



REPORT NO: D7716/1

REVISION NO: 0

GEOENVIRONMENTAL APPRAISAL FOR LAND AT

PORLOCK, JARROW

PREPARED FOR:

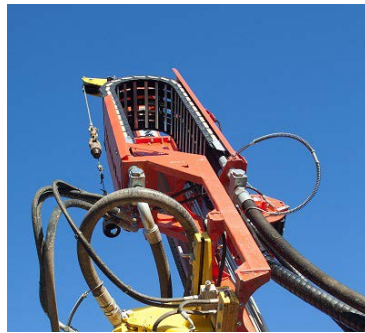
SOUTH TYNESIDE HOMES.

WRITTEN BY: KJ

DATE: 06/01/2017

CHECKED BY: AIL

DATE: 06/01/2017



● FOUNDATION HOUSE ● ST. JOHN'S ROAD ● MEADOWFIELD ● DURHAM ● DH7 8TZ

● TEL: 0191 378 3151 ● FAX: 0191 378 3157



PORLOCK, JARROW – EXECUTIVE SUMMARY

SUMMARY OF GEOENVIRONMENTAL ISSUES

Issue	Remarks
Grid Reference	433725, 564280
Proposed Development	Residential properties
Former Uses	Sewage pipeline.
Present Uses	None.
Made Ground	Up to 2.1m.
Natural Ground	Locally soft, generally firm and stiff clays.
Contamination	Lead and PAH in the topsoil in the location of MBH9, lead, arsenic, PAH and asbestos in the made ground.
Hazardous Gas	A gas risk assessment will be provided on completion of the monitoring period.
Mining & Quarrying	The site is not in an area affected by shallow coal mining. No evidence has been found to suggest the site is affected by quarrying.
Foundation Solution	Strip foundations at 0.9m, or trench fill deepened to found on natural ground of adequate bearing capacity.
Groundwater & Excavations	Surface water flooding should be anticipated.
Flooding	The site is in an area affected by surface water flooding.
Drainage	Soakaway tests recorded no fall in water level. In addition, the site is in an area affected by surface water flooding.
Highways	A CBR of at least 2% should be achievable within natural clay.
Remediation and Preparatory Works	A remediation strategy will be required.
Recommendations for Further SI Works	Possible further testing around MBH9, to confirm that contaminated topsoil is an isolated hotspot.

CONTENTS

1	INTRODUCTION.....	1
1.1	SCOPE OF INVESTIGATION.....	1
2	SITE RECONNAISSANCE.....	1
2.1	GENERAL.....	1
2.2	TOPOGRAPHY AND SITE FEATURES.....	1
3	SITE WORKS AND LABORATORY TESTING.....	1
3.1	CONCEPTUAL SITE MODEL.....	1
3.2	SUMMARY OF INVESTIGATION.....	1
3.3	CHEMICAL TESTING.....	2
3.4	GEOTECHNICAL TESTING.....	2
4	GROUND CONDITIONS & MATERIAL PROPERTIES.....	2
4.1	GENERAL.....	2
4.2	TOPSOIL.....	2
4.3	MADE GROUND.....	2
4.4	BURIED OBSTRUCTIONS.....	2
4.5	NATURAL SOILS.....	2
4.6	ROCK HEAD.....	2
4.7	EXCAVATION STABILITY.....	2
4.8	GROUNDWATER.....	2
4.9	HYDROCARBON CONTAMINATION.....	3
4.10	CONCRETE IN AGGRESSIVE GROUND.....	3
4.11	SOAKAWAY TESTS.....	3
5	EARTHWORKS.....	3
5.1	INTRODUCTION.....	3
5.2	EARTHWORKS SPECIFICATION AND SITE VALIDATION.....	3
5.3	SITE WON MATERIALS.....	3
5.4	NATURAL SOILS.....	3
5.5	GROUNDWATER.....	4
5.6	ASSESSMENT OF MATERIALS.....	4
5.7	VALIDATION AND AUDIT PROCEDURE.....	4
6	CHEMICAL TESTING RESULTS.....	5
6.1	SELECTION OF CHEMICAL TESTING.....	5
6.2	GENERIC ASSESSMENT CRITERIA FOR INORGANIC CONTAMINATION.....	5
6.3	TOPSOIL.....	6
6.4	MADE GROUND (INORGANIC CONTAMINANTS).....	6
6.5	ASBESTOS TESTING.....	7
6.6	ORGANIC CONTAMINATION.....	7
7	ASSESSMENT OF CONTAMINATION RISKS.....	8
7.1	SUMMARY OF CONTAMINATION SOURCES.....	8
7.2	HAZARD ASSESSMENT.....	8
7.3	PRELIMINARY OPTIONS APPRAISAL.....	9
7.4	REMEDIATION STRATEGY.....	10
8	HAZARDOUS GAS.....	10
8.1	HAZARD IDENTIFICATION.....	10

8.2	RESULTS AND DISCUSSION.....	10
9	FOUNDATIONS AND GEOTECHNICAL ISSUES.....	10
9.1	INTRODUCTION.....	10
9.2	MINING.....	11
9.3	FOUNDATIONS	11
9.4	FLOOR SLABS	11
9.5	BURIED OBSTRUCTIONS	12
9.6	EXCAVATIONS.....	12
9.7	ROAD PAVEMENT DESIGN	12



LIST OF APPENDICES

APPENDIX A - Drawings

Drawing Number Drawing Title

D7716/01 Site Location Plan

D7716/02 Exploratory Hole Location Plan

D7716/03 Conceptual Site Model

APPENDIX B - Exploratory Hole Records

APPENDIX C - Chemical Testing Results

APPENDIX D - Geotechnical Testing Results

APPENDIX E - Gas Monitoring Results

APPENDIX F - Dunelm Conditions of Offer, Notes on Limitations & Basis for Contract



1 INTRODUCTION

1.1 SCOPE OF INVESTIGATION

Dunelm Geotechnical and Environmental Limited (Dunelm) carried out a Geoenvironmental Appraisal of land at Porlock, Jarrow on behalf of South Tyneside Homes.

It is proposed to develop the site with residential properties.

Dunelm have previously produced a Preliminary Geoenvironmental Appraisal Report (Ref D7716) dated December 2016. Reference should be made to this report for details of the site's history and environmental setting.

The objectives of this exploratory phase of investigation were as follows:

- To assess risks from ground contamination.
- To provide recommendations for foundations.

This report may be regarded as providing a Preliminary Risk Assessment and Generic Quantitative Risk Assessment in accordance with the Environment Agency's guidance document Model Procedures for the Management of Land Contamination (Contaminated Land Report 11, 2004).

Conditions of offer and notes on limitations relevant to all Dunelm geoenvironmental investigations are described in Appendix F and should be read in conjunction with this report.

2 SITE RECONNAISSANCE

2.1 GENERAL

The centre of the site is located at OS Grid Ref 433725, 564280. The site is situated approximately 1km southeast of Jarrow town centre. The site location is shown in Drawing Number D7716/01 in Appendix A to this report.

2.2 TOPOGRAPHY AND SITE FEATURES

The site is relatively flat. The site is currently an area of grassed public open space, with occasional public footpaths.

Mature hedgerows are present along the western boundary of the site.

3 SITE WORKS AND LABORATORY TESTING

3.1 CONCEPTUAL SITE MODEL

A preliminary conceptual site model, including an assessment of potential pollutant linkages, has been determined based on the desk study information presented in report D7716.

The main receptors include future site residents and the secondary (A) Aquifer beneath the site.

3.2 SUMMARY OF INVESTIGATION

The exploratory holes listed below were advanced during December 2016. Records for each of the exploratory holes noted are included in Appendix B and the locations are shown on Drawing Number D7716/02 in Appendix A.

- Trial pits with soakaway test SA1 and SA2.
- Mini percussion boreholes MBH1-9 and MBH7A and 7B.

3.3 CHEMICAL TESTING

Appropriate samples were delivered to a suitably accredited laboratory with a schedule of testing drawn up by Dunelm. The laboratory test results are presented in Appendix C to this report and discussed in Section 6.

3.4 GEOTECHNICAL TESTING

Samples of natural soil were delivered to a geotechnical laboratory with a schedule of testing drawn up by Dunelm. The geotechnical laboratory test results are presented in Appendix D to this report. Material properties assessed using the results are considered further in the following Section.

4 GROUND CONDITIONS & MATERIAL PROPERTIES

4.1 GENERAL

Strata encountered were generally similar beneath all parts of the site. Ground conditions are described in the following sections.

4.2 TOPSOIL

Topsoil up to 0.5m thick was encountered in many of the exploratory positions. The topsoil contained occasional fragments of brick, glass and plastic.

4.3 MADE GROUND

Made ground was encountered through the centre of the site up to 2.1m thick. The made ground generally consisted of reworked clays. The made ground contained a small proportion of brick and glass.

4.4 BURIED OBSTRUCTIONS

Buried obstructions were not encountered during this investigation.

4.5 NATURAL SOILS

The natural soils at the site consisted of locally soft, generally firm and stiff clays to depths of at least 5.45m bgl.

SPT 'N' values within the clays ranged from 10 to 32, confirming the generally firm and stiff nature of the deposits. Moisture content values within the clays ranged from 20% to 51%, together with plasticity index values between 18 and 36 suggest the clay is of intermediate to high plasticity and medium to low volume change potential.

4.6 ROCK HEAD

Rock head was not encountered during this investigation.

4.7 EXCAVATION STABILITY

During excavation of the trial pits, the side walls were observed to be generally stable.

4.8 GROUNDWATER

Groundwater was encountered at a depth of around 0.8m bgl in MBH6, thought to represent perched groundwater in the made ground.

Groundwater monitoring has been carried out following the completion of fieldwork and the groundwater levels recorded are shown in Appendix E. Groundwater was recorded at a depth from 0.11m bgl, however, this is thought to possibly be due to water seeping in to the installation from the surface.

4.9 HYDROCARBON CONTAMINATION

No visual or olfactory evidence of hydrocarbon contamination was noted during the investigation.

4.10 CONCRETE IN AGGRESSIVE GROUND

To enable buried concrete to be designed to resist sulfate attack, samples of made ground and natural strata from depths corresponding to the anticipated foundation depth have been tested for water-soluble sulfate and pH.

The maximum water-soluble sulfate concentration is 4000mg/l and the lowest recorded pH value is 7.4.

Based on the above results, Design Sulfate Class DS-4 and ACEC Classification AC-4 would be appropriate for buried concrete at the site.

4.11 SOAKAWAY TESTS

Soakaway tests have been carried out in trial pits SA1 and SA2 in accordance with the methods outlined in BRE Digest 365. The water level did not fall, and therefore, an infiltration rate cannot be calculated.

5 EARTHWORKS

5.1 INTRODUCTION

Earthworks operations may be undertaken on site, including;

- Excavation and stockpiling of cut material from the site
- Re-engineering of site generated materials to areas of the development

5.2 EARTHWORKS SPECIFICATION AND SITE VALIDATION

All earthworks required for the site development works are to be undertaken in accordance with an earthworks specification, this includes all site won materials and use of all imported materials.

All suitable excavation arisings generated by excavation of the ground shall be re-used as fill onsite where possible. These materials shall be assessed and validated for geotechnical works in accordance with an earthworks specification.

The validation of imported materials and identification and validation of contaminants within the site won materials will be required. Earthworks required for the site development works are to be undertaken in accordance with an earthworks specification, this includes all site won materials and use of all imported materials.

5.3 SITE WON MATERIALS

Materials excavated from the site are expected to include:

- Natural cohesive material (Glacial Clay)

5.4 NATURAL SOILS

The natural soils at the site consisted of locally soft becoming firm and stiff clays to a depth of 5.45m bgl.

Earthworks testing was carried out on the cohesive deposits. The results are included in Appendix D. The results show that the cohesive material from this location would be classified as a 2A wet cohesive fill in line with the Specification for Highways Works.

Dry density/moisture content relationship indicates the maximum dry density ranges from 1.48Mg/m³ to 1.64Mg/m³ with the optimum moisture ranging from 13% to 16%. The received moisture content for the

samples tested ranged from 28% to 33%. Therefore, the clay would need drying to within 5% of the optimum moisture content before re-use.

5.5 GROUNDWATER

Groundwater has been recorded at a depth from 0.11mbgl in monitoring visits post site works, however, this is thought to represent perched groundwater.

5.6 ASSESSMENT OF MATERIALS

Laboratory testing has indicated that the cohesive material would be classified as Class 2A (wet cohesive material), however, the classification of the clay may vary at different times of the year. The moisture content generally falls within the range PL-4 to 1.2PL, however, some areas of clay may require drying. Once the moisture is at acceptable limits (11.7-26.3%, with the maximum moisture content value being based on the average results of 1.2 times the plastic limit, and 0.5 times the liquid limit; the minimum moisture content value being based on the dry density/moisture content value tests). The re-use will be dependent upon the moisture content, onsite assessment/validation and weather conditions. At times of inclement weather, materials are likely to deteriorate quickly and achieving a lower moisture content may be difficult without the use of cement or lime stabilisation. Based on the acceptable moisture limits of 11.7-26.3% and the Moisture Condition Value (MCV) test results, it is recommended that MCVs between 12 and 21 are achieved for the re-used clay.

5.7 VALIDATION AND AUDIT PROCEDURE

The contractor shall appoint a suitably qualified engineer who will be responsible for auditing site earthworks operations. The responsibilities of the engineer will be as detailed in the following sections.

The engineer will be responsible for ensuring that the earthworks on site are carried out in accordance with the method statement.

The contractor will liaise with the regulatory and statutory authorities on environmental matters, as required, to ensure their satisfaction with the site works, and compliance with all planning consent conditions, licensing etc requirements.

The engineer will inspect the excavated and stockpiled material, and the cut and prepared ground surfaces, as stated in the method statement, to provide a visual assessment of the materials encountered.

The engineer will carry out the necessary sampling and laboratory analyses of material handled during the work in order to ensure compliance with the method statement.

The engineer will arrange insitu and laboratory testing, if unknown relic underground structures and tanks are encountered.

The engineer will review documentary records to be provided by the contractor of the reclamation procedures carried out. This documentary evidence will include:

- Site diary of works.
- Plans and records of depths, lateral extent and nature of any contaminated materials encountered.
- Plans and records of in-situ and laboratory testing carried out.
- Plans and records of the re-use of site excavated fill materials reinstated on site.
- Plans and records of any 'imported' fill materials reinstated onsite.
- Plans and records of the natural soil arisings reinstated on site.
- Documentation for all wastes disposed of to landfill.
- Plans and records of any 'contaminated' fill materials reinstated on site.

