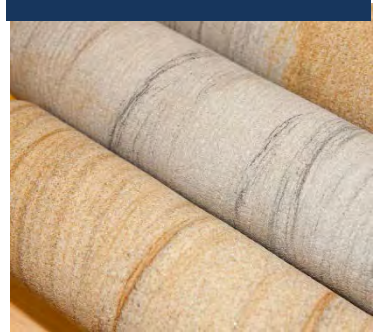
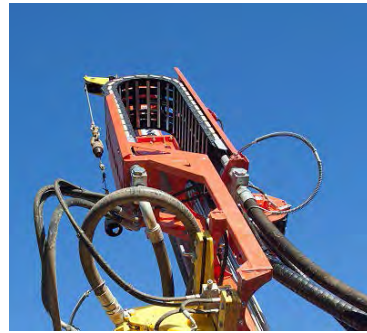




REPORT NO: D8947/02

**GEOENVIRONMENTAL APPRAISAL FOR LAND AT
NANNY MARR ROAD, DARFIELD – PHASE TWO
PREPARED FOR:
PARTNER CONSTRUCTION AND PERVERIL
SECURITIES LTD**



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Contract No.	D8947
Job Name	Nanny Marr Road, Darfield – Phase 2

REPORT REVISIONS

Revision No.	Issue Date	Details
D8947/01	27/09/2018	
D8947/02	04/12/2018	Updated site layout

VERIFICATION

Revision No.	Issue Date		Written By	Checked By	Verified By
D8947/02	04/12/18	Initials	SG	AIL	AIL
		Signature	<i>SG</i>	<i>AIL</i>	<i>AIL</i>

NANNY MARR ROAD, DARFIELD – PHASE 2 – EXECUTIVE SUMMARY

SUMMARY OF GEOENVIRONMENTAL ISSUES

Issue	Remarks
Grid Reference	441554, 404477
Proposed Development	Two storey residential properties
Former Uses	School
Present Uses	Community centre and open ground.
Made Ground	Up to 1.90m
Natural Ground	Completely weathered sandstone rockhead recovered as sand and sandy gravel.
Contamination	The made ground has been found to contain asbestos and PAHs. There is leachable PAHs within the made ground.
Hazardous Gas	No special precautions required.
Mining & Quarrying	No shallow known workings. Possible unrecorded workings within the Sharleston Top Coal Seam, expected to be below the site at depths of greater than 30m. No evidence has been found to suggest that the site has been affected by quarrying.
Foundation Solution	Strip or trench fill foundations.
Groundwater & Excavations	No major groundwater flows encountered. Trial pits were generally stable, with the exception of the soakaway trial pits which recorded instability below 1.70m. No buried obstructions were encountered during this or previous ground investigations, however, the site has been previously developed and obstructions may lie undetected elsewhere on site.
Flooding	Not within an indicative flood plain.
Drainage	Three soakaway tests were undertaken, the water soaked away and infiltration rates where between 8.49×10^{-4} and 5.67×10^{-5} (m/sec)
Highways	A CBR of at least 5% within re-engineered granular fill.
Remediation and Preparatory Works	Remediation of garden and landscaped areas and delineation of asbestos contaminated made ground. Existing building to be demolished.

The executive summary is intended as a synopsis only. Further detail and limitations of the assessment is provided within the main body of the Report

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LIST OF APPENDICES**APPENDIX A - Drawings****Drawing Number Drawing Title**

D8947/01 Site Location Plan

D8947/02 Exploratory Hole Location Plan

D8947/03 Conceptual Site Model

APPENDIX B - Photographs**APPENDIX C - Exploratory Hole Records****APPENDIX D - Chemical Testing Results****APPENDIX E - Geotechnical Testing Results (Including Soakaway Test 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 Nanny Marr Road, Darfield on behalf of Partner Construction and Peveril Securities Ltd.

It is proposed to develop the site with residential properties.

Dunelm have previously undertaken the following reports for the wider site area which includes the proposed residential development area (previously considered for commercial development):

- Geoenvironmental Appraisal of land at Nanny Marr Road, Darfield. Report D6643, dated October 2015. Reference should be made to this report for details of the site's history and environmental setting.
- Supplementary Investigation letter Report D6643/02, dated October 2015
- Soakaway Letter Report D6643/03, dated December 2015
- Soakaway Letter Report D6643/04, dated December 2015

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

- To assess risks from ground contamination encountered during this and previous investigations in relation to a residential development
- To undertake additional soakaway testing in area of the site that was previously inaccessible due to a gas main
- 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 441573, 404401. The site is situated in the centre of Darfield, approximately 10km east of Barnsley town centre. The site location is shown in Drawing Number D8947/01 in Appendix A to this report.

2.2 TOPOGRAPHY AND SITE FEATURES

The site is relatively flat and is covered by rough grass. The site boundaries currently comprise walls and metal fencing. Several mature trees were noted near the southern and eastern site boundaries.

2.3 EVIDENCE OF PRESENT AND FORMER LAND USE

There is a single storey building located in the southern area of the site, the site is mainly disused.

3 GEOLOGICAL SETTING

3.1 INFORMATION SOURCES

The geological setting of the site was determined through reference to the following:

- British Geological Survey (BGS) 1: 50,000 scale sheet No 87 Barnsley
- Coal Mining Report from David Bellis Associates (based on data obtained from the Coal Authority).
- Groundsure Report (including historical map extracts)
- BRE Publication BR211 *Radon: Guidance on Protective Measures for New Dwellings*.
- BGS borehole logs.

3.2 GEOLOGY

Drift deposits are not shown on the geological plan.

The solid geology underlying the site comprises the Mexborough Rock of the Upper Carboniferous Middle Coal Measures. The strata are relatively flat lying in the area.

The Sharleston Top coal seam, recorded in the area to be of variable thickness up to 1.90m is shown to outcrop to the south and west of the site and dip below the site.

No significant ground hazards have been identified by the British Geological Survey as reported in the Groundsure Report.

3.3 MINING & QUARRYING

The mining report indicates that the site may be underlain by workings in seven coal seams, the shallowest being the Meltonfield seam at a depth of approximately 226m below ground level.

The geological plan shows the site to be underlain by the Sharleston Top coal seam. There is no evidence from the mining report to indicate that this seam has been worked although the possibility of unrecorded shallow workings cannot be ruled out. The thickness of this seam is recorded on the geological plans to be up to 1.90m in the region. However, information contained within nearby boreholes indicates a shallow coal seam, up dip of the site, with a recorded thickness of 0.46m. As noted in the BGS Internal Report (IR/06/135 – The Penine Lower and Middle Coal Measures formations of the Barnsley District) the seam is noted to increase in thickness to >1m to the north of the site in the Frickely and Hemsworth areas. In view of the depth to the known workings within the Meltonfield coal seam, and based on the generalised vertical section on the geological plan and nearby boreholes the Sharleston Top coal seam would be expected at a depth of around 20m bgl.

The Groundsure report indicates that there may be non-coal mining activities associated with Iron Ore in the area of the site. No evidence is present within the historical plans of such activity and the geological information does not indicate the presence of shallow iron ore below the site.

There are no recorded mine entries within 20m of the site.

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

4 SITE WORKS AND LABORATORY TESTING

4.1 CONCEPTUAL SITE MODEL

A preliminary conceptual site model, including an assessment of potential pollutant linkages, has been determined based on the information from the earlier report.

The site has been occupied previously and it is possible that contamination is present associated with the

demolition of the school buildings previously on site.

The following contaminants have been identified with the demolition of the buildings on site:

- Metals
- PAH
- TPH
- Asbestos

The main receptors include future site residents and the underlying minor aquifer.

4.2 SUMMARY OF INVESTIGATION

Dunelm have previously investigated the larger site area which includes the new proposed residential development area to the south. The following exploratory logs have been considered as part of the geoenvironmental assessment:

Previous Investigation

- Trial pits TP7, TP8, TP10, TP11, TP13 and TP14
- Hand excavated trial pits HDTP01, HDTP08, HDTP09, HDTP10, HDTP11, HDTP12
- Trial pit and Soakaway SA2

New Investigation

- Trial pit and soakaway SA1-1 and SA2-1

Records for each of the exploratory holes noted are included in Appendix C and the locations are shown on Drawing Number D8947/02/02 in Appendix A.

4.3 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 D to this report and discussed in Section 7.

4.4 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 E to this report. Material properties assessed using the results are considered further in the following Section.

5 GROUND CONDITIONS & MATERIAL PROPERTIES

5.1 GENERAL

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

5.2 TOPSOIL

Topsoil was generally not encountered across the site, where encountered in the south eastern area of the site topsoil was 200mm in thickness. The topsoil was noted to be generally free from debris.

5.3 MADE GROUND

Made ground was encountered across the site at depths of between 0.45m to 1.90m bgl. The made ground

generally consisted of granular material including brick, concrete and flagstones. The made ground contained a small proportion of glass.

5.4 BURIED OBSTRUCTIONS

Buried obstructions were not encountered during this investigation. However, the site has been previously developed and it may be possible that they lie undetected elsewhere on the site.

5.5 NATURAL SOILS/ROCK HEAD

The natural soils at the site consisted of gravelly sand considered to represent completely weathered sandstone rockhead.

