any harm were to occur it is more likely that the harm would be relatively mild. Investigation is normally required to clarify the risk and to determine the potential liability. Some remedial works may be required in the longer term.
Low risk	It is possible that harm could arise to a designated receptor from an identified hazard, but it is likely that this harm, if realized, would at worst normally be mild.
Very low risk	There is a low possibility that harm could arise to a receptor. In the vent of such harm being realized it is not likely to be severe.



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