- Plans and records of the lateral extent and thicknesses of the cover materials installed in landscaped areas.
- Documentation of all licences, consents, permits etc issued by the Statutory and regulatory authorities, and evidence of compliance with any requirement of the above.

6 CHEMICAL TESTING RESULTS

6.1 SELECTION OF CHEMICAL TESTING

This section represents the 'Hazard Identification' process required in accordance with CLR11.

Contaminants identified in association with the former site uses have been discussed in report D7716.

Significant thicknesses of made ground were encountered in many of the exploratory locations during the ground investigation.

Appropriate chemical testing has been undertaken taking into account potential contaminants identified and evidence of contamination recorded during the ground investigation.

Laboratory test certificates are presented in Appendix C to this report. The test results are presented in the following sections.

6.2 GENERIC ASSESSMENT CRITERIA FOR INORGANIC CONTAMINATION

Generic Assessment Criteria (GAC) appropriate to current UK practice for the assessment of inorganic contamination are shown in the table below. These criteria are dependent on the nature of the proposed development. In addition, some contaminants depend on other soil parameters as shown.

GENERIC ASSESSMENT CRITERIA FOR HUMAN HEALTH

All values in mg/kg	Residential (based on 6% SOM)	Residential without homegrown produce (based on 6% SOM)	Commercial (based on 6% SOM)	Allotments (based on 6% SOM)	Public Open space (resi) (based on 6% SOM)
Arsenic	37	40	640	43	79
Cadmium	11	85	190	1.9	120
Chromium (Total)	910	910	8,600	18,000	1,500
Chromium (VI)	6	6	33	1.8	7.7
Copper	2,400	7,100	68,000	520	12,000
Lead	200*	310*	2,330*	80*	No SSV
Mercury	40	56	1,100	19	120
Nickel	130	180	980	53	230
Selenium	250	430	12,000	88	1,100
Zinc	3,700	40,000	730,000	620	81,000

Soil Screening Values from The LQM/CIEH S4ULs for human Health Risk Assessment (2015). *taken from DEFRA C4SL database.

GENERIC ASSESSMENT CRITERIA FOR PHYTOTOXIC EFFECTS ON PLANTS

Contaminant	Maximum Permissible Concentration from MAFF <i>The Soil Code</i> (1998) (mg/kg)
Copper (soil pH 5.0-5.5)	80
Copper (soil pH 5.5-6.0)	100
Copper (soil pH 6.0-7.0)	135
Copper (soil pH >7.0 & CaCO ₃ > 5%)	200
Zinc (soil pH 5.0-7.0)	200

Zinc (soil pH >7.0 & CaCO ₃ > 5%)	300
--	-----

6.3 TOPSOIL

A summary of the results of inorganic testing on topsoil samples is shown in the table below.

INORGANIC TEST RESULTS- TOPSOIL

Contaminant	Units	No. of topsoil samples tested	No. of samples exceeding GAC	Generic Assessment Criteria	Max concentration above GAC
pH	-	4	0	5-11	-
Arsenic	mg/kg	4	0	37	-
Cadmium	mg/kg	4	0	11	-
Chromium (Total)	mg/kg	4	0	910	-
Chromium (VI)	mg/kg	4	0	6	-
Lead*	mg/kg	4	1	200	210
Mercury	mg/kg	4	0	40	-
Nickel	mg/kg	4	0	130	-
Selenium	mg/kg	4	0	250	-
Copper (GAC from MAFF)	mg/kg	4	0	200	-
Zinc (GAC from MAFF)	mg/kg	4	0	300	-
Asbestos	-	4	0	Present	-

Soil Screening Values from The LQM/CIEH S4ULs for human Health Risk Assessment (2015). *taken from DEFRA C4SL database.

Based on the above results, the topsoil has been found to contain significantly elevated concentrations of lead in the location of MBH9 compared to a residential with plant update end use.

6.4 MADE GROUND (INORGANIC CONTAMINANTS)

A summary of the results of inorganic testing on made ground samples is shown in the table below.

INORGANIC TEST RESULTS – MADE GROUND

Contaminant	Units	No. of made ground samples tested	No. of samples exceeding GAC	Generic Assessment Criteria	Max concentration above GAC
pH	-	4	0	5-11	-
Arsenic	mg/kg	4	1	37	54
Cadmium	mg/kg	4	0	11	-
Chromium (Total)	mg/kg	4	0	910	-
Chromium VI	mg/kg	4	0	6	-
Lead*	mg/kg	4	1	200	310
Mercury	mg/kg	4	0	40	-
Nickel	mg/kg	4	0	130	-
Selenium	mg/kg	4	0	250	-
Copper	mg/kg	4	0	2,400	-
Zinc	mg/kg	4	0	3,700	-
Asbestos	-	4	1	Present	Chrysotile fibres

Soil Screening Values from The LQM/CIEH S4ULs for human Health Risk Assessment (2015). *Taken from DEFRA C4SL database.

Based on the above results, the made ground has been found to contain elevated concentrations of lead and arsenic in MBH2 at 0.5m bgl.

6.5 ASBESTOS TESTING

The made ground has been found to contain asbestos in the location of MBH7 at 0.4m bgl, in the form of bundles of chrysotile fibres.

6.6 ORGANIC CONTAMINATION

The selection of hydrocarbon (organic) testing was based on the conceptual model and the assessment of potential contamination sources presented in earlier sections of this report.

Results for the 13 petroleum hydrocarbon fractions are presented in the table below together with appropriate generic assessment criteria.

SUMMARY OF RESULTS FOR PETROLEUM HYDROCARBON FRACTIONS

EC bands	Aromatic fractions							Aliphatic fractions					
	5-7	7-8	8-10	10-12	12-16	16-21	21-35	5-6	6-8	8-10	10-12	12-16	16-35
GAC (residential with plant uptake) mg/kg	70	130	34	74	140	260	1,100	42	100	27	130	1,100	65,000
GAC (residential without plant uptake) mg/kg	370	860	47	250	1,800	1,900	1,900	42	100	27	130	1,100	65,000
GAC (allot) mg/kg	13	22	8.6	13	23	46	370	730	2,300	320	2,200	11,000	260,000
GAC (comm) mg/kg	26,000	56,000	3,500	16,000	36,000	28,000	28,000	3,200	7,800	2,000	9,700	59,000	1,600,000
GAC (Public Open Space)	56,000	56,000	5,000	5,000	5,000	3,800	3,800	570,000	600,000	13,000	13,000	13,000	250,000
Sample location & depth (m bgl)	Recorded concentrations (mg/kg) - exceedances in bold												
MBH1 0.2	<0.01	<0.01	<0.01	<0.9	<0.5	<0.6	<1.4	<0.01	<0.01	<0.01	<1.5	<1.2	<4.9
MBH2 0.5	<0.01	<0.01	<0.01	<0.9	<0.5	<0.6	<1.4	<0.01	<0.01	<0.01	<1.5	<1.2	<4.9
MBH6 0.5	<0.01	<0.01	<0.01	<0.9	<0.5	<0.6	<1.4	<0.01	<0.01	<0.01	<1.5	<1.2	<4.9
MBH7 0.4	<0.01	<0.01	<0.01	<0.9	<0.5	<0.6	<1.4	<0.01	<0.01	<0.01	<1.5	<1.2	<4.9
MBH8 0.4	<0.01	<0.01	<0.01	<0.9	<0.5	<0.6	<1.4	<0.01	<0.01	<0.01	<1.5	<1.2	<4.9
MBH9 0.2	<0.01	<0.01	<0.01	<0.9	<0.5	<0.6	<1.4	<0.01	<0.01	<0.01	<1.5	<1.2	<4.9

Soil Screening Values from the LQM/CIEH S4ULs for Human Health Risk Assessment (2015) for a 1% SOM soil, for a residential after use.

The above assessment of the 13 petroleum hydrocarbon fractions indicates that no significant TPH concentrations have been recorded during this investigation.

Appropriate samples were tested for Organic Matter Content and the results ranged from 1.8% to 11%.

Samples of made ground and topsoil were tested for selected polynuclear aromatic hydrocarbon (PAH) compounds.

An assessment of selected PAH compounds is shown in the following table together with Generic Assessment Criteria (GAC) from the LQM guidance.

SUMMARY OF RESULTS FOR POLYNUCLEAR AROMATIC HYDROCARBONS

Contaminant	Generic Assessment Criteria (mg/kg)					No. of samples tested	No. of samples with value greater than GAC	Max Concentration above GAC (mg/kg)
	Resi with plant uptake	Residential without home grown produce	Allotments	Comm / industrial	Public Open Space			
Acenaphthene	210	3,000	34	84,000	15,000	8	0	-
Acenaphthylene	170	2,900	28	83,000	15,000	8	0	-
Anthracene	2400	31,000	380	520,000	74,000	8	0	-
Benzo(a)anthracene	7.2	11	2.9	170	29	8	1	44
Benzo(a)pyrene	2.2	3.2	0.97	35	5.7	8	1	38
Benzo(b)fluoranthene	2.6	3.9	0.99	44	7.1	8	1	35
Benzo(g,h,i)perylene	320	360	290	3,900	640	8	0	-
Benzo(k)fluoranthene	77	110	37	1,200	190	8	0	-
Chrysene	15	30	4.1	350	57	8	1	47
Dibenz(a,h)anthracene	0.24	0.31	0.14	3.5	0.57	8	2	5.5
Fluoranthene	280	1,500	52	23,000	3,100	8	0	-
Fluorene	170	2,800	27	63,000	9,900	8	0	-
Indeno(1,2,3,-cd)pyrene	27	45	9.5	500	82	8	0	-
Napthalene	2.3	2.3	4.1	190	4,900	8	1	15
Phenanthrene	95	1,300	15	22,000	3,100	8	0	-
Pyrene	620	3,700	110	54,000	7,400	8	0	-

Soil Screening Values from the LQM/CIEH S4ULs for Human Health Risk Assessment (2015) for 1% SOM soil, for a residential after use.

Results indicate elevated PAH in the made ground and topsoil in the location of MBH9 compared to a residential with plant uptake end use; this will require further consideration.

7 ASSESSMENT OF CONTAMINATION RISKS

7.1 SUMMARY OF CONTAMINATION SOURCES

TOPSOIL

Topsoil up to 0.5m thick is present across the majority of the site. The topsoil contains slightly elevated concentrations of lead and PAH in the location of MBH9. It is therefore considered that the topsoil in this location is unsuitable for re-use in garden and landscaped areas.

MADE GROUND

The majority of the site is underlain by a layer of cohesive made ground up to 2.1m thick.

The made ground is contaminated with arsenic, lead and PAH.

In addition the made ground has been found to contain asbestos.

7.2 HAZARD ASSESSMENT

The results of the 'Hazard Identification' process for significant sources of contamination in accordance with CLR11 are summarised above. The following section describes the results of the 'Hazard Assessment' process in which unacceptable risks are identified. Pathways and receptors are considered below. Contamination sources and pollutant linkages are shown in the revised Conceptual Site Model presented as Drawing No. D7716/03 in Appendix A.

PATHWAYS

The proposed end use of the development is residential. Potential contaminant pathways to humans therefore include:

- ingestion of soil (outdoors) / dust (indoors)
- skin contact with soil (outdoors) / dust (indoors)
- inhalation of dust (outdoors and indoors)
- consumption of vegetables & soil attached to vegetables (proposed gardens only)
- contamination via buried water pipes

Potential contaminant pathways to controlled water receptors include:

- surface water run-off, including via existing drainage infrastructure
- downward infiltration of leachable contaminants to groundwater

RECEPTORS

Significant potential receptors are as follows:

- end users of the site (residents)
- plants in gardens / landscaped areas
- Secondary (A) Aquifer beneath the site

Transient risks to construction workers will be addressed by the adoption of appropriate health and safety measures and consequently this receptor group has not been considered further.

Based on the revised Conceptual Site Model, unacceptable risks have been identified and further action will be required as discussed in the following section.

7.3 PRELIMINARY OPTIONS APPRAISAL

This section identifies feasible remediation options for each relevant pollutant linkage; it does not represent a detailed evaluation of all possible remedial options. In practice, as noted in CLR11, "there may be a number of ways to reduce or control unacceptable risks, all of which have advantages and limitations in particular cases".

TOPSOIL

The topsoil contains elevated concentrations of lead and PAH in the location of MBH9 only. It is therefore considered possible that the contamination represents an isolated hot spot. It is recommended that the topsoil around this area should be removed from site. Further testing may be required around the location of MBH9, to confirm that the contamination is limited to this area. Once carefully stripped from the site and stockpiled, the remaining topsoil should be tested to confirm reusability, given that site works could contaminate the topsoil, if mixed with the underlying made ground.

CONTAMINATION - MADE GROUND

The made ground has been found to contain asbestos; due to the site's intended use for residential development it is recommended that all made ground containing asbestos should be excavated and removed from the site.

In addition, the made ground at the site contains elevated concentrations of arsenic, lead and PAH.

Where made ground is to remain on site it is recommended that a cover system should be placed in order to break pathways between the contamination source and future site users. This cover layer should be placed over proposed garden and soft landscaped areas, and other parts of the site that will not be covered by buildings, roads, or hardstanding.

The cover layer should comprise 450mm clean subsoil and 150mm clean topsoil.

A no dig layer incorporating an asbestos alert membrane is recommended at the base of the cover layer in order to limit future excavation into the underlying material; this layer could be sourced from suitable site derived granular material or alternatively could be formed using a geotextile with asbestos alert warning.

It is recommended that further advice be sought from all statutory service bodies with respect to the ground conditions within which they will lay services.

CONTAMINATION TO CONTROLLED WATERS

There are no controlled water receptors in the vicinity of the site. In addition, the site is underlain by a layer of clay. Therefore, there is not considered to be a significant risk of contamination to controlled waters.

7.4 REMEDIATION STRATEGY

A Remediation Strategy will be required by the regulatory authorities prior to site redevelopment. The Remediation Strategy document would describe the objectives of the proposed remedial works; a Method Statement is normally required from the Contractor undertaking the works, describing how these objectives are to be met. Validation of the remediation works should be undertaken by a suitably qualified engineer.

8 HAZARDOUS GAS

8.1 HAZARD IDENTIFICATION

The site is not in an area susceptible to radon emissions and as such no radon protection measures are required for new dwellings at the site.

Desk study information has indicated that the site could be affected by potential sources of gas including landfills and backfilled ground within 250m, and made ground on site.