5.6 EXCAVATION STABILITY

During excavation of the trial pits, the side walls were observed to be generally stable, some instability was noted within the soakaway trial pits below 1.70m.

5.7 GROUNDWATER

Groundwater was not encountered during this investigation or previous investigations.

5.8 HYDROCARBON CONTAMINATION

No visual or olfactory evidence of hydrocarbon contamination was noted during this or previous investigations.

5.9 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 340mg/l and the lowest recorded pH value is 6.7.

Based on the above results, Design Sulfate Class DS-1 and ACEC Classification AC-1 would be appropriate for buried concrete at the site.

5.10 SOAKAWAY TESTS

Soakaway tests have been carried out in trial pits SA2, SA1-1 and SA2-1 in accordance with the methods outlined in BRE Digest 365. The test results are presented in Appendix E.

Calculations to determine the soil infiltration rate (permeability) of the soil were carried out and the calculated soil infiltration rates are listed below:

Trial Pit No.	Initial Water Depth (m)	Soil Infiltration Rate f (m/sec)
TP SA 2	0.44	2.18×10^{-4}
SA1-1	1.67	8.49×10^{-4}
SA2-1	1.34	5.67×10^{-5}

6 CHEMICAL TESTING RESULTS

6.1 SELECTION OF CHEMICAL TESTING

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

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

Laboratory test certificates are presented in Appendix D 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

<i>All values in mg/kg</i>	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.

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
pH	-	2	0	<5 >11	8.4
Arsenic	mg/kg	2	0	37	32
Cadmium	mg/kg	2	0	11	0.66
Chromium (Total)	mg/kg	2	0	910	52
Chromium (VI)	mg/kg	2	0	6	<0.50
Lead*	mg/kg	2	0	200	140
Mercury	mg/kg	2	0	40	0.58
Nickel	mg/kg	2	0	130	32

Selenium	mg/kg	2	0	250	1.0
Copper (GAC from MAFF)	mg/kg	2	0	200	67
Zinc (GAC from MAFF)	mg/kg	2	0	300	200
Asbestos	-	2	0	Present	-

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

The samples tested fall below the relevant guideline values.

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
pH	-	16	0	<5 >11	9.3
Arsenic	mg/kg	16	0	37	18
Cadmium	mg/kg	16	0	11	0.8
Chromium (Total)	mg/kg	16	0	910	73
Chromium VI	mg/kg	16	0	6	<1.0
Lead*	mg/kg	16	0	200	78
Mercury	mg/kg	16	0	40	0.36
Nickel	mg/kg	16	0	130	27
Selenium	mg/kg	16	0	250	0.5
Copper	mg/kg	16	0	2,400	48
Zinc	mg/kg	16	0	3,700	98
Asbestos	-	14	1	Present	Amosite present as fibre bundles in HDTP01 at 0.20m

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

The samples tested fall below the relevant guideline values with the exception of asbestos which was identified within the HDTP01 at 0.20m and will require further consideration.

6.5 ASBESTOS TESTING

Asbestos was present as amosite fibre bundles in HDTP01 at 0.20m bgl.

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.

Analysis for organic determinands has been carried out in general accordance with the EA Report: *The UK Approach for Evaluating Human Health Risks from Petroleum Hydrocarbons in Soils* (2005). Consequently, samples of made ground were tested for the following:

- 13 petroleum hydrocarbon fractions based on the methodology of the United States Total Petroleum Hydrocarbon Criteria Working Group (TPHCWG).
- Polycyclic aromatic hydrocarbon compounds.

All the samples tested for MTBE recorded values below the laboratory detection limit.

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

	Aromatic fractions							Aliphatic fractions					
EC bands	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
Sample location & depth (m bgl)	Recorded concentrations (mg/kg) - exceedances in bold												
HDTP01 0.20m	<0.01	<0.01	<0.01	<0.9	5.1	93	960	<0.01	<0.01	<0.01	<1.5	4.1	751
TP7 0.30m	<0.01	<0.01	<0.01	<0.9	<0.5	<0.6	<1.4	<0.01	<0.01	<0.01	<1.5	<1.2	<3.4
TP7 1.00m	<0.01	<0.01	<0.01	<0.9	<0.5	3.5	16	<0.01	<0.01	<0.01	<1.5	<1.2	<3.4
TP10 0.20m	<0.01	<0.01	<0.01	<0.9	<0.5	0.9	<1.4	<0.01	<0.01	<0.01	<1.5	<1.2	<3.4
TP14 0.20m	<0.01	<0.01	<0.01	<0.9	<0.5	<0.6	<1.4	<0.01	<0.01	<0.01	<1.5	<1.2	<3.4

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.

Samples of made ground were tested for selected polycyclic 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 POLYCYCLIC AROMATIC HYDROCARBONS

Contaminant	Generic Assessment Criteria (mg/kg)					No. of samples tested	No. of samples with value greater than GAC	Max concentration (mg/kg)
	Resi with plant uptake	Residential without home grown produce	Allotments	Comm / industrial	Public Open Space			
Napthalene	5.6	5.6	10	460	4,900	9	0	0.3
Acenaphthylene	420	4,600	69	97,000	15,000	9	0	0.3
Acenaphthene	510	4,700	85	97,000	15,000	9	0	0.5
Fluorene	400	3,800	67	68,000	9,900	9	0	0.6
Phenanthrene	220	1,500	38	22,000	3,100	9	0	5.5
Anthracene	5400	35,000	950	540,000	74,000	9	0	1.6
Fluoranthene	560	1,600	130	23,000	3,100	9	0	15
Pyrene	1,200	3,800	270	54,000	7,400	9	0	15
Benz(a)anthracene	11	14	6.5	170	29	9	0	5.9
Chrysene	22	31	9.4	350	57	9	0	6.1
Benzo(b)fluoranthene	3.3	4	2.1	44	7.2	9	1	TP13 0.30m 4.3mg/kg
Benzo(k)fluoranthene	93	110	75	1200	190	9	0	2.9
Benzo(a)pyrene	2.7	3.2	2	35	5.7	9	1	TP13 0.30m 6.2mg/kg
Indeno(1,2,3-cd)pyrene	36	46	21	510	82	9	0	3.7

Contaminant	Generic Assessment Criteria (mg/kg)					No. of samples tested	No. of samples with value greater than GAC	Max concentration (mg/kg)
	Resi with plant uptake	Residential without home grown produce	Allotments	Comm / industrial	Public Open Space			
Dibenz(a,h)anthracene	0.28	0.32	0.27	3.6	0.57	9	3	SA2 0.30m 0.84mg/kg HDTP01 0.20m 0.80mg/kg TP13 0.30m 0.90mg/kg
Benzo(g,h,i)perylene	340	360	470	4000	640	9	0	2.5

Soil Screening Values from the LQM/CIEH S4ULs for Human Health Risk Assessment (2015) for 2.5% SOM soil, for a residential after use

Results indicate elevated benzo(a)pyrene, dibenz(a,h)anthracene, benzo(b)fluoranthene in the made ground compared to a residential with plant uptake end use; this will require further consideration.

6.7 LEACHABILITY TESTS RESULTS

A summary of the leachability testing results is shown below together with appropriate Tier 1 Remedial Targets based on the environmental setting of the site. In accordance with the methodology described in Environment Agency *R&D Publication 20*, for Tier 1 assessment the Remedial Target is equal to the Target Concentration.

SUMMARY LEACHABILITY TEST RESULTS (INORGANIC)

Contaminant	Units	No. of leachate samples tested	No. of samples exceeding GAC	GAC (Tier 1 Remedial Target)	Max concentration in leachate samples
pH	-	2	0	Range 6.5 - 10 *	7.1
Arsenic	mg/l	2	0	0.01 *	0.0016
Cadmium	mg/l	2	0	0.005 *	<0.00003
Chromium (Total)	mg/l	2	0	0.05 *	<0.00025
Lead	mg/l	2	0	0.01 *	0.00055
Mercury	mg/l	2	0	0.001 *	<0.00001
Selenium	mg/l	2	0	0.01 *	0.00069
Copper	mg/l	2	0	2 *	0.0016
Nickel	mg/l	2	0	0.02 *	<0.0005
Zinc	mg/l	2	0	0.075	<0.00125
Threshold values					
* Water Supply (Water Quality) Regulations 2018					

Based on the above results, the sample tested fall below the Tier 1 remedial targets.

SUMMARY OF LEACHABILITY TESTS RESULTS (ORGANIC)

Contaminant	Units	No. of leachate samples tested	No. of samples exceeding GAC	GAC (Tier 1 Remedial Target)	Max concentration in leachate samples
TPH C ₆ to C ₁₀	mg/l	1	0	(0.001) ♦ *(0.03) # ♦	<0.001
TPH C ₁₀ to C ₄₀	mg/l	1	0	(0.01) **(1) \$\$	<0.01
Benzo(a)pyrene	mg/l	1	1	(0.00001)*	0.00002
Threshold values					
* Water Supply (Water Quality) Regulations 2018					
** Value for oils/hydrocarbons cited in Environment Agency Report <i>Technical Advice to Third Parties on Pollution of Controlled Waters</i>					

for Part IIA of the EPA 1990 (equivalent to drinking water standard)

Environmental Quality Standard

◇ 'Conservative' value assuming all TPH C₆ to C₁₀ is benzene

\$\$ DW3 Criteria For Classification Of Waters limit for Dissolved or Emulsified Hydrocarbons - *Surface Waters (Abstraction for Drinking Water) (Classification) Regulations 1996*

Based on the above results, leachable benzo(a)pyrene was encountered in TP14 at 0.20m and exceeded the Tier 1 remedial targets and require further consideration.