Given the above, gas monitoring wells were installed in three boreholes during the fieldwork. Details of the monitoring installations are shown on the exploratory hole records in Appendix B.

Two visits have been carried out to record methane and carbon dioxide concentrations and borehole flow rates in accordance with current guidance.

8.2 RESULTS AND DISCUSSION

No methane was detected. Carbon dioxide concentrations of up to 3.0% v/v were recorded.

Once the monitoring period is complete, the complete set of monitoring results will be provided together with a gas risk assessment report with recommendations for gas protection measures for new structures. It is essential that the monitoring wells are protected from damage during re-development works such as site clearance or demolition.

9 FOUNDATIONS AND GEOTECHNICAL ISSUES

9.1 INTRODUCTION

The proposed development is understood to consist of residential properties.

Ground conditions encountered during this investigation comprised made ground up to 2.1m thick consisting of cohesive material. The underlying natural ground consisted of locally soft, generally firm and stiff clays to a depth of at least 5.45m bgl.

Rock head was not encountered during this investigation.

9.2 MINING

The site is not in an area affected by shallow coal mining.

No evidence has been found to indicate that the site has been affected by quarrying.

9.3 FOUNDATIONS

Due to the heterogeneous nature of the made ground, unacceptable total and differential settlements may occur if foundations are placed on made ground. Therefore, foundations should be taken through made ground onto underlying natural ground of adequate bearing capacity.

It is considered that strip or trench fill foundations should be suitable for the proposed structures.

Sub-surface concrete should be Design Sulphate Class DS-4, with the site allocated an ACEC Classification of AC-4.

Based on the visual description and laboratory testing, a safe bearing capacity of 100kN/m² has been determined for strip foundations 0.6m wide founding on the natural firm and stiff clay at depths of around 0.9m bgl. At this width of foundation and bearing pressure settlements should be less than 25mm.

Based on plasticity index results, all cohesive soils at the site should be regarded as being of medium volume change potential. Foundations should therefore be placed at a minimum depth of 0.9m below original or finished ground level, whichever is the lower. Where locally soft clays/made ground are encountered, foundations should be deepened to found on natural strata of adequate bearing capacity.

Foundations near existing or proposed trees should be deepened and provided with appropriate heave precautions in accordance with NHBC Standards Chapter 4.2.

Overdeepened foundations should be stepped in accordance with NHBC Standards, Chapter 4.4.

Where existing trees are to be felled, it is recommended that a tree survey be undertaken prior to felling. This would enable detailed foundation recommendations to be provided.

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

The site is in an area affected by surface water flooding. It is therefore recommended that a temporary drainage solution is adopted throughout construction.

It should be recognised that clay rich soils can deteriorate fairly rapidly on exposure, particularly in periods of wet weather and frost. It would be prudent to protect all exposed soils in foundation excavations with a concrete blinding layer, particularly if they are likely to remain open for extended period of time.

Prior to placing foundation concrete, obvious soft or loose spots should be removed and replaced with suitably recompacted hardcore or lean mix concrete. In addition, all excavations should be inspected to ensure that they fully penetrate areas of disturbed ground.

Further advice should be sought from Dunelm if unexpected ground conditions are encountered during redevelopment.

9.4 FLOOR SLABS

In accordance with NHBC guidelines, suspended floor slabs should be adopted where made ground exceeds 0.6m in thickness.

Alternatively, in order to utilise ground bearing slabs, made ground could be removed from beneath the footprint of the buildings and a blanket of compacted granular fill placed in accordance with an engineering specification.

Where significantly desiccated soil is present, or where foundation depths are to be increased to more than 1.5m due to the presence of trees, a suspended ground floor slab construction should be adopted. The suspended slab should have a minimum void height in accordance with NHBC Standards Chapter 4.2.

9.5 BURIED OBSTRUCTIONS

Buried obstructions were not encountered during this investigation.

9.6 EXCAVATIONS

Observations made during the fieldwork indicate that perched groundwater flows would be anticipated in shallow excavations. However, the rapid rate of advancement of the exploratory holes may mask minor seepages and it should be borne in mind that water levels fluctuate with a number of influences including season, rainfall, dewatering and pumping activities. Therefore, water levels significantly higher than those found during this investigation may be encountered.

It should be noted that the site is in an area affected surface water flooding, and a temporary drainage solution should be designed throughout construction, and during earthworks operations.

Shallow excavations should remain stable in the short term but if left open for a significant period of time will require shoring. Excavation sides should be designed, constructed and supported in accordance with the recommendations given in CIRIA Report No. 97.

It is recommended that an adequate drainage system for surface water be installed by a competent contractor in order to prevent surface water ponding or collecting during and post construction, which may in turn lead to deterioration of the founding stratum.

Based on the nature of the ground conditions encountered, excavations should be within the capacity of normal earthworks plant although breaking out of obstructions should be anticipated.

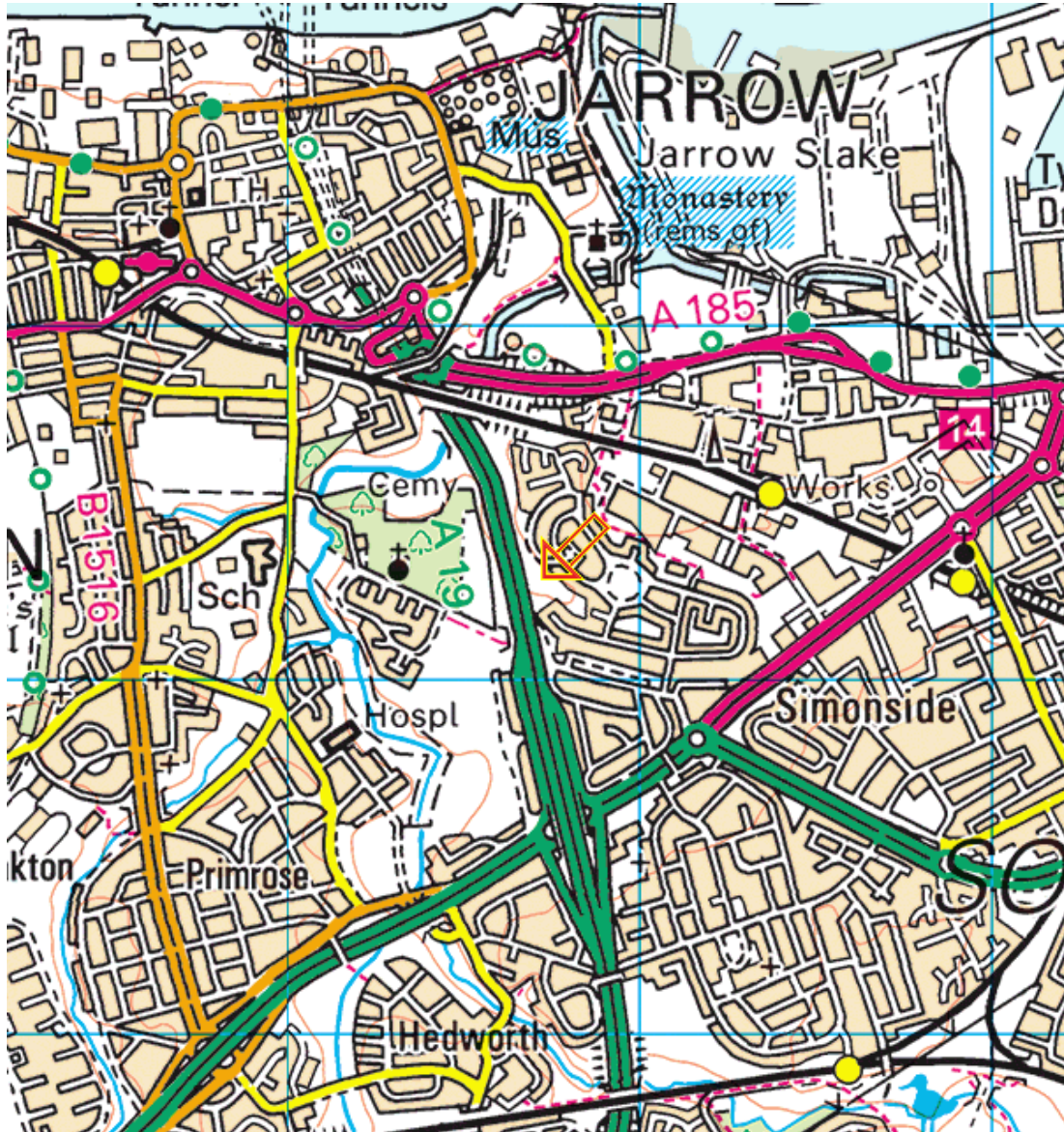
9.7 ROAD PAVEMENT DESIGN

A CBR value of 2% should be assumed for highway construction within natural clays. This is based on visual inspection and laboratory testing.


APPENDIX A

Drawings






Ordnance Survey © Crown copyright 2012 All rights reserved. Licence number 100048410.

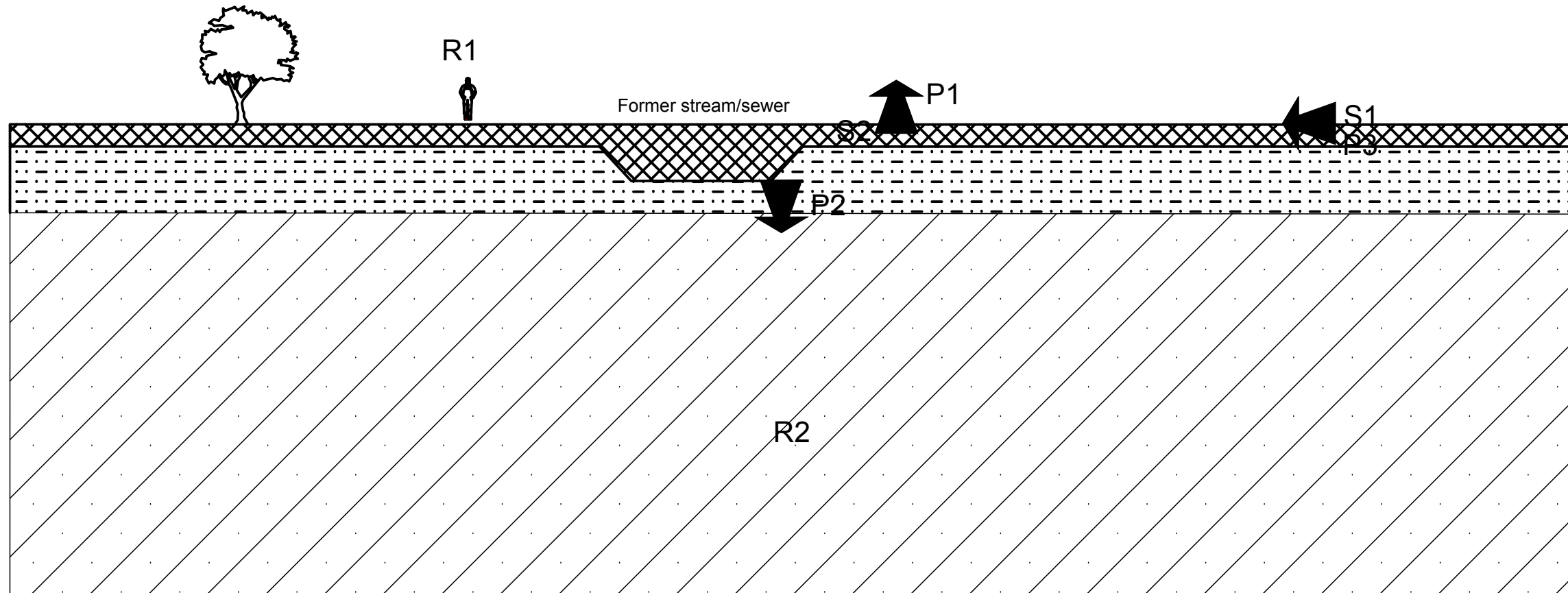
	Contract: Porlock, Jarrow		Contract No: D7716	
	Client: South Tyneside Homes			
TEL: 0191 378 3151 FAX: 0191 378 3157	Drawing Title: Site Location Plan			
Drawing No: D7716/01	Date: November 2016	Scale: NTS	Status: Final	Drawn by: KJ



	Contract: Porlock, Jarrow		Contract No: D7716	
	Client: South Tyneside Homes			
TEL: 0191 378 3151 FAX: 0191 378 3157		Drawing Title: Exploratory Hole location Plan		
Drawing No: D7716/02	Date: April 2013	Scale: NTS	Status: Final	Drawn by: GD

Western boundary

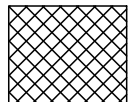
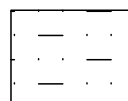
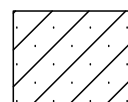
Eastern boundary



Dunelm Geotechnical & Environmental Ltd
 Foundation House, St John's Road, Meadowfield
 Durham, DH78TZ
 Tel: 0191 378 3151
 Fax: 0191 378 3157
 e-mail: admin@dunelm.co.uk
 web: www.dunelm.co.uk

NOT TO SCALE: Contractor to check all dimensions on site before commencement of any works. No dimensions to be scaled from this drawing.
 © Copyright Reserved

Ground Conditions Summary

-  MADE GROUND
-  PELAW CLAY DEPOSITS
-  COAL MEASURES

Pollutant Linkages

SOURCE	<ol style="list-style-type: none"> Gas emissions from offsite sources. Contamination within the made ground.
PATHWAY	<ol style="list-style-type: none"> Gas emissions and inhalation or ingestion of determinants within made ground. Migration of contamination into underlying natural deposits Gas emissions & inhalation of gases from off site.
RECEPTOR	<ol style="list-style-type: none"> Human Health Secondary (A) Aquifer

CLIENT:
 South Tyneside Homes

PROJECT TITLE:
 Porlock, Jarrow

DRAWING TITLE:
 Conceptual Site Model

DRAWING NUMBER:
 D7716/03

DATE:
 November 2016

APPENDIX B
Exploratory Hole Records





BOREHOLE RECORD

Borehole MBH3

Contract No: D7716

Site: Porlock, Jarrow

GL (m AOD) -
Easting: -
Northing: -
Scale 1:50

Client: South Tyneside Homes

Driller: SF

Logged By: TMK

Sheet 1 of 1

Method: Mini Percussive Drilling

Checked By: KJ

Dates: 28/11/2016

SAMPLE DETAILS			(Casing) Groundwater	STRATA RECORD Description	Depth (m)	Level (m AOD)	Legend	Well/ Backfill		
Type	Depth From-To (m)	In situ Testing								
D	0.20		1	MADE GROUND: Dark brown slightly sandy, silty gravelly clayey topsoil, with occasional cobbles of sandstone. Gravel is angular, fine to coarse of sandstone, mudstone and coal. Firm light orangey brown mottled grey, slightly silty, slightly gravelly CLAY. Gravel is angular, fine to medium of mudstone, sandstone and occasional coal.	(0.40)					
ES	0.20									
B	0.30 - 0.50									
D	0.40									
D	1.20 - 1.65	N=14 (2,3/3,3,4,4)			From 1.20m: Decreasing silt and gravel content. Becoming stiff	1.10				
SPT (S)	1.20 - 1.65					1.50				
D	1.50				Stiff dark brown mottled grey, silty CLAY.					
D	2.00 - 2.45	N=19 (4,4/4,5,5,5)			2	Stiff dark brown, slightly sandy, silty, gravelly CLAY. Gravel is angular, fine to medium of sandstone, mudstone and coal.			(1.50)	
SPT (S)	2.00 - 2.45									
D	2.50									
D	3.00 - 3.45	N=23 (5,5/5,5,6,7)	3.00							
SPT (S)	3.00 - 3.45									
D	3.50		(1.31)							
D	4.00 - 4.30	N=50+ (7,7/11,27,12 for 10mm)	4	End of Borehole at 4.31 m			4.31			
SPT (S)	4.00 - 4.31									

Ground Water (m)					Chiselling / Hard Strata			Casing Depths		Hole Diameter		General Remarks
Depth Struck (m)	Casing Depth (m)	Water Level	Minutes	Water sealed (m)	From (m)	To (m)	Time (hr)	Diameter (mm)	Depth (m)	Diameter (mm)	Depth (m)	
												1. Hand dug inspection pit to 1.20m. 2. No groundwater encountered.

Log last updated 09/01/2017



BOREHOLE RECORD

Borehole MBH6

Contract No: D7716

Site: Porlock, Jarrow

GL (m AOD) -
Easting: -
Northing: -
Scale 1:50

Client: South Tyneside Homes

Driller: SF

Logged By: BC

Sheet 1 of 1

Method: Mini Percussive Drilling

Checked By: KJ

Dates: 06/12/2016

SAMPLE DETAILS			(Casing) Groundwater	STRATA RECORD Description	Depth (m)	Level (m AOD)	Legend	Well/ Backfill
Type	Depth From-To (m)	Insitu Testing						
D ES	0.20 0.20		▼	MADE GROUND: Dark brown clayey topsoil.	(0.45)			
D ES	0.50 0.50		▽	MADE GROUND: Brown sandy, slightly gravelly clay, with frequent cobbles of brick. Gravel is angular of sandstone and brick.	0.45 (0.75)			
				End of Borehole at 1.20 m	1.20			
					1			
					2			
					3			
					4			
					5			
					6			
					7			
					8			
					9			
					10			

Ground Water (m)					Chiselling / Hard Strata			Casing Depths		Hole Diameter		General Remarks
Depth Struck (m)	Casing Depth (m)	Water Level	Minutes	Water sealed (m)	From (m)	To (m)	Time (hr)	Diameter (mm)	Depth (m)	Diameter (mm)	Depth (m)	
0.80		0.30	20									1. Hand dug inspection pit to 1.20m. 2. Borehole terminated at 1.20m due to possible service.
Log last updated 09/01/2017												



BOREHOLE RECORD

Borehole MBH7

Contract No: D7716

Site: Porlock, Jarrow

GL (m AOD) Scale 1:50
 -
 Easting: Northing:
 - -

Client: South Tyneside Homes

Driller: SF

Logged By: TMK

Sheet 1 of 1

Method: Mini Percussive Drilling

Checked By: KJ

Dates: 28/11/2016

SAMPLE DETAILS			Casing Groundwater	STRATA RECORD Description	Depth (m)	Level (m AOD)	Legend	Well/ Backfill
Type	Depth From-To (m)	Insitu Testing						
D ES B D ES	0.20 0.20 0.40 - 0.90 0.40 0.40			MADE GROUND: Dark brown clayey, silty, sandy gravelly topsoil. Gravel is angular to subrounded, fine to coarse of mudstone and sandstone. MADE GROUND: Dark brown silty, slightly sandy, gravelly clay. Gravel is angular, fine to coarse of sandstone, mudstone, coal and brick.	(0.20) 0.20 (0.70)			
B D	0.90 0.90		1	Firm light orangey brown mottled grey, slightly silty, slightly sandy, gravelly CLAY. Gravel is fine to coarse angular to subrounded of sandstone, mudstone and coal. End of Borehole at 1.20 m	0.90 (0.30) 1.20			
			2					
			3					
			4					
			5					
			6					
			7					
			8					
			9					
			10					

Ground Water (m)					Chiselling / Hard Strata			Casing Depths		Hole Diameter		General Remarks
Depth Struck (m)	Casing Depth (m)	Water Level	Minutes	Water sealed (m)	From (m)	To (m)	Time (hr)	Diameter (mm)	Depth (m)	Diameter (mm)	Depth (m)	
												1. Hand dug inspection pit to 1.20m. 2. No groundwater encountered.

Log last updated 09/01/2017



BOREHOLE RECORD

Borehole MBH7A

Contract No: D7716

Site: Porlock, Jarrow

GL (m AOD) Scale 1:50
 -
 Easting: Northing:
 - -

Client: South Tyneside Homes

Driller: SF

Logged By: TMK

Sheet 1 of 1

Method: Mini Percussive Drilling

Checked By: KJ

Dates: 28/11/2016

SAMPLE DETAILS			Casing Groundwater	STRATA RECORD Description	Depth (m)	Level (m AOD)	Legend	Well/ Backfill
Type	Depth From-To (m)	Insitu Testing						
D ES B D ES	0.20 0.20 0.40 0.40 0.40			MADE GROUND: Dark brown clayey, silty, sandy gravelly topsoil. Gravel is angular to subrounded, fine to coarse of mudstone and sandstone.	(0.20) 0.20			█
			MADE GROUND: Dark brown silty, slightly sandy, gravelly clay. Gravel is angular, fine to coarse of sandstone, mudstone, coal and brick.	(0.70)				
B D	0.90 0.90		Firm light orangey brown mottled grey, slightly silty, gravelly CLAY. Gravel is fine to coarse angular to subrounded of sandstone, mudstone and coal. End of Borehole at 1.20 m	0.90 (0.30) 1.20				
			1					
			2					
			3					
			4					
			5					
			6					
			7					
			8					
			9					
			10					

Ground Water (m)					Chiselling / Hard Strata			Casing Depths		Hole Diameter		General Remarks
Depth Struck (m)	Casing Depth (m)	Water Level	Minutes	Water sealed (m)	From (m)	To (m)	Time (hr)	Diameter (mm)	Depth (m)	Diameter (mm)	Depth (m)	
												1. Hand dug inspection pit to 1.20m. 2. No groundwater encountered.

Log last updated 09/01/2017



BOREHOLE RECORD

Borehole MBH7B

Contract No: D7716

Site: Porlock, Jarrow

GL (m AOD) Scale 1:50
 -
 Easting: Northing:
 - -

Client: South Tyneside Homes

Driller: SF

Logged By: TMK

Sheet 1 of 1

Method: Mini Percussive Drilling

Checked By: KJ

Dates: 28/11/2016

SAMPLE DETAILS			Casing/ Groundwater	STRATA RECORD Description	Depth (m)	Level (m AOD)	Legend	Well/ Backfill
Type	Depth From-To (m)	Insitu Testing						
D ES B D ES	0.20 0.20 0.40 0.40 0.40			MADE GROUND: Dark brown clayey, silty, sandy gravelly topsoil. Gravel is angular to subrounded, fine to coarse of mudstone and sandstone.	(0.20) 0.20			█
D ES	0.40 0.40			MADE GROUND: Dark brown silty, slightly sandy, gravelly clay. Gravel is angular, fine to coarse of sandstone, mudstone, coal and brick.	(0.70)			
B D	0.90 0.90		1	Firm light orangey brown mottled grey, slightly silty, very gravelly CLAY. Gravel is fine to coarse angular to subrounded of sandstone, mudstone and coal. End of Borehole at 1.20 m	0.90 (0.30) 1.20			
			2					
			3					
			4					
			5					
			6					
			7					
			8					
			9					
			10					

Ground Water (m)					Chiselling / Hard Strata			Casing Depths		Hole Diameter		General Remarks
Depth Struck (m)	Casing Depth (m)	Water Level	Minutes	Water sealed (m)	From (m)	To (m)	Time (hr)	Diameter (mm)	Depth (m)	Diameter (mm)	Depth (m)	
												1. Hand dug inspection pit to 1.20m. 2. No groundwater encountered. 3. Borehole terminated at 1.20m due to possible service.

Log last updated 09/01/2017



TRIAL PIT RECORD

TP No.
SA1

Contract No.: D7716

Site: Porlock, Jarrow

Scale 1:25

Client: South Tyneside Homes

Logged By: DF

Sheet 1 of 1

Method: Machine Excavated Trial Pit

Checked By: KJ

Dates: 29/11/2016

SAMPLE DETAILS			Groundwater	STRATA RECORD Description	Depth (m)	Level (m AOD) PID (ppm)	Legend	Backfill
Type	Depth From-To (m)	Insitu Testing						
B ES D	0.20 - 0.40 0.20 0.30			MADE GROUND: Dark brown clayey, slightly sandy topsoil. Gravel is subangular to subrounded, fine to medium of sandstone, mudstone and coal. Organic fibres noted. Rare glass and brick fragments noted.				
ES D	0.60 0.70		1	Stiff brown mottled grey, slightly sandy, slightly gravelly CLAY. Gravel is subangular to subrounded, fine to coarse of sandstone.	0.50			
D	1.40			Stiff brown slightly sandy, slightly gravelly CLAY. Gravel is subangular to subrounded, fine to medium of sandstone and mudstone.	1.30			
				----- End of Trial Pit at 1.50 m	1.50			
			2					
			3					
			4					
			5					

Remarks 1. No groundwater encountered.	Ground Water (m)		Excavation Details		Orientation	
	Depth	Strike	Remarks	Dimensions: 0.40m x 1.50m		<div style="display: flex; align-items: center; justify-content: center;"> <div style="border: 1px solid black; padding: 5px; margin-right: 10px;"> D A C B </div> 170° </div>
				Stability: Stable		
				Weather:		
			Remarks: Machine Excavated Trial Pit			



TRIAL PIT RECORD

TP No.
SA2

Contract No.: D7716

Site: Porlock, Jarrow

Scale 1:25

Client: South Tyneside Homes

Logged By: DF

Sheet 1 of 1

Method: Hand Excavated Trial Pit

Checked By: KJ

Dates: 29/11/2016

SAMPLE DETAILS			Groundwater	STRATA RECORD Description	Depth (m)	Level (m AOD) PID (ppm)	Legend	Backfill
Type	Depth From-To (m)	Insitu Testing						
D	0.20		<div style="display: flex; align-items: center;"> <div style="flex: 1; border-right: 1px dashed black; margin-right: 5px;"> <div style="text-align: center; margin-bottom: 10px;">1</div> <div style="text-align: center; margin-bottom: 10px;">2</div> <div style="text-align: center; margin-bottom: 10px;">3</div> <div style="text-align: center; margin-bottom: 10px;">4</div> <div style="text-align: center;">5</div> </div> <div style="flex: 1; border-left: 1px dashed black;"> <div style="text-align: center; margin-bottom: 10px;">1.20</div> </div> </div>	MADE GROUND: Brown slightly sandy, slightly gravelly clay. Gravel is subangular to subrounded, fine to coarse of sandstone and brick.				
				End of Trial Pit at 1.20 m				

Remarks 1. No groundwater encountered.	Ground Water (m)		Excavation Details		Orientation	
	Depth Strike	Remarks	Dimensions: m x m		<div style="display: flex; align-items: center; justify-content: center;"> <div style="border: 1px solid black; padding: 5px; margin-right: 10px;"> D A C B </div> ° </div>	
			Stability:			
			Weather:			
		Remarks: Hand Excavated Trial Pit				

APPENDIX C
Chemical Testing Results





Certificate of Analysis

Certificate Number 16-85738

13-Dec-16

Client Dunelm Geotechnical & Environmental Ltd
Foundation House
St. John's Road
Meadowfield
Durham
DH7 8TZ

Our Reference 16-85738

Client Reference D7716

Order No 9890KJD7716

Contract Title Porlocj

Description 8 Soil samples.

Date Received 05-Dec-16

Date Started 05-Dec-16

Date Completed 13-Dec-16

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

Notes Opinions and interpretations are outside the scope of UKAS 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. Observations and interpretations are outside the scope of ISO 17025. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.

Approved By

A handwritten signature in black ink, appearing to read 'Rob Brown'.