7 ASSESSMENT OF CONTAMINATION RISKS

7.1 SUMMARY OF CONTAMINATION SOURCES

TOPSOIL

Topsoil was generally not encountered across the site, where encountered topsoil was 200mm in thickness. Testing has indicated that this material does not contain elevated concentrations of the determinands tested.

MADE GROUND

The majority of the site is underlain by a layer of granular made ground at depths of between 0.45m to 1.90m thick.

Testing has indicated that this made ground does not contain elevated concentrations of inorganic contaminants.

Asbestos was identified within the made ground within HDTP01 at 0.20m.

HYDROCARBON CONTAMINATION

Results indicate elevated benzo(a)pyrene, dibenz(a,h)anthracene, benzo(b)fluoranthene within the made ground.

LEACHABLE CONTAMINATION

Testing has indicated that the made ground has the potential to produce leachable benzo(a)pyrene at concentrations in excess of the Tier 1 Remedial Target. This is consistent with contamination identified within the soils in this area.

7.2 HAZARD ASSESSMENT

The made ground is contaminated with elevated PAHs and asbestos.

Asbestos may be present undetected elsewhere on the site, it is therefore advised that earthworks are supervised by a qualified asbestos surveyor. All works should be undertaken in accordance with the Control of Asbestos Regulations 2012.

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. D8947/03 in Appendix B.

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
- 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)
- Minor Aquifer

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

Testing of the topsoil where encountered has indicated that this material does not contain elevated concentrations of the determinands tested and has been noted to be generally free from debris.

However it should be noted that the topsoil is of variable thickness. Consequently, a topsoil strip may result in mixing with underlying contaminated or unsuitable made ground and may therefore be considered impractical.

INORGANIC CONTAMINATION - MADE GROUND

The made ground has been found to contain asbestos within HDTP01 at 0.20m; due to the site’s intended use for residential development it is recommended that further delineation of the asbestos containing soils be undertaken. This will allow for the soils to be excavated and removed from site. Alternatively, utilise an area of public open space within the proposed development and to excavate a “borrow pit” to accommodate the impacted made ground. The void would then be backfilled with the made ground containing asbestos and capped with a 0.6m thick clean cover layer with a basal geogrid membrane to act as a no-dig layer.

In addition the made ground has been found to be contaminated with PAHs. 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. This cover thickness would be sufficient to allow combustible materials to remain beneath proposed garden areas.

A no dig layer 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.

An alternative strategy to isolate the contamination from end users would require the contaminated made

ground to be excavated and replaced beneath areas of hardstanding.

Areas of proposed landscaping or tree planting should be provided with an appropriate thickness of clean soils that will provide a suitable growing medium.

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.

LEACHABLE CONTAMINATION

Testing has indicated that the made ground has the potential to produce leachable benzo(a)pyrene at concentrations in excess of the Tier 1 Remedial Target selected. These leachable concentrations are consistent with contamination identified within the soils in this area.

Should the made ground be removed from site then the leachable benzo(a)pyrene will also be removed. Where the made ground is left on site it will either be covered with buildings and other areas of hardstanding or a clean cover layer and mechanical break layer and as such infiltration and leaching will be limited. In this scenario and based on the absence of nearby abstractions and the aquifer being a minor one (not a principal one) the concentrations identified are not expected to pose a significant risk 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

Desk study information indicates that there are no known active or former landfill sites within 250m of the site. The site is not located in an area considered susceptible to mines gas emissions. It is therefore not considered likely that the site will be affected by hazardous gas from these sources.

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.

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 typically up to 1.90m thick. The underlying natural ground consisted of weathered sandstone.

9.2 MINING

The mining report indicates that the site may be underlain by workings in seven coal seams, the shallowest being the Meltonfield seam at a depth of approximately 226m below ground level.

The geological plan shows the site to be underlain by the Sharleston Top coal seam. There is no evidence from the mining report to indicate that this seam has been worked although the possibility of unrecorded shallow workings cannot be ruled out. The thickness of this seam is recorded on the geological plans to be up to 1.90m in the region. However, information contained within nearby boreholes indicates a shallow coal seam, up dip of the site, with a recorded thickness of 0.46m. As noted in the BGS Internal Report (IR/06/135 – The Penine Lower and Middle Coal Measures formations of the Barnsley District) the seam is noted to

increase in thickness to >1m to the north of the site in the Frickely and Hemsworth areas. In view of the depth to the known workings within the Meltonfield coal seam, and based on the generalised vertical section on the geological plan and nearby boreholes the Sharleston Top coal seam would be expected at a depth of around 20m bgl.

The Groundsure report indicates that there may be non-coal mining activities associated with Iron Ore in the area of the site. No evidence is present within the historical plans of such activity and the geological information does not indicate the presence of shallow iron ore below the site.

Based on the above, the risk from mining below the site is considered to be low. However, should this risk require proving then rotary boreholes are recommended.

No evidence has been found to suggest 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-1, with the site allocated an ACEC Classification of AC-1.

Directly beneath the made ground weathered sandstone rockhead was encountered. Based on the visual descriptions an estimated safe bearing capacity of 100kN/m² can be expected for strip or trench fill foundations up to 0.60m wide founding on the weathered rockhead.

It is recommended that foundations in sand be placed at a minimum depth of 0.55m.

In order to minimise disturbance of the base of foundation excavations in sand, the excavator should be fitted with a machine bucket without teeth.

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.

9.5 BURIED OBSTRUCTIONS

Buried obstructions were encountered not encountered during this investigation. However, the site has been previously developed and it may be possible that they lie undetected elsewhere on the site.

9.6 EXCAVATIONS

Observations made during the fieldwork indicate that significant groundwater flows would not 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.

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 relict foundations and other obstructions should be anticipated.

Weathered rockhead was encountered directly below the made ground and should be expected to increase in competency with depth.

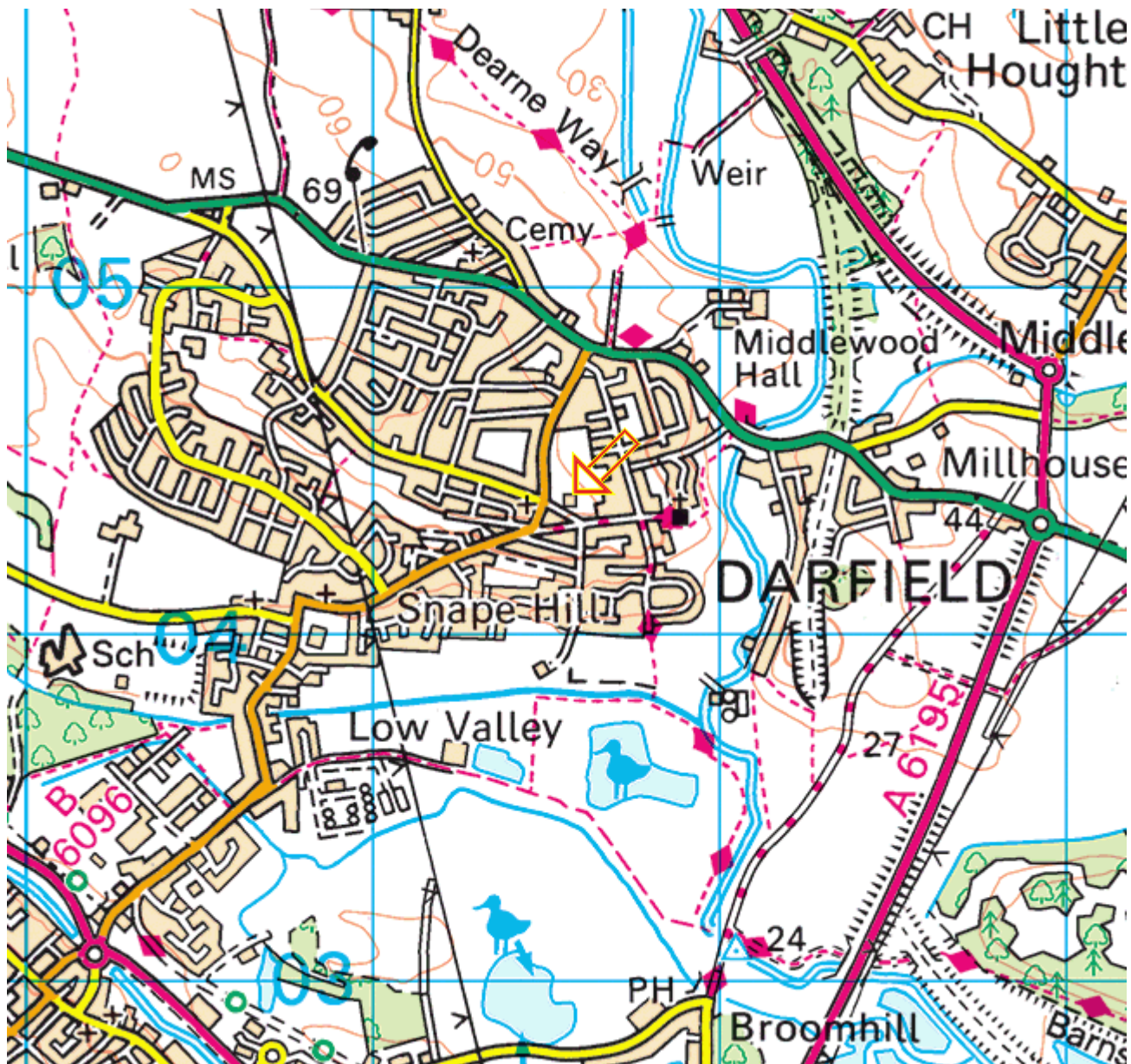
9.7 ROAD PAVEMENT DESIGN

Where the granular made ground is re-engineered it is considered that a CBR value of 5% should be achievable, however, this should be verified by insitu CBR testing on site and confirmed with the adopting authority.