Rob Brown
Business Manager



Summary of Chemical Analysis

Soil Samples

Our Ref 16-85738
 Client Ref D7716
 Contract Title Porlocj

Lab No	1094245	1094246	1094247	1094248	1094249	1094250
Sample ID	MBH1	MBH2	MBH3	MBH5	MBH6	MBH7
Depth	0.20	0.50	0.20	0.20	0.50	0.40
Other ID						
Sample Type	ES	ES	ES	ES	ES	ES
Sampling Date	29/11/16	29/11/16	28/11/16	29/11/16	29/11/16	28/11/16
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units						
Metals									
Arsenic	DETSC 2301#	0.2	mg/kg	8.6	54	20	16	8.7	19
Cadmium	DETSC 2301#	0.1	mg/kg	0.6	3.0	1.0	0.9	0.6	0.5
Chromium	DETSC 2301#	0.15	mg/kg	21	19	32	22	22	22
Chromium, Hexavalent	DETSC 2204*	1	mg/kg	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Copper	DETSC 2301#	0.2	mg/kg	23	170	50	49	25	39
Lead	DETSC 2301#	0.3	mg/kg	51	310	120	110	41	42
Mercury	DETSC 2325#	0.05	mg/kg	0.07	0.41	0.18	0.19	0.08	0.10
Nickel	DETSC 2301#	1	mg/kg	19	29	22	23	24	22
Selenium	DETSC 2301#	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Zinc	DETSC 2301#	1	mg/kg	60	890	120	180	67	79
Inorganics									
pH	DETSC 2008#			8.1	7.6	7.4	7.7	8.2	8.1
Organic matter	DETSC 2002#	0.1	%	3.6	4.7	5.0	11	1.8	2.7
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l	33	2000	70	380	840	130
Petroleum Hydrocarbons									
Aliphatic C5-C6	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01			< 0.01	< 0.01
Aliphatic C6-C8	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01			< 0.01	< 0.01
Aliphatic C8-C10	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01			< 0.01	< 0.01
Aliphatic C10-C12	DETSC 3072#	1.5	mg/kg	< 1.5	< 1.5			< 1.5	< 1.5
Aliphatic C12-C16	DETSC 3072#	1.2	mg/kg	< 1.2	< 1.2			< 1.2	< 1.2
Aliphatic C16-C21	DETSC 3072#	1.5	mg/kg	< 1.5	< 1.5			< 1.5	< 1.5
Aliphatic C21-C35	DETSC 3072#	3.4	mg/kg	< 3.4	< 3.4			< 3.4	< 3.4
Aliphatic C5-C35	DETSC 3072*	10	mg/kg	< 10	< 10			< 10	< 10
Aromatic C5-C7	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01			< 0.01	< 0.01
Aromatic C7-C8	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01			< 0.01	< 0.01
Aromatic C8-C10	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01			< 0.01	< 0.01
Aromatic C10-C12	DETSC 3072#	0.9	mg/kg	< 0.9	< 0.9			< 0.9	< 0.9
Aromatic C12-C16	DETSC 3072#	0.5	mg/kg	< 0.5	< 0.5			< 0.5	< 0.5
Aromatic C16-C21	DETSC 3072#	0.6	mg/kg	< 0.6	< 0.6			< 0.6	< 0.6
Aromatic C21-C35	DETSC 3072#	1.4	mg/kg	< 1.4	< 1.4			< 1.4	< 1.4
Aromatic C5-C35	DETSC 3072*	10	mg/kg	< 10	< 10			< 10	< 10
TPH Ali/Aro Total	DETSC 3072*	10	mg/kg	< 10	< 10			< 10	< 10
PAHs									
Naphthalene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	15
Acenaphthylene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.5
Acenaphthene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	21
Fluorene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	18
Phenanthrene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	0.3	< 0.1	130
Anthracene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	0.6	< 0.1	18
Fluoranthene	DETSC 3301	0.1	mg/kg	0.2	< 0.1	< 0.1	1.1	0.2	120
Pyrene	DETSC 3301	0.1	mg/kg	0.1	< 0.1	< 0.1	0.7	0.4	93

Summary of Chemical Analysis Soil Samples

Our Ref 16-85738
Client Ref D7716
Contract Title Porlocj

Lab No	1094245	1094246	1094247	1094248	1094249	1094250
Sample ID	MBH1	MBH2	MBH3	MBH5	MBH6	MBH7
Depth	0.20	0.50	0.20	0.20	0.50	0.40
Other ID						
Sample Type	ES	ES	ES	ES	ES	ES
Sampling Date	29/11/16	29/11/16	28/11/16	29/11/16	29/11/16	28/11/16
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units						
Benzo(a)anthracene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	0.6	< 0.1	44
Chrysene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	0.5	< 0.1	47
Benzo(b)fluoranthene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	0.3	< 0.1	35
Benzo(k)fluoranthene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	0.2	< 0.1	20
Benzo(a)pyrene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	0.4	< 0.1	38
Indeno(1,2,3-c,d)pyrene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	26
Dibenzo(a,h)anthracene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	5.5
Benzo(g,h,i)perylene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	25
PAH Total	DETSC 3301	1.6	mg/kg	< 1.6	< 1.6	< 1.6	4.8	< 1.6	660

Summary of Chemical Analysis

Soil Samples

Our Ref 16-85738
 Client Ref D7716
 Contract Title Porlocj

Lab No	1094251	1094252
Sample ID	MBH8	MBH9
Depth	0.40	0.20
Other ID		
Sample Type	ES	ES
Sampling Date	28/11/16	28/11/16
Sampling Time	n/s	n/s

Test	Method	LOD	Units		
Metals					
Arsenic	DETSC 2301#	0.2	mg/kg	13	23
Cadmium	DETSC 2301#	0.1	mg/kg	0.9	1.0
Chromium	DETSC 2301#	0.15	mg/kg	21	24
Chromium, Hexavalent	DETSC 2204*	1	mg/kg	< 1.0	< 1.0
Copper	DETSC 2301#	0.2	mg/kg	62	81
Lead	DETSC 2301#	0.3	mg/kg	75	210
Mercury	DETSC 2325#	0.05	mg/kg	< 0.05	0.55
Nickel	DETSC 2301#	1	mg/kg	26	29
Selenium	DETSC 2301#	0.5	mg/kg	< 0.5	< 0.5
Zinc	DETSC 2301#	1	mg/kg	160	180
Inorganics					
pH	DETSC 2008#			8.9	8.2
Organic matter	DETSC 2002#	0.1	%	2.9	6.3
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l	58	29
Petroleum Hydrocarbons					
Aliphatic C5-C6	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01
Aliphatic C6-C8	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01
Aliphatic C8-C10	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01
Aliphatic C10-C12	DETSC 3072#	1.5	mg/kg	< 1.5	< 1.5
Aliphatic C12-C16	DETSC 3072#	1.2	mg/kg	< 1.2	< 1.2
Aliphatic C16-C21	DETSC 3072#	1.5	mg/kg	< 1.5	< 1.5
Aliphatic C21-C35	DETSC 3072#	3.4	mg/kg	< 3.4	< 3.4
Aliphatic C5-C35	DETSC 3072*	10	mg/kg	< 10	< 10
Aromatic C5-C7	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01
Aromatic C7-C8	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01
Aromatic C8-C10	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01
Aromatic C10-C12	DETSC 3072#	0.9	mg/kg	< 0.9	< 0.9
Aromatic C12-C16	DETSC 3072#	0.5	mg/kg	< 0.5	< 0.5
Aromatic C16-C21	DETSC 3072#	0.6	mg/kg	< 0.6	< 0.6
Aromatic C21-C35	DETSC 3072#	1.4	mg/kg	< 1.4	< 1.4
Aromatic C5-C35	DETSC 3072*	10	mg/kg	< 10	< 10
TPH Ali/Aro Total	DETSC 3072*	10	mg/kg	< 10	< 10
PAHs					
Naphthalene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1
Acenaphthylene	DETSC 3301	0.1	mg/kg	< 0.1	0.4
Acenaphthene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1
Fluorene	DETSC 3301	0.1	mg/kg	< 0.1	0.4
Phenanthrene	DETSC 3301	0.1	mg/kg	< 0.1	3.2
Anthracene	DETSC 3301	0.1	mg/kg	< 0.1	1.1
Fluoranthene	DETSC 3301	0.1	mg/kg	0.2	4.4
Pyrene	DETSC 3301	0.1	mg/kg	0.3	3.7

Summary of Chemical Analysis Soil Samples

Our Ref 16-85738
Client Ref D7716
Contract Title Porlocj

Lab No	1094251	1094252
Sample ID	MBH8	MBH9
Depth	0.40	0.20
Other ID		
Sample Type	ES	ES
Sampling Date	28/11/16	28/11/16
Sampling Time	n/s	n/s

Test	Method	LOD	Units		
Benzo(a)anthracene	DETSC 3301	0.1	mg/kg	< 0.1	2.0
Chrysene	DETSC 3301	0.1	mg/kg	< 0.1	1.9
Benzo(b)fluoranthene	DETSC 3301	0.1	mg/kg	< 0.1	1.2
Benzo(k)fluoranthene	DETSC 3301	0.1	mg/kg	< 0.1	0.8
Benzo(a)pyrene	DETSC 3301	0.1	mg/kg	< 0.1	1.7
Indeno(1,2,3-c,d)pyrene	DETSC 3301	0.1	mg/kg	< 0.1	0.8
Dibenzo(a,h)anthracene	DETSC 3301	0.1	mg/kg	< 0.1	0.3
Benzo(g,h,i)perylene	DETSC 3301	0.1	mg/kg	< 0.1	0.9
PAH Total	DETSC 3301	1.6	mg/kg	< 1.6	23

Summary of Asbestos Analysis

Soil Samples

Our Ref 16-85738

Client Ref D7716

Contract Title Porlocj

Lab No	Sample ID	Material Type	Result	Comment*	Analyst
1094245	MBH1 0.20	SOIL	NAD	none	Andrew Little
1094246	MBH2 0.50	SOIL	NAD	none	Andrew Little
1094247	MBH3 0.20	SOIL	NAD	none	Andrew Little
1094248	MBH5 0.20	SOIL	NAD	none	Andrew Little
1094249	MBH6 0.50	SOIL	NAD	none	Andrew Little
1094250	MBH7 0.40	SOIL	Chrysotile	Small bundle of Chrysotile fibres present	Andrew Little
1094251	MBH8 0.40	SOIL	NAD	none	Andrew Little
1094252	MBH9 0.20	SOIL	NAD	none	Andrew Little

Crocidolite = Blue Asbestos, Amosite = Brown Asbestos, Chrysotile = White Asbestos. Anthophyllite, Actinolite and Tremolite are other forms of Asbestos. Samples are analysed by DETSC 1101 using polarised light microscopy in accordance with HSG248 and documented in-house methods. NAD = No Asbestos Detected. Where a sample is NAD, the result is based on analysis of at least 2 sub-samples and should be taken to mean 'no asbestos detected in sample'. Key: * -not included in laboratory scope of accreditation.

Information in Support of the Analytical Results

Our Ref 16-85738
Client Ref D7716
Contract Porlocj

Containers Received & Deviating Samples

Lab No	Sample ID	Date Sampled	Containers Received	Holding time exceeded for tests	Inappropriate container for tests
1094245	MBH1 0.20 SOIL	29/11/16	GJ 250ml, GJ 60ml, PT 1L x2		
1094246	MBH2 0.50 SOIL	29/11/16	GJ 250ml x2, PT 1L		
1094247	MBH3 0.20 SOIL	28/11/16	GJ 60ml, PT 1L		
1094248	MBH5 0.20 SOIL	29/11/16	GJ 250ml, GJ 60ml, PT 1L		
1094249	MBH6 0.50 SOIL	29/11/16	GJ 250ml, GJ 60ml, PT 1L		
1094250	MBH7 0.40 SOIL	28/11/16	GJ 60ml, PT 1L x2		
1094251	MBH8 0.40 SOIL	28/11/16	GJ 250ml, GJ 60ml, PT 1L		
1094252	MBH9 0.20 SOIL	28/11/16	GJ 250ml, GJ 60ml, PT 1L		

Key: G-Glass P-Plastic J-Jar 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 D
Geotechnical Testing Results





Certificate of Analysis

Certificate Number 16-86210

15-Dec-16

Client SOLMEK
12 Yarm Road
Stockton On Tees
Cleveland
TS18 3NA

Our Reference 16-86210

Client Reference D7716

Order No (not supplied)

Contract Title Porlock, Jarrow

Description 3 Soil samples.

Date Received 09-Dec-16

Date Started 09-Dec-16

Date Completed 15-Dec-16

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

Notes Opinions and interpretations are outside the scope of UKAS 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. Observations and interpretations are outside the scope of ISO 17025. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.

Approved By

A handwritten signature in black ink, appearing to read "Rob Brown".

Rob Brown
Business Manager



Summary of Chemical Analysis

Soil Samples

Our Ref 16-86210

Client Ref D7716

Contract Title Porlock, Jarrow

Lab No	1096884	1096885	1096886
Sample ID	MBH1	MBH2	MBH7
Depth	0.50	2.50	0.90
Other ID			
Sample Type	SOIL	SOIL	SOIL
Sampling Date	n/s	n/s	n/s
Sampling Time	n/s	n/s	n/s

Test	Method	LOD	Units			
Inorganics						
pH	DETSC 2008#			7.8	8.0	8.0
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l	200	4000	82

Information in Support of the Analytical Results

Our Ref 16-86210
Client Ref D7716
Contract Porlock, Jarrow

Containers Received & Deviating Samples

Lab No	Sample ID	Date Sampled	Containers Received	Holding time exceeded for tests	Inappropriate container for tests
1096884	MBH1 0.50 SOIL		PT 1L		
1096885	MBH2 2.50 SOIL		PT 1L		
1096886	MBH7 0.90 SOIL		PT 1L		

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

Laboratory Report Front Sheet

Solmek
12-16 Yarm Road,
Stockton on Tees,
TS18 3NA
01642 607083
lab@solmek.com



Site name	Job number
Porlock, Jarrow	D7716

Client details:

Reference: D7716
Name: Dunelm
Address: Foundation House,
St John's Road,
Meadowfield,
County Durham,
DH7 8TZ
Telephone: 0191 3783151
Email: kjones@dunelm.co.uk
FAO: K Jones

Date commenced: 08/12/2016

Date reported: 21/12/2016

Observations and interpretations are outside of 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 in full, without the prior written approval of the laboratory.

Samples will be held at the laboratory for a period of 4 weeks after the report date. After the 21-01-2017 all samples will be disposed of. Should further testing be required then the office should be informed before the above date.

Signature:	Approved Signatories:
	<input checked="" type="checkbox"/> K Watkin (Lab Manager) <input type="checkbox"/> U Mazhar (Assistant Lab Manager) <input type="checkbox"/> I Nicholson (Technical Manager)

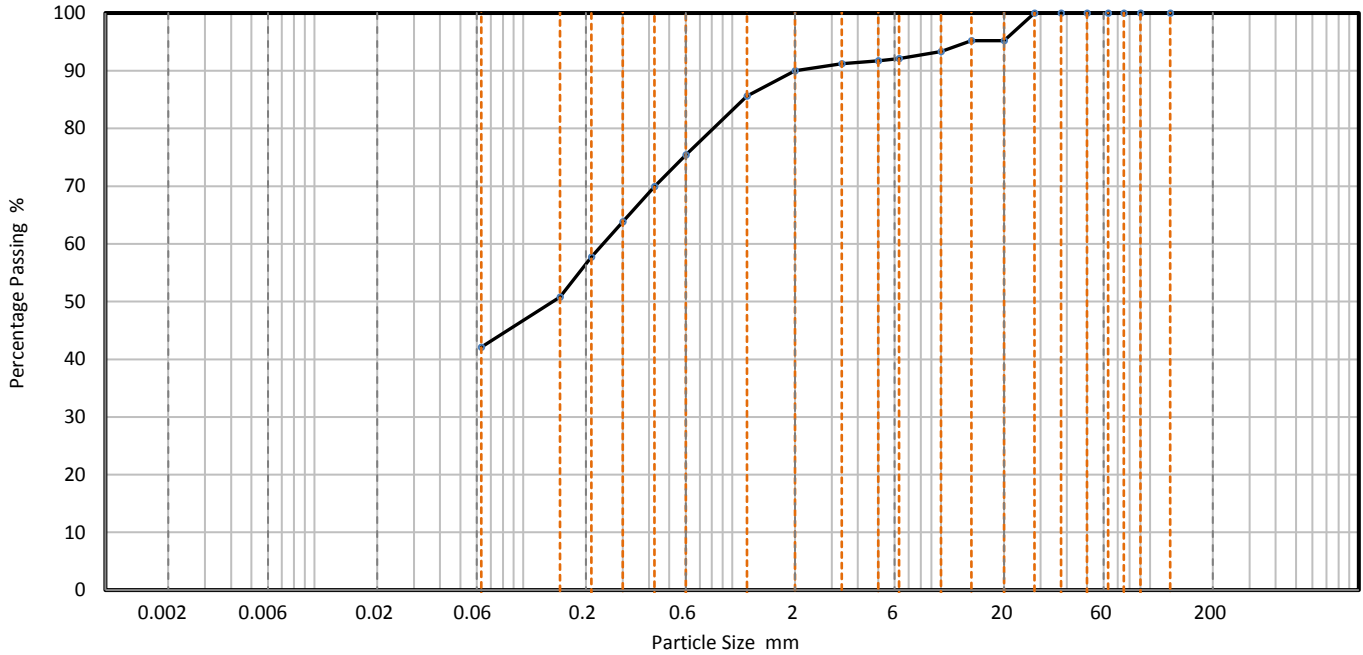
PARTICLE SIZE DISTRIBUTION

Solmek
12-16 Yarm Road,
Stockton on Tees,
TS18 3NA
01642 607083
lab@solmek.com



Site name	Job number
Porlock, Jarrow	D7716

Hole	MBH3	Lab sample ID	SLMK2016121028
Depth (Top)	m 0.30	Test Method	BS 1377 - 2 : 1990 Clause 9.2
Depth (Base)	m	Soil Description	brown, slightly gravelly, clayey SAND
Sample type	B		



CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	95		
14	95		
10	93		
6.3	92		
5	92		
3.35	91		
2	90		
1.18	86		
0.6	75	Particle density (assumed) 2.65 Mg/m3	
0.425	70		
0.3	64		
0.212	58		
0.15	51		
0.063	42		

Dry Mass of sample, g

394

Sample Proportions	% dry mass
Very coarse	0
Gravel	10
Sand	48
Fines <0.063mm	42

Grading Analysis	
D100	mm
D60	mm 0.242
D30	mm
D10	mm
Uniformity Coefficient	
Curvature Coefficient	

Remarks
Preparation and testing in accordance with test method unless noted below

Accreditation status

Sedimentation tests are not currently part of the Solmek UKAS accreditation schedule.

Approved by	KW
Approval date	16/12/2016 07:50

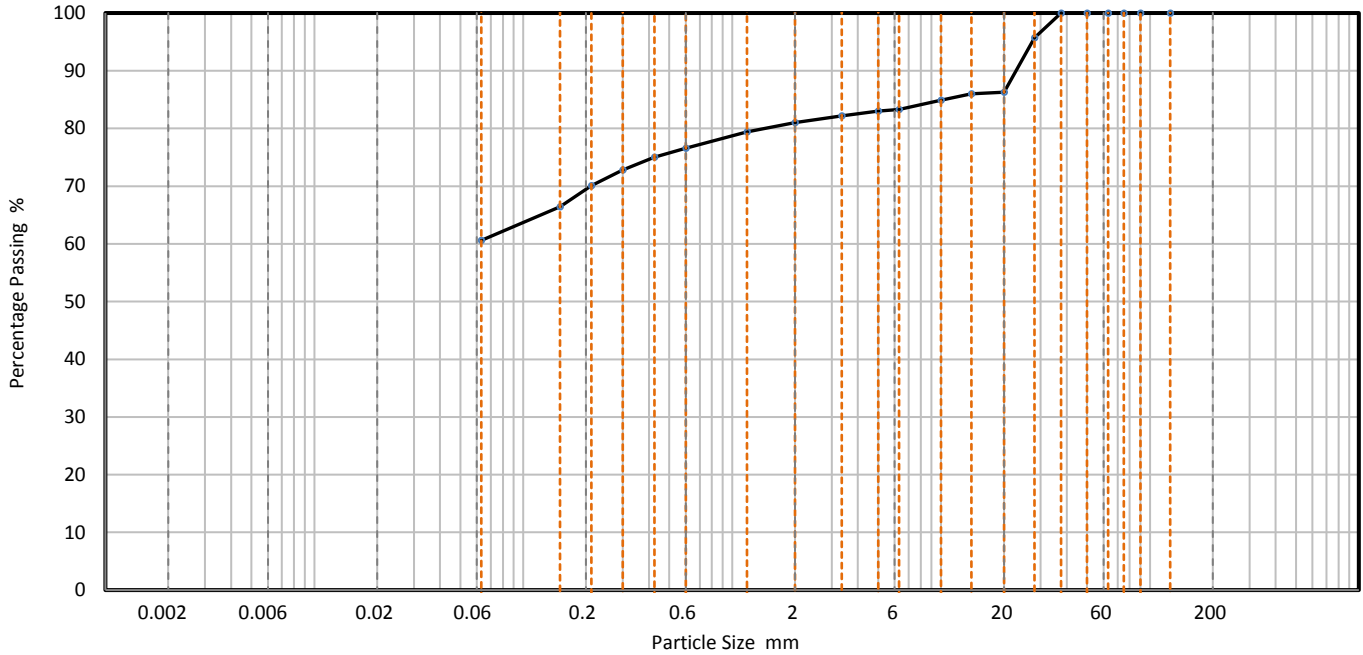
PARTICLE SIZE DISTRIBUTION

Solmek
12-16 Yarm Road,
Stockton on Tees,
TS18 3NA
01642 607083
lab@solmek.com



Site name	Job number
Porlock, Jarrow	D7716

Hole	MBH5	Lab sample ID	SLMK2016121029
Depth (Top)	m 1.20	Test Method	BS 1377 - 2 : 1990 Clause 9.2
Depth (Base)	m	Soil Description	brown, slightly gravelly CLAY
Sample type	L		



CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	96		
20	86		
14	86		
10	85		
6.3	83		
5	83		
3.35	82		
2	81		
1.18	79		
0.6	77	Particle density (assumed) 2.65 Mg/m3	
0.425	75		
0.3	73		
0.212	70		
0.15	66		
0.063	61		

Dry Mass of sample, g 955

Sample Proportions	% dry mass
Very coarse	0
Gravel	19
Sand	20
Fines <0.063mm	61

Grading Analysis	
D100	mm
D60	mm
D30	mm
D10	mm
Uniformity Coefficient	
Curvature Coefficient	

Remarks
Preparation and testing in accordance with test method unless noted below

Accreditation status

Sedimentation tests are not currently part of the Solmek UKAS accreditation schedule.

Approved by	KW
Approval date	16/12/2016 07:54

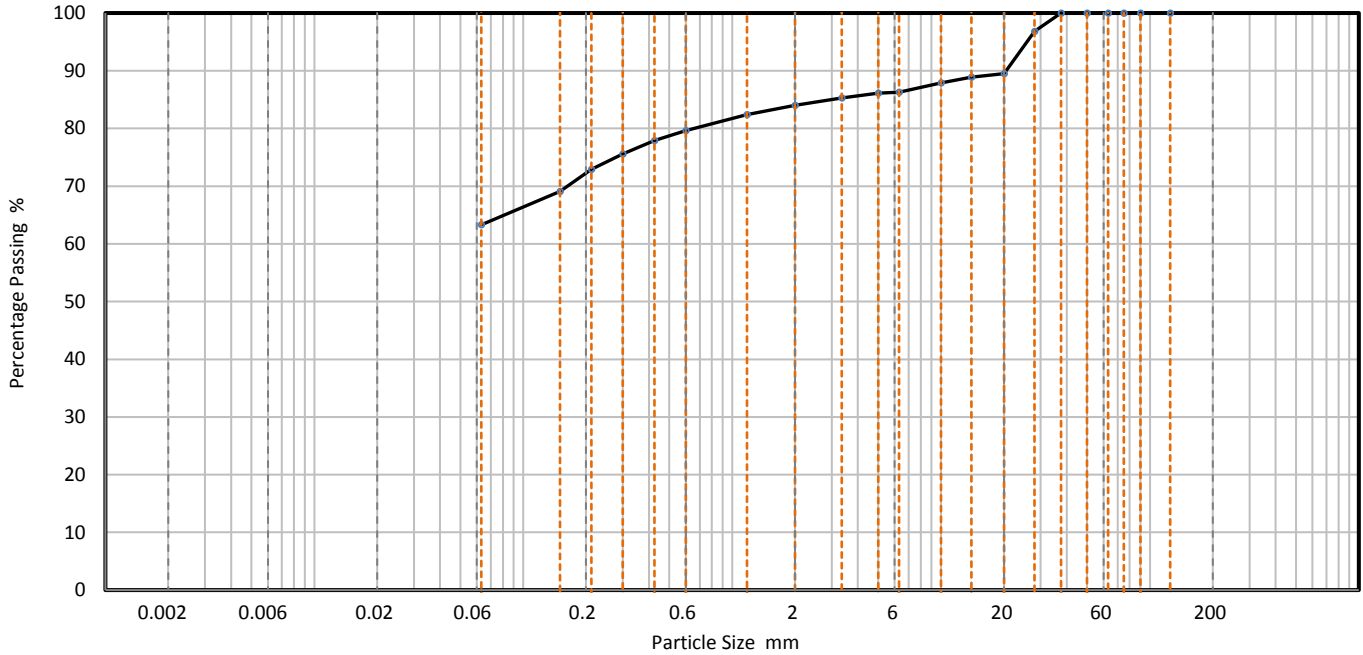
PARTICLE SIZE DISTRIBUTION

Solmek
12-16 Yarm Road,
Stockton on Tees,
TS18 3NA
01642 607083
lab@solmek.com



Site name	Job number
Porlock, Jarrow	D7716

Hole	MBH9	Lab sample ID	SLMK2016121031
Depth (Top)	m 0.50	Test Method	BS 1377 - 2 : 1990 Clause 9.2
Depth (Base)	m	Soil Description	brown, slightly gravelly, sandy CLAY
Sample type	B		



CLAY	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES	BOULDERS
	SILT			SAND			GRAVEL				

Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	97		
20	90		
14	89		
10	88		
6.3	86		
5	86		
3.35	85		
2	84		
1.18	82		
0.6	80	Particle density (assumed) 2.65 Mg/m3	
0.425	78		
0.3	76		
0.212	73		
0.15	69		
0.063	63		

Dry Mass of sample, g 950

Sample Proportions	% dry mass
Very coarse	0
Gravel	16
Sand	21
Fines <0.063mm	63

Grading Analysis	
D100	mm
D60	mm
D30	mm
D10	mm
Uniformity Coefficient	
Curvature Coefficient	

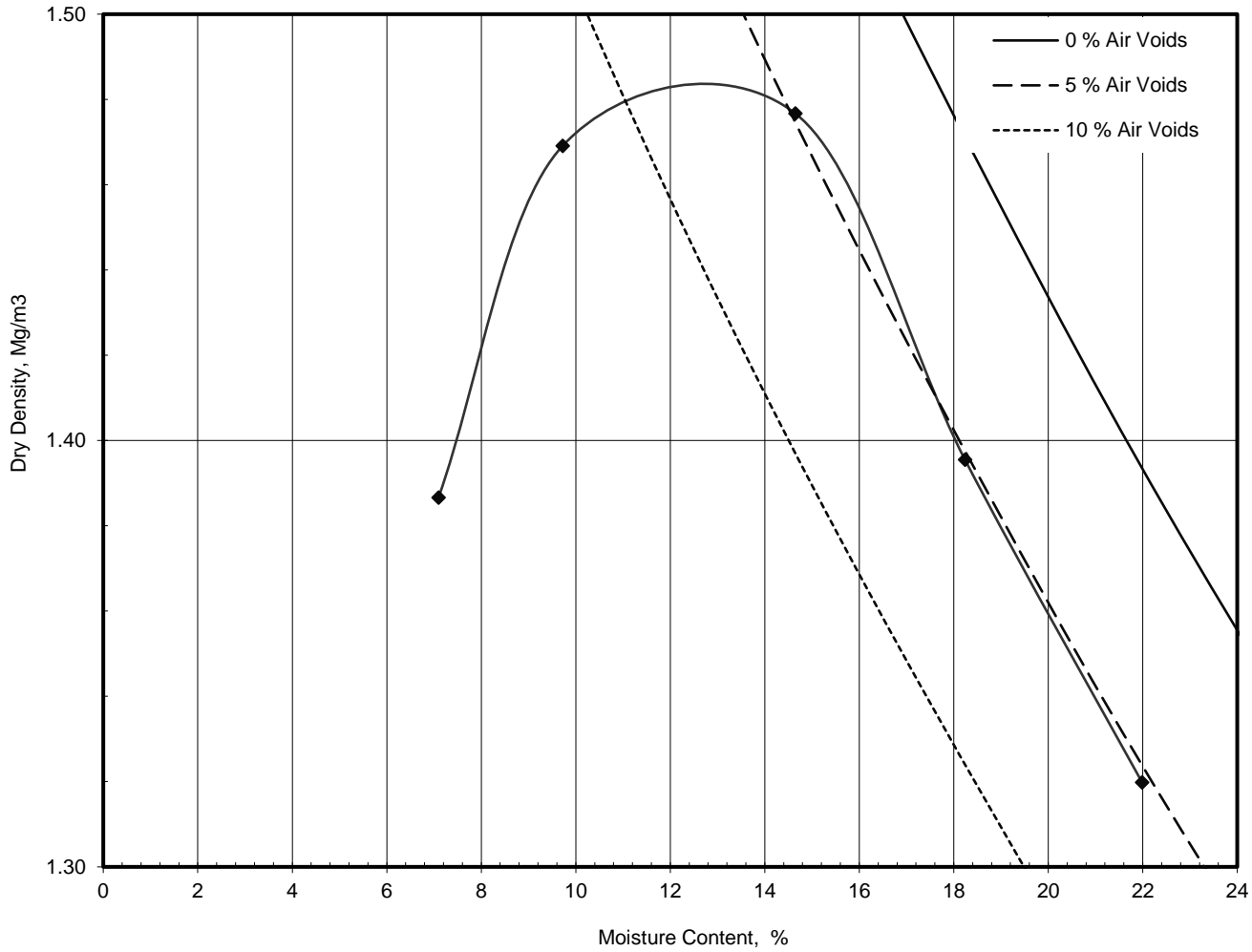
Remarks
Preparation and testing in accordance with test method unless noted below

Accreditation status

Sedimentation tests are not currently part of the Solmek UKAS accreditation schedule.