Appendix A

Drawings





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



Contract:
Nanny Marr Road, Darfield Phase 2

Contract No:
D8947

Client:
Partner Construction / Peveril Securities Ltd

TEL: 0191 378 3151
FAX: 0191 378 3157

Drawing Title:
Site Location Plan

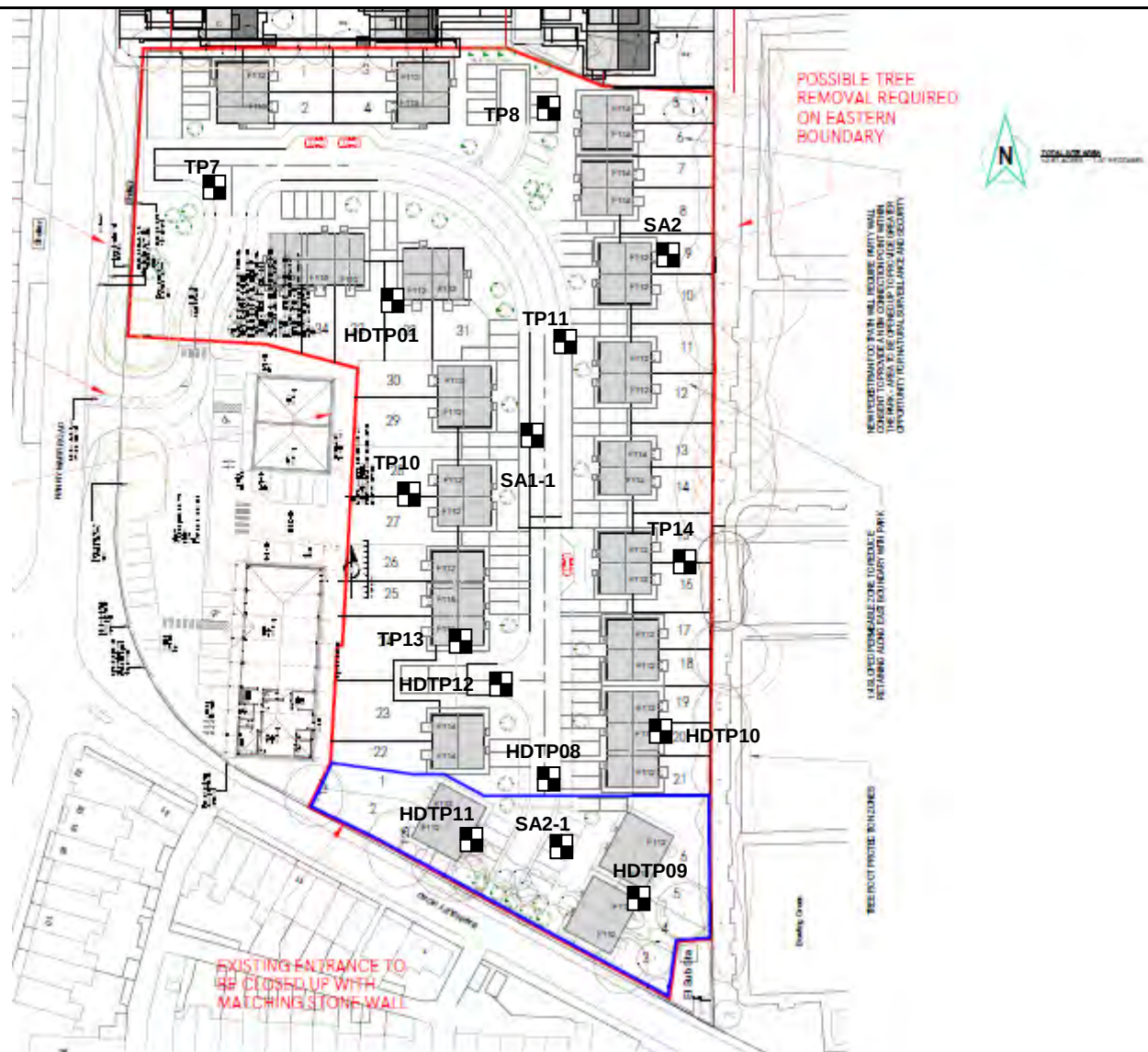
Drawing No:
D8947/02/01

Date:
December 2018

Scale:
NTS

Status:
Final

Drawn by:
SG



Contract:
Nanny Marr Road, Darfield Phase 2

Drawing Title:
Exploratory hole location plan

Drawing No:
D8947/02/02

Date:
December 2018

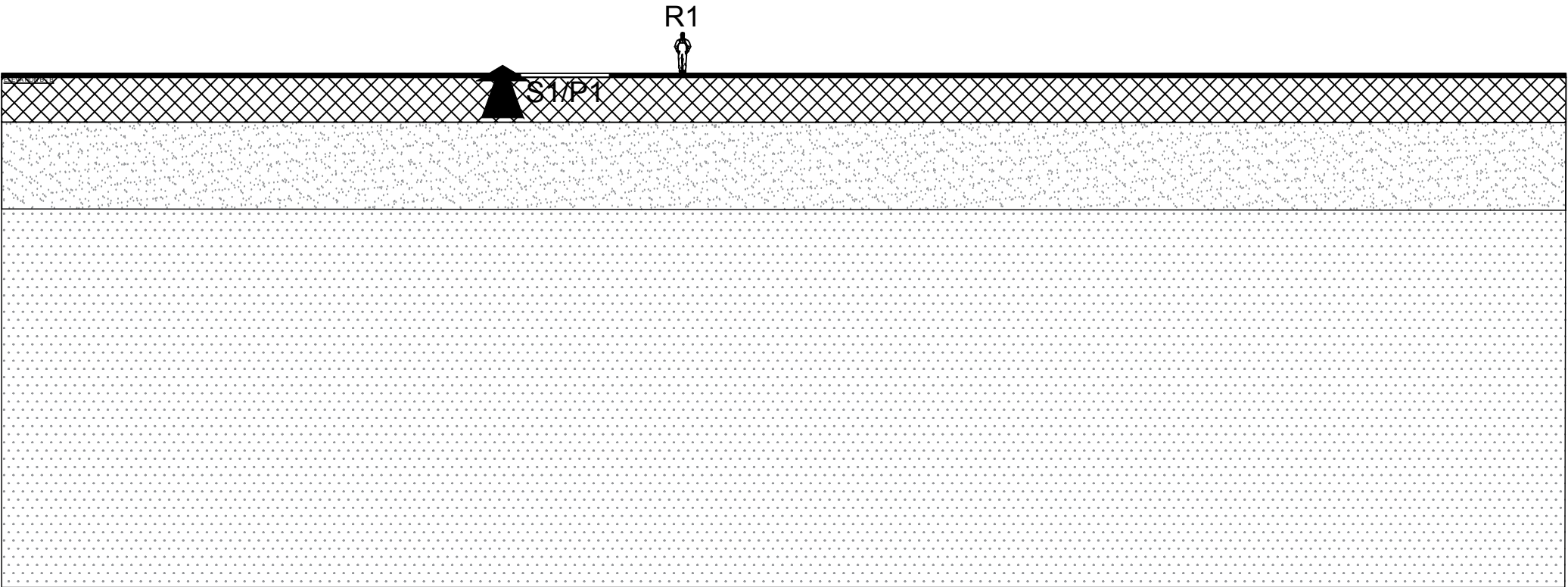
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Drawn by:
SG

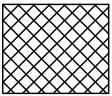
Cross Section Through the Site (Approximately West to East)

Western boundary

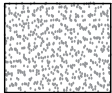
Eastern boundary



Ground Conditions Summary



MADE GROUND



WEATHERED ROCK HEAD



MEXBOROUGH ROCK

Pollutant Linkages

SOURCE

1. Asbestos within the made ground. Elevated PAHs within the made ground.

PATHWAY

1. Ingestion, inhalation and dermal contact with contaminated soil.

RECEPTOR

1. Human Health



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

CLIENT:

Partner Construction and Peveril
Securities Ltd

PROJECT TITLE:

Nanny Marr Road, Darfield Phase 2

DRAWING TITLE:

Conceptual Site Model

DRAWING NUMBER:

D8947/02/03

DATE:

December 2018

Appendix B
Photographs





SA1 - 1



**Photographic
Survey**

Contract: Nanny Marr Road, Darfield Phase 2

Client: Partner Construction/Peveril Securities Ltd

Date: September 2018

Contract No: D8947

Plate: 1



SA2-1



Photographic
Survey

Contract: Nanny Marr Road, Darfield Phase 2

Client: Partner Construction/Peveril Securities Ltd

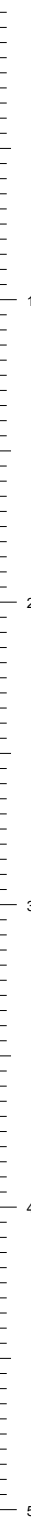
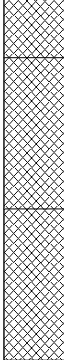
Date: September 2018

Contract No: D8947

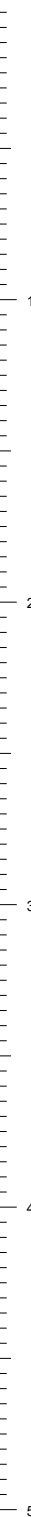
Plate: 2

Appendix C
Exploratory Hole Records

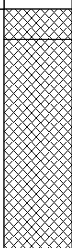


			TRIAL PIT RECORD			TP No. HDP01			
Contract No.: D6643			Site: Nanny Marr Road, Darfield			Scale 1:25			
Client: Partner Construction and Peveril Securities Ltd				Logged By: RB		Sheet 1 of 1			
Method: Hand Dug Trial Pit				Checked By: SC		Dates: 10/09/2015			
SAMPLE DETAILS			Groundwater	STRATA RECORD Description	Depth (m)	Level (m AOD) PID (ppm)	Legend	Backfill	
Type	Depth From-To (m)	Insitu Testing							
ES	0.20			MADE GROUND: Brown slightly gravelly sand. Gravel is angular to sub angular, fine to coarse of sandstone and brick.	(0.20)				
				MADE GROUND: Grey, very gravelly, sandy clay. Sand is fine to medium. Gravel is fine to coarse, angular, subrounded dolomite and brick.	0.20 (0.50)				
ES	0.70			MADE GROUND: Grey, gravelly sand. Sand is fine to coarse. Gravel is angular, subrounded, fine to coarse of sandstone.	0.70 (0.50)				
ES	1.20			End of Trial Pit at 1.20 m	1.20				
Remarks				Ground Water (m)		Excavation Details		Orientation	
				Depth Strike	Remarks	Dimensions: m x m		A C D B °	
						Stability:			
						Weather:			
						Remarks: Hand Dug Trial Pit			

			TRIAL PIT RECORD				TP No. HOTP08		
Contract No.: D6643			Site: Nanny Marr Road, Darfield				Scale 1:25		
Client: Partner Construction and Peveril Securities Ltd				Logged By: RB		Sheet 1 of 1			
Method: Hand Dug Trial Pit				Checked By: SC		Dates: 10/09/2015			
SAMPLE DETAILS			Groundwater	STRATA RECORD Description	Depth (m)	Level (m AOD) PID (ppm)	Legend	Backfill	
Type	Depth From-To (m)	Insitu Testing							
ES	0.20			MADE GROUND: Brown slightly gravelly sand. Gravel is angular to sub angular, fine to coarse of sandstone and brick. MADE GROUND: White sandy gravel. Sand is fine to coarse. Gravel is angular, subrounded, fine to coarse of dolomite.	(0.10) 0.10 (0.70) 0.80				
ES	0.80			End of Trial Pit at 0.80 m					
Remarks				Ground Water (m)		Excavation Details		Orientation	
				Depth Strike	Remarks	Dimensions: m x m		D A C B °	
						Stability:			
						Weather:			
						Remarks: Hand Dug Trial Pit			

			TRIAL PIT RECORD			TP No. HOTP09			
Contract No.: D6643			Site: Nanny Marr Road, Darfield			Scale 1:25			
Client: Partner Construction and Peveril Securities Ltd				Logged By: RB		Sheet 1 of 1			
Method: Hand Dug Trial Pit				Checked By: SC		Dates: 10/09/2015			
SAMPLE DETAILS			Groundwater	STRATA RECORD Description	Depth (m)	Level (m AOD) PID (ppm)	Legend	Backfill	
Type	Depth From-To (m)	Insitu Testing							
ES	0.20			MADE GROUND: Brown slightly gravelly sand. Gravel is angular to sub angular, fine to coarse of sandstone and brick.	(0.20)				
				MADE GROUND: Brown and grey, slightly gravelly, sandy clay. Sand is fine to medium. Gravel is subangular, subrounded, fine to coarse of sandstone and brick.	0.20 (0.30)				
ES	0.50			Light brown, gravelly SAND. Sand is fine to medium. Gravel is subangular, subrounded, fine to coarse of sandstone.	0.50 (0.60)				
				Light brown, fine to medium SAND.	1.10 (0.10)				
				End of Trial Pit at 1.20 m	1.20				
Remarks				Ground Water (m)		Excavation Details		Orientation	
				Depth Strike	Remarks	Dimensions: m x m		A C D B °	
						Stability:			
						Weather:			
						Remarks: Hand Dug Trial Pit			

Remarks	Ground Water (m)		Excavation Details	Orientation
	Depth Strike	Remarks	Dimensions: m x m	D A B C °
			Stability:	
			Weather:	
			Remarks: Hand Dug Trial Pit	

			TRIAL PIT RECORD				TP No. HOTP12		
Contract No.: D6643			Site: Nanny Marr Road, Darfield				Scale 1:25		
Client: Partner Construction and Peveril Securities Ltd				Logged By: RB		Sheet 1 of 1			
Method: Hand Dug Trial Pit				Checked By: SC		Dates: 10/09/2015			
SAMPLE DETAILS			Groundwater	STRATA RECORD Description	Depth (m)	Level (m AOD) PID (ppm)	Legend	Backfill	
Type	Depth From-To (m)	Insitu Testing							
ES	0.20			MADE GROUND: Brown slightly gravelly sand. Gravel is angular to sub angular, fine to coarse of sandstone and brick. MADE GROUND: White sandy gravel. Sand is fine to coarse. Gravel is angular, subrounded, fine to coarse of dolomite.	(0.10)				
ES	0.30				0.10				
ES	0.85				(0.70)				
				End of Trial Pit at 0.80 m	0.80				
Remarks				Ground Water (m)		Excavation Details		Orientation	
				Depth Strike	Remarks	Dimensions: m x m		D A C B °	
						Stability:			
						Weather:			
						Remarks: Hand Dug Trial Pit			

			TRIAL PIT RECORD			TP No. TP7			
Contract No.: D6643			Site: Nanny Marr Road, Darfield			Scale 1:25			
Client: Partner Construction and Peveril Securities Ltd				Logged By: FM		Sheet 1 of 1			
Method: JCB 3CX				Checked By: AIL		Dates: 16/02/2015			
SAMPLE DETAILS			Groundwater	STRATA RECORD Description	Depth (m)	Level (m AOD) PID (ppm)	Legend	Backfill	
Type	Depth From-To (m)	Insitu Testing							
D ES	0.20 0.20			MADE GROUND: Brown slightly gravelly sand with occasional cobbles. Gravel is angular to sub angular, fine to coarse of sandstone, mudstone, brick and glass. Cobbles are sub angular of sandstone.	(0.25)				
				MADE GROUND: Brown, slightly gravelly sand. Gravel is angular, fine to coarse of brick, sandstone, concrete, flag stones and pottery.	0.25				
D ES	1.00 1.00		1		(1.65)				
D	2.00		2	Yellow highly weathered sandstone. Recovered as gravelly SAND. Gravel is fine to coarse, sub angular to angular of sandstone.	1.90 (0.40)				
				End of Trial Pit at 2.30 m	2.30				
			3						
			4						
			5						
Remarks				Ground Water (m)		Excavation Details		Orientation	
1) No groundwater encountered.				Depth Strike	Remarks	Dimensions: m x m		D A C B °	
						Stability: Stable			
						Weather: Dry			
						Remarks: JCB 3CX			

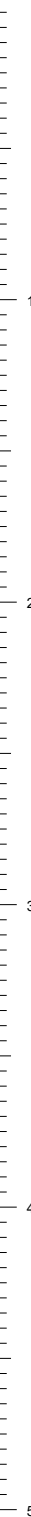
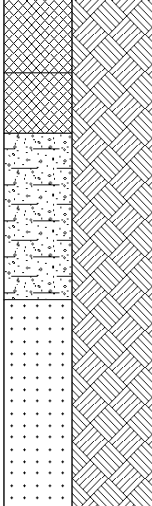
			TRIAL PIT RECORD				TP No. TP10		
Contract No.: D6643			Site: Nanny Marr Road, Darfield				Scale 1:25		
Client: Partner Construction and Peveril Securities Ltd			Logged By: FM		Sheet 1 of 1				
Method: JCB 3CX			Checked By: AIL		Dates: 16/02/2015				
SAMPLE DETAILS			Groundwater	STRATA RECORD Description	Depth (m)	Level (m AOD) PID (ppm)	Legend	Backfill	
Type	Depth From-To (m)	Insitu Testing							
D ES	0.20 0.20			MADE GROUND: Brown slightly gravelly sand with occasional cobbles. Gravel is angular to sub angular, fine to coarse of sandstone, mudstone, brick and glass. Cobbles are sub angular of sandstone. MADE GROUND: Brown, slightly gravelly sand. Gravel is angular, fine to coarse of brick, sandstone, concrete, flag stones and pottery.	(0.20) 0.20				
ES	0.50					(0.90)			
D	1.00			1	Yellow highly weathered sandstone. Recovered as gravelly SAND. Gravel is fine to coarse, sub angular to angular of sandstone.	1.10			
D	2.00			2		(1.90)			
D	3.00		3	End of Trial Pit at 3.00 m	3.00				
			4						
			5						
Remarks				Ground Water (m)		Excavation Details		Orientation	
1) No groundwater encountered.				Depth Strike	Remarks	Dimensions: m x m		D A C B °	
						Stability: Stable			
						Weather: Dry			
						Remarks: JCB 3CX			