Approved by	KW
Approval date	21/12/2016 11:15

Dry Density / Moisture Content Relationship Light Compaction		Job Ref	D7716
		Borehole / Pit No	MBH3
Site Name	Porlock, Jarrow		Sample No
Soil Description	brown, slightly gravelly, clayey SAND		Depth 0.30 m
Specimen Ref.	Specimen Depth	m	Sample Type B
Test Method	BS1377:Part 4:1990, clause 3.3, 2.5kg rammer		Keylab ID SLMK2016121028
Compaction Test Reference/No.			



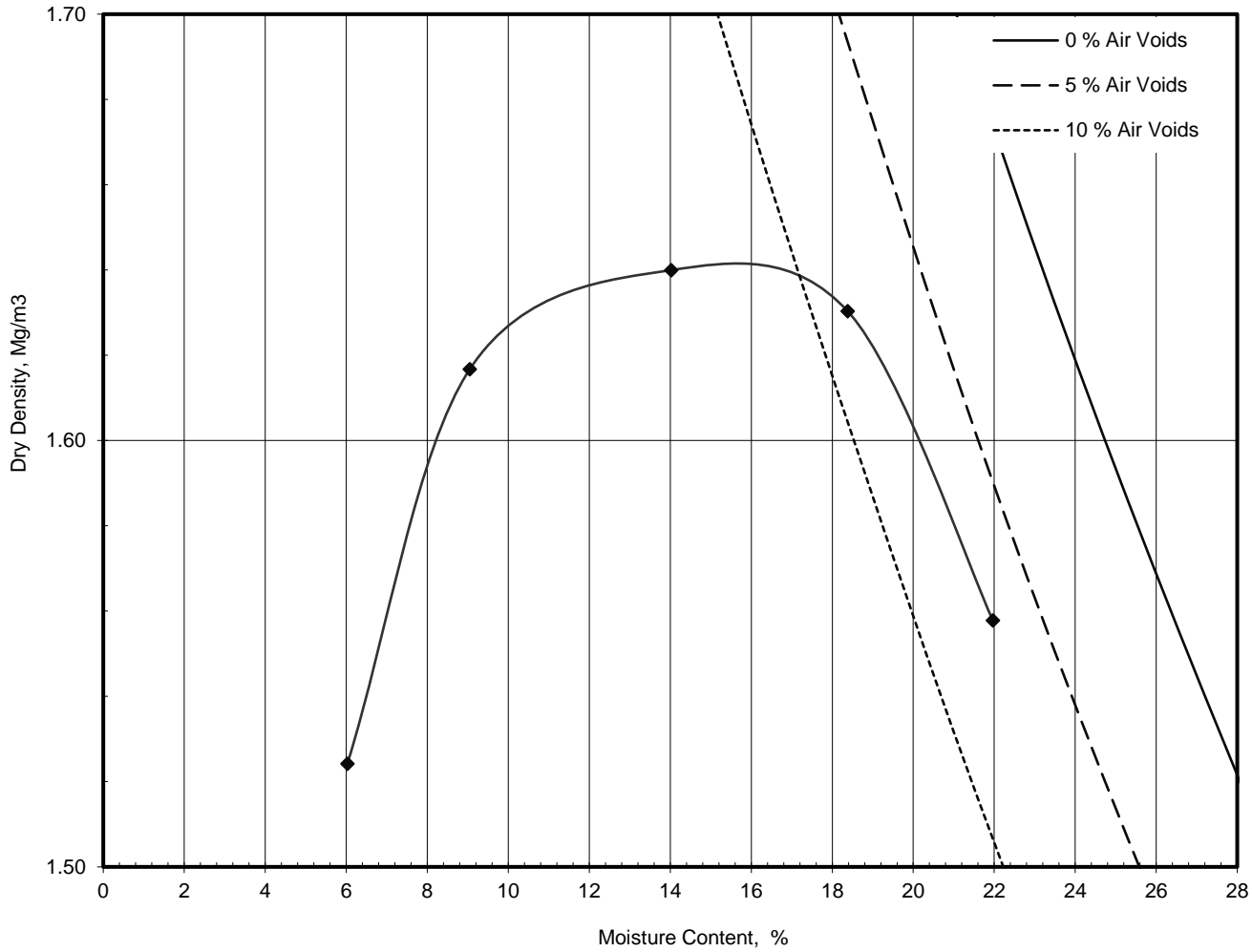
Mould Type		One Litre
Samples Used		Single sample tested
Material Retained on 37.5 mm Sieve	%	0
Material Retained on 20.0 mm Sieve	%	0
Particle Density - Assumed	Mg/m ³	2.01

Maximum Dry Density	Mg/m ³	1.48
----------------------------	-------------------	-------------

Optimum Moisture Content	%	13
---------------------------------	---	-----------

Operator	Checked	Approved	Remarks	Fig Sheet 1 of 1
M.Southgate		KW		

Dry Density / Moisture Content Relationship Light Compaction		Job Ref	D7716
		Borehole / Pit No	MBH5
Site Name	Porlock, Jarrow		Sample No
Soil Description	brown, slightly gravelly CLAY		Depth 1.20 m
Specimen Ref.	Specimen Depth	m	Sample Type L
Test Method	BS1377:Part 4:1990, clause 3.3, 2.5kg rammer		Keylab ID SLMK2016121029
Compaction Test Reference/No.			



Mould Type	One Litre
Samples Used	Single sample tested
Material Retained on 37.5 mm Sieve	2
Material Retained on 20.0 mm Sieve	2
Particle Density - Assumed	2.65

Maximum Dry Density	Mg/m³	1.64
----------------------------	-------	-------------

Optimum Moisture Content	%	16
---------------------------------	---	-----------

Operator	Checked	Approved	Remarks	Fig Sheet 1 of 1
M.Southgate		KW		

	Moisture Condition Value / Moisture Content Relationship		Job Ref	D7716	
			Borehole/Pit No.	MBH3	
Site Name	Porlock, Jarrow		Sample No.		
Soil Description			Depth	0.3	
Specimen Reference		Specimen Depth	m	Sample Type	B
Specimen Description	à![,) È ã @r Á iæ^ r È&æ^ ^ ÀÜÖ		KeyLAB ID	SLMK2016121028	
Test Method	BS1377:Part4:1990:clause 5.5		Date started	10/12/2016	

Sample preparation

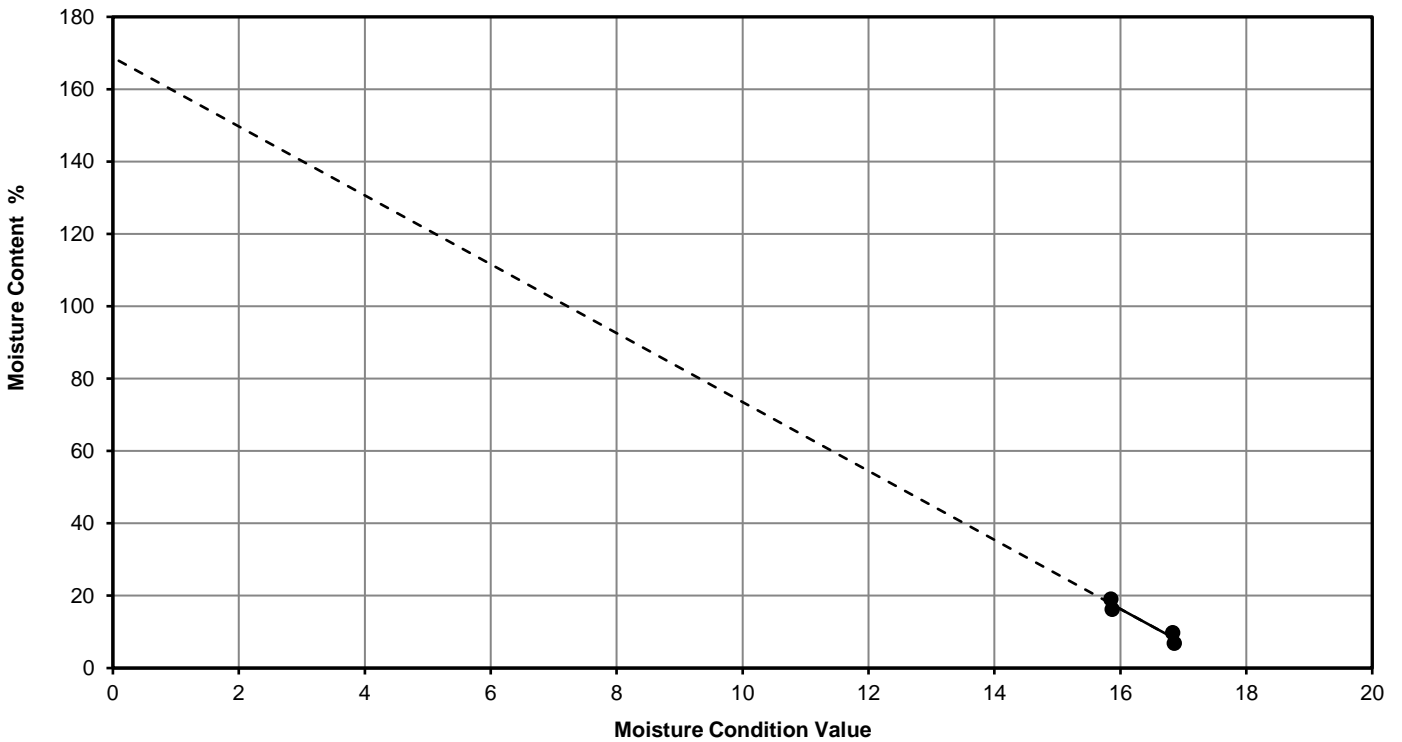
Amount of material larger than 20mm sieve removed	0	%
Natural Moisture Content of sample	33	%
Initial Moisture Content of test sample below 20mm		%

General remarks

Table of results

MCV Test Number	1	2	3	4	
Moisture Content, %	6.9	9.8	16.2	19.1	
Moisture Condition Value	16.9	16.8	15.9	15.8	
MCV report	16.9	16.8	15.9	15.8	
Effective / Valid data point	YES	YES	YES	YES	
Specimen remarks					

● valid points × invalid points - - - - extended regression — linear regression



Tested	Checked	Approved
M.Southgate		KW

	Moisture Condition Value / Moisture Content Relationship		Job Ref	D7716	
			Borehole/Pit No.	MBH5	
Site Name	Porlock, Jarrow		Sample No.		
Soil Description			Depth	1.2	
Specimen Reference		Specimen Depth	m	Sample Type	L
Specimen Description	brown, slightly gravelly CLAY		KeyLAB ID	SLMK2016121029	
Test Method	BS1377:Part4:1990:clause 5.5		Date started	10/12/2016	

Sample preparation

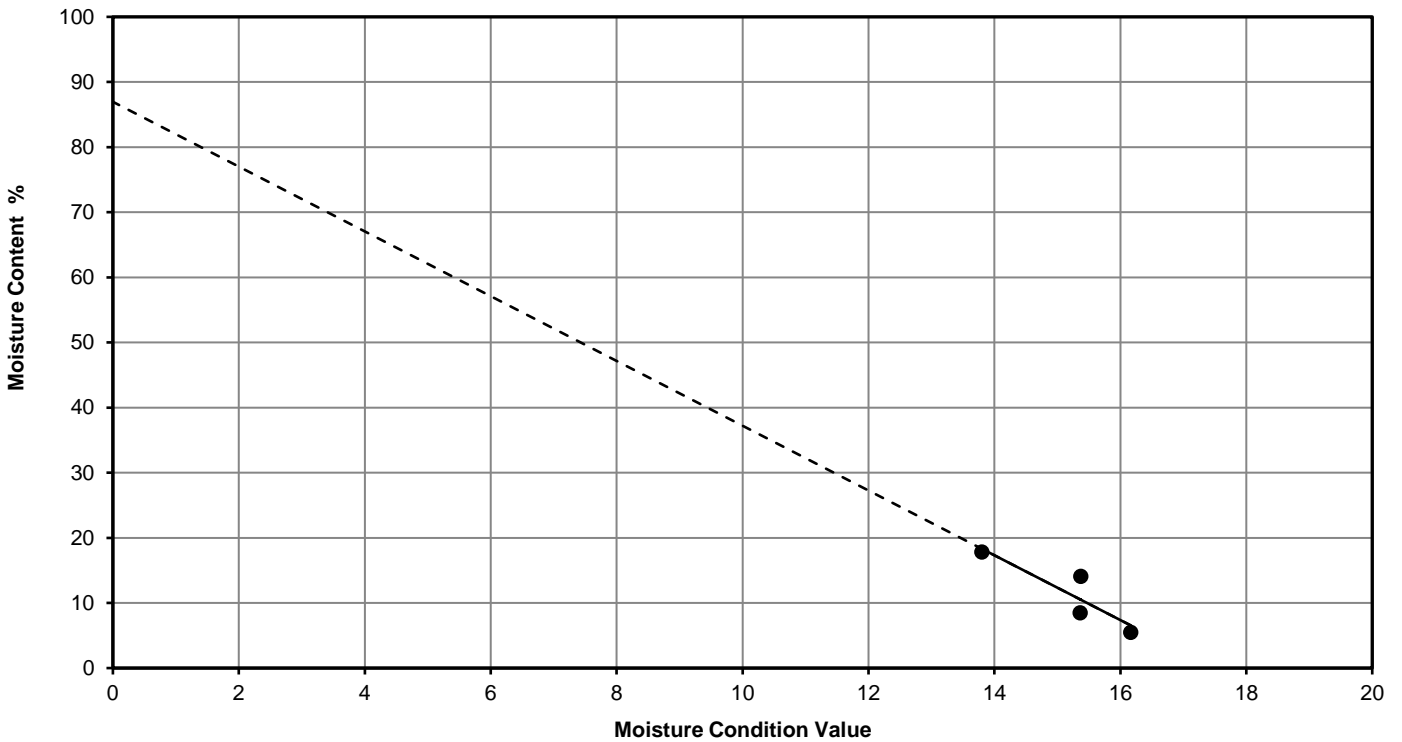
Amount of material larger than 20mm sieve removed	4	%
Natural Moisture Content of sample	25	%
Initial Moisture Content of test sample below 20mm		%