			TRIAL PIT RECORD				TP No. TP11		
Contract No.: D6643			Site: Nanny Marr Road, Darfield				Scale 1:25		
Client: Partner Construction and Peveril Securities Ltd				Logged By: FM		Sheet 1 of 1			
Method: JCB 3CX				Checked By: AIL		Dates: 16/02/2015			
SAMPLE DETAILS			Groundwater	STRATA RECORD Description	Depth (m)	Level (m AOD) PID (ppm)	Legend	Backfill	
Type	Depth From-To (m)	Insitu Testing							
D ES	0.20 0.20			MADE GROUND: Brown slightly gravelly sand with occasional cobbles. Gravel is angular to sub angular, fine to coarse of sandstone, mudstone, brick and glass. Cobbles are sub angular of sandstone.	(0.25)				
	D ES	0.50 0.50		MADE GROUND: Brown, slightly gravelly sand. Gravel is angular, fine to coarse of brick, sandstone, concrete, flag stones and pottery.	0.25 (0.35)				
D		1.70			Yellow highly weathered sandstone. Recovered as gravelly SAND. Gravel is fine to coarse, sub angular to angular of sandstone.				0.60
D	2.50				(2.40)				
			1						
			2						
			3	End of Trial Pit at 3.00 m	3.00				
			4						
			5						
Remarks				Ground Water (m)		Excavation Details		Orientation	
1) No groundwater encountered.				Depth Strike	Remarks	Dimensions: m x m		D A C B °	
						Stability: Stable			
						Weather: Dry			
						Remarks: JCB 3CX			

Remarks	Ground Water (m)		Excavation Details	Orientation
1) No groundwater encountered.	Depth Strike	Remarks	Dimensions: m x m	A C D B
			Stability: Stable	
			Weather: Dry	
			Remarks: JCB 3CX	

			TRIAL PIT RECORD			TP No. TP14			
Contract No.: D6643			Site: Nanny Marr Road, Darfield			Scale 1:25			
Client: Partner Construction and Peveril Securities Ltd				Logged By: FM		Sheet 1 of 1			
Method: JCB 3CX				Checked By: AIL		Dates: 16/02/2015			
SAMPLE DETAILS			Groundwater	STRATA RECORD Description	Depth (m)	Level (m AOD) PID (ppm)	Legend	Backfill	
Type	Depth From-To (m)	Insitu Testing							
D ES	0.20 0.20			MADE GROUND: Brown slightly gravelly sand with occasional cobbles. Gravel is angular to sub angular, fine to coarse of sandstone and brick. Cobbles are angular, fine of brick. MADE GROUND: White gravel. Gravel is fine to coarse, sub angular to angular of dolomite.	(0.20) 0.20				
	D	1.00		1	Yellow weathered sandstone. Recovered as gravelly SAND. Gravel is fine to coarse, sub angular to angular of sandstone.	1.20			
D	2.00		2		(1.80)				
D	3.00		3	End of Trial Pit at 3.00 m	3.00				
			4						
			5						
Remarks				Ground Water (m)		Excavation Details		Orientation	
1) No groundwater encountered.				Depth Strike	Remarks	Dimensions: m x m		D A C B °	
						Stability: Stable			
						Weather: Dry			
						Remarks: JCB 3CX			

Remarks	Ground Water (m)		Excavation Details	Orientation
1. No groundwater encountered. 2. Fracture within the sandstone recovered at 1.80m.	Depth	Strike	Dimensions: 0.60m x 2.80m	D A C B 10°
			Stability: Unstable	
			Weather: Dry	
			Remarks: Machine Excavated Trial Pit	

			TRIAL PIT RECORD			TP No. SA2-1			
Contract No.: D8947			Site: Nanny Marr Road, Darfield Phase Two			Scale 1:25			
Client: Partner Construction and Peveril Securities Ltd			Logged By: AH			Sheet 1 of 1			
Method: Machine Excavated Trial Pit			Checked By: SG			Dates: 24/08/2018			
SAMPLE DETAILS			Groundwater	STRATA RECORD Description	Depth (m)	Level (m AOD) PID (ppm)	Legend	Backfill	
Type	Depth From-To (m)	Insitu Testing							
D ES	0.10 0.10			MADE GROUND: Dark brown slightly gravelly, sandy topsoil. Sand is fine to coarse. Gravel is angular to subangular, fine to coarse of sandstone and mudstone.	(0.25)				
ES	0.30			MADE GROUND: Dark brown slightly gravelly sand. Sand is fine to coarse. Gravel is fine to coarse, angular to subangular of sandstone and brick.	0.25 (0.20)				
B D	0.50 0.50			0.25m-1.10m: Orange and yellow sandy fine to coarse gravel. Dark brown slightly gravelly, clayey SAND. Sand is fine to coarse. Gravel is fine to coarse, angular of sandstone. (Possible weathered sandstone)	0.45 (0.55)				
				Destructured dark brown SANDSTONE. Recovered as sandy gravel. Gravel is fine to coarse, angular of sandstone.	1.00 (0.70)				
B D ES	1.50 1.50 1.50			End of Trial Pit at 1.70 m	1.70				
Remarks				Ground Water (m)		Excavation Details		Orientation	
1. No groundwater encountered. 2. Trial pit collapse at 1.70m.				Depth Strike	Remarks	Dimensions: 0.60m x 2.20m		D A C B 80°	
						Stability: Unstable			
						Weather: Dry			
						Remarks: Machine Excavated Trial Pit			

Appendix D
Chemical Testing Records





2183

Final Report

Report No.: 18-27421-1

Initial Date of Issue: 18-Sep-2018

Client Dunelm Geotechnical and Environmental

Client Address: Foundation House
St Johns Road
Meadowfield
County Durham
DH78TZ

Contact(s): Sarah Grieves

Project D8947 - Nanny Marr Road

Quotation No.: **Date Received:** 11-Sep-2018

Order No.: **Date Instructed:** 11-Sep-2018

No. of Samples: 4

Turnaround (Wkdays): 5 **Results Due:** 17-Sep-2018

Date Approved: 18-Sep-2018

Approved By:



Details: Martin Dyer, Laboratory Manager

Project: D8947 - Nanny Marr Road

Client: Dunelm Geotechnical and Environmental	Chemtest Job No.:				18-27421	18-27421	18-27421	18-27421
Quotation No.:	Chemtest Sample ID.:				685766	685767	685768	685769
	Sample Location:				SA1	SA1	SA2	SA2
	Sample Type:				SOIL	SOIL	SOIL	SOIL
	Top Depth (m):				0.10	0.30	0.10	0.30
	Date Sampled:				24-Aug-2018	24-Aug-2018	24-Aug-2018	24-Aug-2018
	Asbestos Lab:				COVENTRY	COVENTRY	COVENTRY	COVENTRY
Determinand	Accred.	SOP	Units	LOD				
ACM Type	U	2192		N/A	-	-	-	-
Asbestos Identification	U	2192	%	0.001	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected
Moisture	N	2030	%	0.020	8.7	6.0	6.5	9.0
pH	U	2010		N/A	7.7	8.4	8.4	8.1
Sulphate (2:1 Water Soluble) as SO4	U	2120	g/l	0.010	0.029	0.012	0.052	< 0.010
Arsenic	U	2450	mg/kg	1.0	32	5.1	23	13
Cadmium	U	2450	mg/kg	0.10	0.66	< 0.10	0.50	0.16
Chromium	U	2450	mg/kg	1.0	52	8.7	22	11
Copper	U	2450	mg/kg	0.50	67	9.6	42	20
Mercury	U	2450	mg/kg	0.10	0.58	< 0.10	0.21	< 0.10
Nickel	U	2450	mg/kg	0.50	32	17	24	16
Lead	U	2450	mg/kg	0.50	140	9.8	120	34
Selenium	U	2450	mg/kg	0.20	1.0	0.27	0.46	0.31
Zinc	U	2450	mg/kg	0.50	200	20	130	45
Chromium (Hexavalent)	N	2490	mg/kg	0.50	< 0.50	< 0.50	< 0.50	< 0.50
Organic Matter	U	2625	%	0.40	8.6	< 0.40	4.7	2.2
Aliphatic TPH >C5-C6	N	2680	mg/kg	1.0		[B] < 1.0		[B] < 1.0
Aliphatic TPH >C6-C8	N	2680	mg/kg	1.0		[B] < 1.0		[B] < 1.0
Aliphatic TPH >C8-C10	U	2680	mg/kg	1.0		[B] < 1.0		[B] < 1.0
Aliphatic TPH >C10-C12	U	2680	mg/kg	1.0		[B] < 1.0		[B] < 1.0
Aliphatic TPH >C12-C16	U	2680	mg/kg	1.0		[B] < 1.0		[B] < 1.0
Aliphatic TPH >C16-C21	U	2680	mg/kg	1.0		[B] < 1.0		[B] < 1.0
Aliphatic TPH >C21-C35	U	2680	mg/kg	1.0		[B] < 1.0		[B] < 1.0
Aliphatic TPH >C35-C44	N	2680	mg/kg	1.0		[B] < 1.0		[B] < 1.0
Total Aliphatic Hydrocarbons	N	2680	mg/kg	5.0		[B] < 5.0		[B] < 5.0
Aromatic TPH >C5-C7	N	2680	mg/kg	1.0		[B] < 1.0		[B] < 1.0
Aromatic TPH >C7-C8	N	2680	mg/kg	1.0		[B] < 1.0		[B] < 1.0
Aromatic TPH >C8-C10	U	2680	mg/kg	1.0		[B] < 1.0		[B] < 1.0
Aromatic TPH >C10-C12	U	2680	mg/kg	1.0		[B] < 1.0		[B] < 1.0
Aromatic TPH >C12-C16	U	2680	mg/kg	1.0		[B] < 1.0		[B] < 1.0
Aromatic TPH >C16-C21	U	2680	mg/kg	1.0		[B] < 1.0		[B] < 1.0
Aromatic TPH >C21-C35	U	2680	mg/kg	1.0		[B] < 1.0		[B] < 1.0
Aromatic TPH >C35-C44	N	2680	mg/kg	1.0		[B] < 1.0		[B] < 1.0
Total Aromatic Hydrocarbons	N	2680	mg/kg	5.0		[B] < 5.0		[B] < 5.0
Total Petroleum Hydrocarbons	N	2680	mg/kg	10.0		[B] < 10		[B] < 10
Naphthalene	U	2700	mg/kg	0.10	4.9	< 0.10	2.2	0.13
Acenaphthylene	U	2700	mg/kg	0.10	1.0	< 0.10	1.3	0.10