General remarks

Table of results

MCV Test Number	1	2	3	4	
Moisture Content, %	5.5	8.5	14.1	17.8	
Moisture Condition Value	16.2	15.4	15.4	13.8	
MCV report	16.2	15.4	15.4	13.8	
Effective / Valid data point	YES	YES	YES	YES	
Specimen remarks					

● valid points × invalid points - - - - extended regression — linear regression



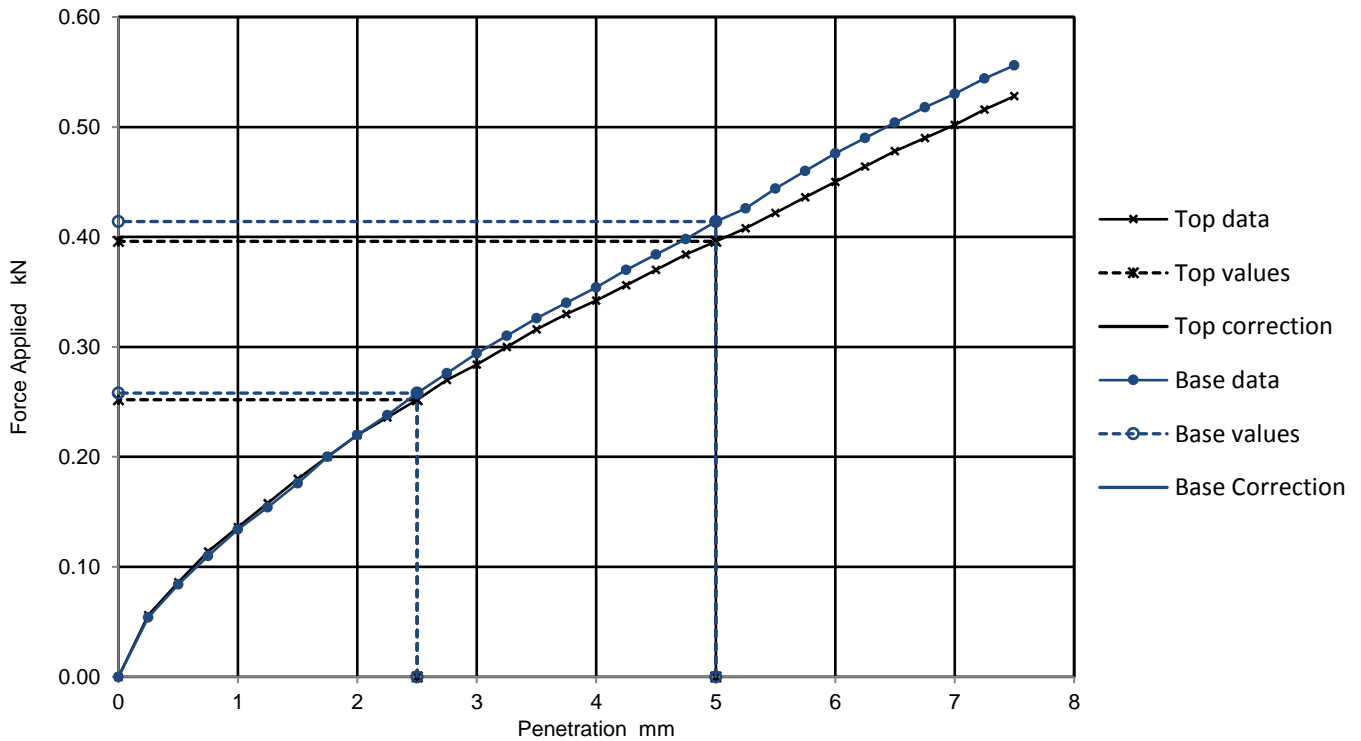
Tested	Checked	Approved
M.Southgate		KW

California Bearing Ratio (CBR)		Job Ref	D7716	
		Borehole/Pit No.	MBH3	
Site Name	Porlock, Jarow		Sample No.	
Soil Description			Depth m	0.30
Specimen Reference	Specimen Depth	m	Sample Type	B
Specimen Description	brown, slightly gravelly, clayey SAND		KeyLAB ID	SLMK2016121028
Test Method	BS1377 : Part 4 : 1990, clause 7		CBR Test Number	1

Specimen Preparation

Condition	REMOULDED	Soaking details	Not soaked	
Details	Recompacted with specified standard effort using 2.5kg rammer	Period of soaking	days	
		Time to surface	days	
		Amount of swell recorded	mm	
Material retained on 20mm sieve removed	0 %	Dry density after soaking	Mg/m3	
Initial Specimen details	Bulk density	1.79 Mg/m3	Surcharge applied	2 kg
	Dry density	1.32 Mg/m3		1 kPa
	Moisture content	35.6 %		

Force v Penetration Plots



Results

	Curve correction applied	CBR Values, %				Moisture Content %
		2.5mm	5mm	Highest	Average	
TOP		1.9	2.0	2.0	2.0	35.6
BASE		2.0	2.1	2.1		34.9

General remarks	Test specific remarks	Approved
		UM

Fig No.	1
Sheet No	1

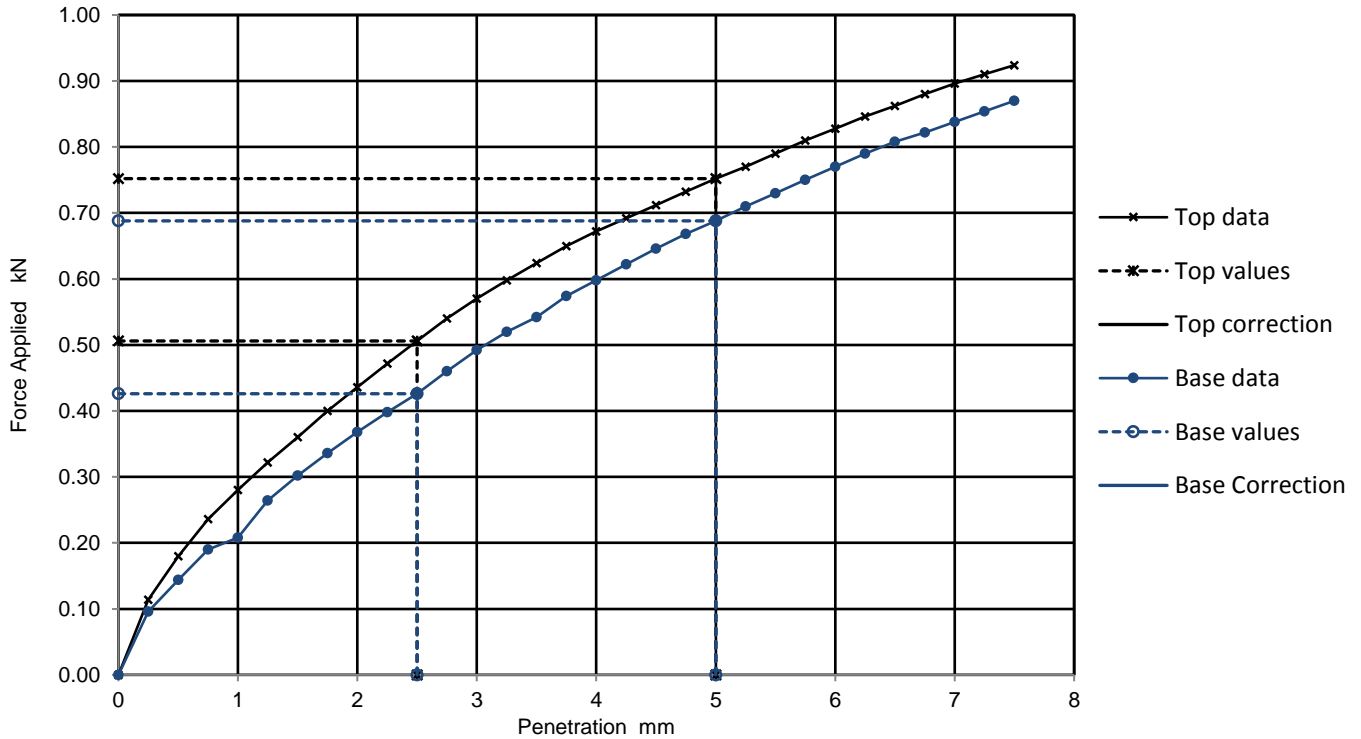
Lab Sheet Reference :

California Bearing Ratio (CBR)		Job Ref	D7716	
		Borehole/Pit No.	MBH5	
Site Name	Porlock, Jarow		Sample No.	
Soil Description			Depth m	1.20
Specimen Reference	Specimen Depth	m	Sample Type	L
Specimen Description	brown, slightly gravelly CLAY		KeyLAB ID	SLMK2016121029
Test Method	BS1377 : Part 4 : 1990, clause 7		CBR Test Number	1

Specimen Preparation

Condition	REMOULDED	Soaking details	Not soaked	
Details	Recompacted with specified standard effort using 2.5kg rammer	Period of soaking	days	
		Time to surface	days	
		Amount of swell recorded	mm	
Material retained on 20mm sieve removed	4 %	Dry density after soaking	Mg/m3	
Initial Specimen details	Bulk density	1.95 Mg/m3	Surcharge applied	2 kg
	Dry density	1.57 Mg/m3		1 kPa
	Moisture content	24.5 %		

Force v Penetration Plots



Results

Curve correction applied	CBR Values, %				Moisture Content %
	2.5mm	5mm	Highest	Average	
TOP	3.8	3.8	3.8	3.6	24.5
BASE	3.2	3.4	3.4		25.6

General remarks	Test specific remarks	Approved
		KW

Fig No.	1
Sheet No	2

Lab Sheet Reference :

APPENDIX E
Gas Monitoring Results



APPENDIX F

Dunelm Conditions of Offer, Notes on Limitations & Basis for Contract



Dunelm Conditions of Offer, Notes on Limitations & Basis for Contract

These conditions accompany our tender and supercede any previous conditions issued. The firm will prepare a report solely for the use of the Client (the party invoiced) and its agent(s). No reliance should be placed on the contents of this report, in whole or in part by 3rd parties. The report, its content and format and associated data are copyright, and the property of the firm. Photocopying of part or all of the contents, transfer or reproduction of any kind is forbidden without written permission from the firm. A charge may be levied against such approval, the same to be made at the discretion of the firm.

Site investigation is a process of sampling. The scope and size of an investigation may be considered proportional to levels of confidence regarding the ground and groundwater conditions. The exploratory holes undertaken investigate only a small volume of the ground in relation to the overall size of the site, and can only provide a general indication of site conditions. The opinions provided and recommendations given in this report are based on the ground conditions as encountered within each of the exploratory holes. There may be different ground conditions elsewhere on the site which have not been identified by this investigation and which therefore have not been taken into account in this report. Reports are generally subject to the comments of the local authority and Environment Agency. The comments made on groundwater conditions are based on observations made at the time that site work was carried out. It should be noted that mobile contamination, soil gas levels and groundwater levels may vary owing to seasonal, tidal and/or weather related effects. Unrecorded ancient mining may occur anywhere where seams that have been worked and influence the rock and soil above. Dissolution cavities can occur where gypsum or chalk is present. Rotary drilling is the recommended technique to prove the integrity of the rock.

Where the scope of the investigation is limited via access to information, time constraints, equipment limitations, testing, interpretation or by the client or his agents budgetary constraints, elements not set out in the proposal and excluded from the report are deemed to be omitted from the scope of the investigation.

The firm cannot be held liable and do not warrant, or otherwise guarantee the validity of information provided by third parties and subsequently used in our reports. The firm are not responsible for the action negligent or otherwise of subcontractors or third parties.

Desk studies are generally prepared in accordance with RICS guidelines. Environmental site investigations are generally undertaken as 'exploratory investigations' in accordance with the definitions provided in paragraph 5.4 of BS 10175:2001 in order to confirm the conceptual assumptions. You are advised to familiarize yourself with the typical scope of such an investigation. No pumping of water will be undertaken unless a licence or facilities/equipment have been arranged by others.

Where the type, number or/and depth of exploratory hole is specified by others, the firm cannot and will not be responsible for any subsequent shortfall or inadequacy in data, and any consequent shortfall in interpretation of environmental and geotechnical aspects which may be required at a later date in order to facilitate the design of permanent or temporary works.

All information acquired by the firm in the course of investigation is the property of the firm, and, only also becomes the joint property of the Client only on the complete settlement of all invoices relating to the project. The firm reserves the right to use the information in commercial tendering and marketing, unless the Client expressly wishes otherwise in writing. The quoted rates do not include VAT, and payment terms are 30 days from dispatch of invoice from our offices. Quotes are subject to a site visit.

We have allowed for 1 mobilisation and normal working hours unless otherwise stated. The scope of the investigation may be reviewed following the desk study and/or fieldwork. We have not allowed for acquiring services information, and cannot be responsible for damage to underground services or pipes not shown to us or not clearly shown on plans. Costs incurred will be passed on to you, and in commissioning the firm, you understand and accept that you/your agent have a contractual relationship with the firm & you accept this. Our rates assume unobstructed, reasonably level and firm access to the exploratory positions and adequate clear working areas and headroom. We have priced on the basis that you or your client have the necessary permissions, wayleaves and approvals to access land. All boreholes and pits are backfilled with arisings except where gas monitoring pipes are installed with stopcock covers. Dunelm are not responsible for any uneven surfaces as a result of siteworks and rutting and backfilled excavations may require re-levelling and/or making good by others after fieldwork is complete. Dunelm have not allowed for subsequent reinstatement as a result of settlement. No price has been provided or requested for a return visit to remove pipework and covers. No price has been provided or requested for a return visit to remove pipework and covers. Hourly rates apply to consultancy only and do not include expenses unless otherwise shown. If warranties are required, legal costs incurred will be passed on to you assuming the firm agree to complete such warranties, modified or otherwise and you understand and agree to pay all costs.

We reserve the right to pursue full payment of the invoice prior to release of any information including reports. We advise you/your client that we may elect to pursue our statutory rights under late payment legislation, and will apply 8% to the base rate for unreasonably late payments. We will also apply the right to claim any associated legal costs incurred with recovery of late payments. The firm is exempt from the CIS Scheme. The firm offer to undertake work only in strict accordance with conditions covered by our current insurances, which are available for inspection. The company are not responsible for acts, negligent or otherwise of subcontractors and as a matter of policy cannot indemnify any other parties. Professional indemnity Insurance is limited to ten times the invoice net total except where stated otherwise by the firm, and we give notice that consequential loss as a direct or indirect result of the firms activities or omission of the same are excluded.