Results - Soil

Client: Dunelm Geotechnical and Environmental	Chemtest Job No.:				18-27421	18-27421	18-27421	18-27421
Quotation No.:	Chemtest Sample ID.:				685766	685767	685768	685769
	Sample Location:				SA1	SA1	SA2	SA2
	Sample Type:				SOIL	SOIL	SOIL	SOIL
	Top Depth (m):				0.10	0.30	0.10	0.30
	Date Sampled:				24-Aug-2018	24-Aug-2018	24-Aug-2018	24-Aug-2018
	Asbestos Lab:				COVENTRY	COVENTRY	COVENTRY	COVENTRY
Determinand	Accred.	SOP	Units	LOD				
Acenaphthene	U	2700	mg/kg	0.10	0.49	< 0.10	11	0.24
Fluorene	U	2700	mg/kg	0.10	1.3	< 0.10	12	0.27
Phenanthrene	U	2700	mg/kg	0.10	5.9	< 0.10	94	1.8
Anthracene	U	2700	mg/kg	0.10	1.7	< 0.10	21	0.49
Fluoranthene	U	2700	mg/kg	0.10	7.1	0.37	86	2.3
Pyrene	U	2700	mg/kg	0.10	7.4	0.59	82	2.5
Benzo[a]anthracene	U	2700	mg/kg	0.10	4.3	< 0.10	31	1.5
Chrysene	U	2700	mg/kg	0.10	5.7	< 0.10	35	2.4
Benzo[b]fluoranthene	U	2700	mg/kg	0.10	4.4	< 0.10	33	2.9
Benzo[k]fluoranthene	U	2700	mg/kg	0.10	1.8	< 0.10	13	0.88
Benzo[a]pyrene	U	2700	mg/kg	0.10	3.7	< 0.10	28	2.2
Indeno(1,2,3-c,d)Pyrene	U	2700	mg/kg	0.10	2.5	< 0.10	1.4	2.4
Dibenz(a,h)Anthracene	U	2700	mg/kg	0.10	0.70	< 0.10	4.5	0.84
Benzo[g,h,i]perylene	U	2700	mg/kg	0.10	2.1	< 0.10	16	1.8
Total Of 16 PAH's	U	2700	mg/kg	2.0	55	< 2.0	470	23

Deviations

In accordance with UKAS Policy on Deviating Samples TPS 63. Chemtest have a procedure to ensure 'upon receipt of each sample a competent laboratory shall assess whether the sample is suitable with regard to the requested test(s)'. This policy and the respective holding times applied, can be supplied upon request. The reason a sample is declared as deviating is detailed below. Where applicable the analysis remains UKAS/MCERTs accredited but the results may be compromised.

Sample:	Sample Ref:	Sample ID:	Sample Location:	Sampled Date:	Deviation Code(s):	Containers Received:
685767			SA1	24-Aug-2018	B	Amber Glass 250ml
685767			SA1	24-Aug-2018	B	Amber Glass 60ml
685769			SA2	24-Aug-2018	B	Amber Glass 250ml
685769			SA2	24-Aug-2018	B	Amber Glass 60ml

SOP	Title	Parameters included	Method summary
2010	pH Value of Soils	pH	pH Meter
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <37°C.
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES
2192	Asbestos	Asbestos	Polarised light microscopy / Gravimetry
2450	Acid Soluble Metals in Soils	Metals, including: Arsenic; Barium; Beryllium; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Vanadium; Zinc	Acid digestion followed by determination of metals in extract by ICP-MS.
2490	Hexavalent Chromium in Soils	Chromium [VI]	Soil extracts are prepared by extracting dried and ground soil samples into boiling water. Chromium [VI] is determined by 'Aquakem 600' Discrete Analyser using 1,5-diphenylcarbazide.
2625	Total Organic Carbon in Soils	Total organic Carbon (TOC)	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.
2680	TPH A/A Split	Aliphatics: >C5–C6, >C6–C8,>C8–C10, >C10–C12, >C12–C16, >C16–C21, >C21–C35, >C35– C44Aromatics: >C5–C7, >C7–C8, >C8– C10, >C10–C12, >C12–C16, >C16– C21, >C21– C35, >C35– C44	Dichloromethane extraction / GCxGC FID detection
2700	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Soil by GC-FID	Acenaphthene; Acenaphthylene; Anthracene; Benzo[a]Anthracene; Benzo[a]Pyrene; Benzo[b]Fluoranthene; Benzo[ghi]Perylene; Benzo[k]Fluoranthene; Chrysene; Dibenzo[ah]Anthracene; Fluoranthene; Fluorene; Indeno[123cd]Pyrene; Naphthalene; Phenanthrene; Pyrene	Dichloromethane extraction / GC-FID

Report Information

Key

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

Comments or interpretations are beyond the scope of UKAS accreditation

The results relate only to the items tested

Uncertainty of measurement for the determinands tested are available upon request

None of the results in this report have been recovery corrected

All results are expressed on a dry weight basis

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

For all other tests the samples were dried at < 37°C prior to analysis

All Asbestos testing is performed at the indicated laboratory

Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

Sample Deviation Codes

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

Sample Retention and Disposal

All soil samples will be retained for a period of 45 days from the date of receipt

All water samples will be retained for 14 days from the date of receipt

Charges may apply to extended sample storage

If you require extended retention of samples, please email your requirements to:

customerservices@chemtest.com

Appendix E

Geotechnical Testing Results (including Soakaway Test Results)





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Final Report

Report No.:	18-27605-1		
Initial Date of Issue:	18-Sep-2018		
Client	Dunelm Geotechnical and Environmental		
Client Address:	Foundation House St Johns Road Meadowfield County Durham DH78TZ		
Contact(s):	Sarah Grieves		
Project	D8947 - Nanny Marr Road		
Quotation No.:		Date Received:	12-Sep-2018
Order No.:		Date Instructed:	12-Sep-2018
No. of Samples:	1		
Turnaround (Wkdays):	5	Results Due:	18-Sep-2018
Date Approved:	18-Sep-2018		
Approved By:			
			
Details:	Robert Monk, Technical Manager		

Project: D8947 - Nanny Marr Road

Results - Soil

Client: Dunelm Geotechnical and Environmental	Chemtest Job No.:		18-27605		
Quotation No.:	Chemtest Sample ID.:		686911		
	Sample Location:		SA2		
	Sample Type:		SOIL		
	Top Depth (m):		1.50		
	Date Sampled:		24-Aug-2018		
Determinand	Accred.	SOP	Units	LOD	
Moisture	N	2030	%	0.020	6.7
pH	U	2010		N/A	7.9
Sulphate (2:1 Water Soluble) as SO ₄	U	2120	g/l	0.010	< 0.010

SOP	Title	Parameters included	Method summary
2010	pH Value of Soils	pH	pH Meter
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <37°C.
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES

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All results are expressed on a dry weight basis

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

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Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

Sample Deviation Codes

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

Sample Retention and Disposal

All soil samples will be retained for a period of 45 days from the date of receipt

All water samples will be retained for 14 days from the date of receipt

Charges may apply to extended sample storage

If you require extended retention of samples, please email your requirements to:

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2183

Final Report

Report No.:	18-27789-1		
Initial Date of Issue:	18-Sep-2018		
Client	Solmek Ltd		
Client Address:	12 Yarm Road Stockton-on-Tees TS18 3NA		
Contact(s):	Kathryn Watkin Office		
Project	D8947 - Nanny Marr Road		
Quotation No.:		Date Received:	13-Sep-2018
Order No.:		Date Instructed:	13-Sep-2018
No. of Samples:	3		
Turnaround (Wkdays):	5	Results Due:	19-Sep-2018
Date Approved:	18-Sep-2018		
Approved By:			



Details: Robert Monk, Technical Manager

Project: D8947 - Nanny Marr Road

Client: Solmek Ltd	Chemtest Job No.:				18-27789	18-27789	18-27789
Quotation No.:	Chemtest Sample ID.:				687751	687752	687753
	Sample Location:				SA1	SA2	SA2
	Sample Type:				SOIL	SOIL	SOIL
	Top Depth (m):				0.50	0.50	1.50
Determinand	Accred.	SOP	Units	LOD			
Moisture	N	2030	%	0.020	6.6	8.6	6.7
pH	U	2010		N/A	[A] 7.7	[A] 8.1	[A] 8.1
Sulphate (2:1 Water Soluble) as SO ₄	U	2120	mg/l	10.000	< 10	< 10	< 10

Deviations

In accordance with UKAS Policy on Deviating Samples TPS 63. Chemtest have a procedure to ensure 'upon receipt of each sample a competent laboratory shall assess whether the sample is suitable with regard to the requested test(s)'. This policy and the respective holding times applied, can be supplied upon request. The reason a sample is declared as deviating is detailed below. Where applicable the analysis remains UKAS/MCERTs accredited but the results may be compromised.

Sample:	Sample Ref:	Sample ID:	Sample Location:	Sampled Date:	Deviation Code(s):	Containers Received:
687751			SA1		A	Plastic Tub 1000g
687752			SA2		A	Plastic Tub 1000g
687753			SA2		A	Plastic Tub 1000g

SOP	Title	Parameters included	Method summary
2010	pH Value of Soils	pH	pH Meter
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <37°C.
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES

Report Information

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- > "greater than"

Comments or interpretations are beyond the scope of UKAS accreditation

The results relate only to the items tested

Uncertainty of measurement for the determinands tested are available upon request

None of the results in this report have been recovery corrected

All results are expressed on a dry weight basis

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

For all other tests the samples were dried at < 37°C prior to analysis

All Asbestos testing is performed at the indicated laboratory

Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

Sample Deviation Codes

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

Sample Retention and Disposal

All soil samples will be retained for a period of 45 days from the date of receipt

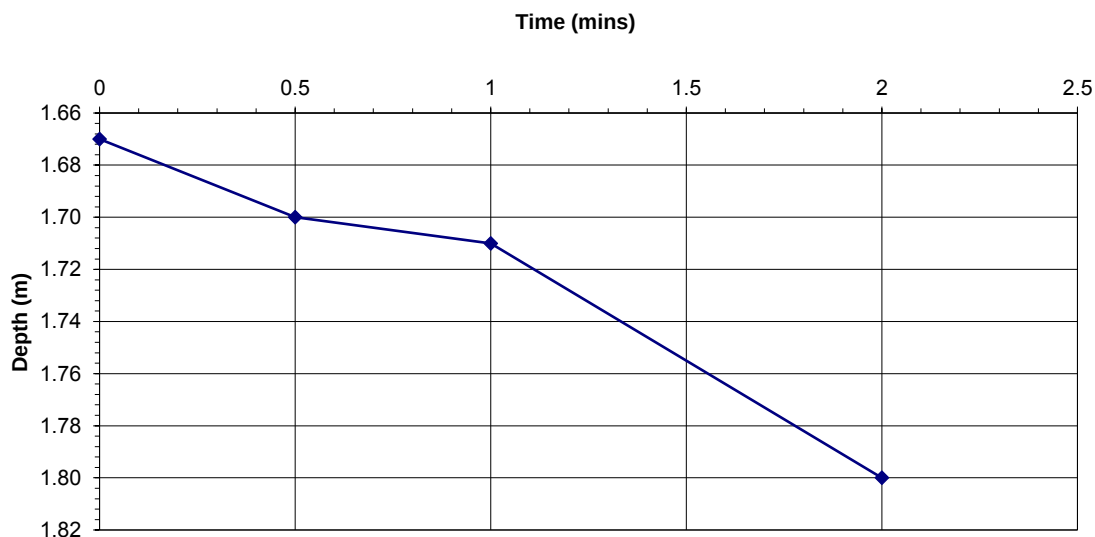
All water samples will be retained for 14 days from the date of receipt

Charges may apply to extended sample storage

If you require extended retention of samples, please email your requirements to:

customerservices@chemtest.com

SOAKAWAY DESIGN IN ACCORDANCE WITH BRE DIGEST 365: 2016 BRE Digest 365, Figure 2, Page 5					
Client: Partner Construction					
Site: Nanny Marr Road, Darfield Phase Two					
Job No: D8947					
Pit No: SA1-1		Test No: 1			
CALCULATION OF SOIL INFILTRATION RATE					
Time (min)	Depth (m)	Pit Dimensions		Length (m) =	2.20
0	1.67			Width (m) =	0.60
0.5	1.70			Depth (m) =	1.80
1	1.71				
2	1.80	Depth at start of test (m) = 1.670			
3		Depth at end of test (m) = 1.800			
4		75% level (m) = 1.703			
5		50% Effective Depth 0.065			
6		25% level (m) = 1.768			
7					
8		Base area of pit (m ²) = 1.320			
9		V _{p75-25} (m ³) = 0.086			
10		α_{p50} (m ²) = 1.684			
15					
20		From the graph:			
25		tp 75 (min) = 0.5			
30		tp 25 (min) = 1.5			
40					
50		Soil infiltration rate, f, (m/s) =		8.49E-04	normal test
		Input by:	NS	Date:	29.08.18
		Checked by:	SG	Date:	07.09.18



SOAKAWAY DESIGN IN ACCORDANCE WITH BRE DIGEST 365: 2016
BRE Digest 365, Figure 2, Page 5

Client: Partner Construction

Site: Nanny Marr Road, Darfield Phase Two

Job No: D8947

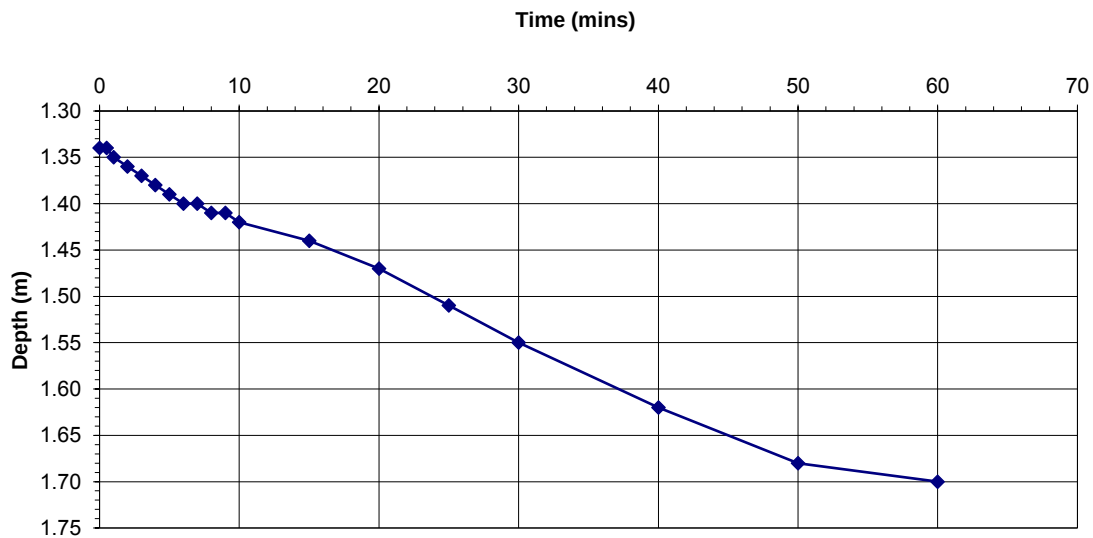
Pit No: SA2-1

Test No:

1

CALCULATION OF SOIL INFILTRATION RATE

Time (min)	Depth (m)	Pit Dimensions		Length (m) =	2.20
0	1.34			Width (m) =	0.60
0.5	1.34			Depth (m) =	1.70
1	1.35				
2	1.36	Depth at start of test (m) = 1.340			
3	1.37	Depth at end of test (m) = 1.700			
4	1.38	75% level (m) = 1.430			
5	1.39	50% Effective Depth 0.180			
6	1.40	25% level (m) = 1.610			
7	1.40				
8	1.41	Base area of pit (m ²) = 1.320			
9	1.41	V _{p75-25} (m ³) = 0.238			
10	1.42	α_{p50} (m ²) = 2.328			
15	1.44				
20	1.47	From the graph:			
25	1.51	tp 75 (min) = 10			
30	1.55	tp 25 (min) = 40			
40	1.62				
50	1.68	Soil infiltration rate, f, (m/s) =		5.67E-05	normal test
60	1.70				
		Input by:	NS	Date:	29.08.18
		Checked by:	SG	Date:	07.09.18



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.