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PHASE 2: GROUND INVESTIGATION REPORT

MAUGHAN, REYNOLDS PARTNERSHIP LIMITED / ST. AIDAN'S COURT

(SOUTH SHIELDS) LIMITED

PROPOSED RESIDENTIAL DEVELOPMENT

FORMER SITE OF ST. AIDAN'S CHURCH

SOUTH SHIELDS

TYNE & WEAR

Project No: 08-494

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The information and/or advice contained in this Phase 2: Ground Investigation Report is based solely on, and is limited to, the boundaries of the site, the immediate area around the site, and the historical use(s) unless otherwise stated. This 'Report' has been prepared in order to collate information relating to the physical, environmental and industrial setting of the site, and to highlight, where possible, the likely problems that might be encountered when considering the future development of this site for the proposed end use. All comments, opinions, diagrams, cross sections and/or sketches contained within the report, and/or any configuration of the findings is conjectural and given for guidance only and confirmation of the anticipated ground conditions should be considered before development proceeds. Agreement for the use or copying of this report by any Third Party must be obtained in writing from Arc Environmental Limited (ARC). If a change in the proposed land use is envisaged, then a reassessment of the site should be carried out.

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1.0 Introduction

January 2009

As requested by Maughan, Reynolds Partnership Limited, of Gateshead, Tyne & Wear, on behalf of their client St. Aidan's Court (South Shields) Limited, and in conjunction with the Phase 1: Desk Top Study Report (Ref no. 08-329), Ground Investigation works have been carried out over an area of land, formerly occupied by St Aidan's Church, located within South Shields, where it is proposed to redevelop the site, comprising the construction of 9 no. 4 bedroom residential town houses, with associated private garden areas, soft landscaping and access roads.

Prior to the completion of the DTS and the GIR an Archaeological Assessment (Report Number 580, May 2006) was completed by the Archaeology Department of Tyne & Wear Museums. This was completed to assess the likelihood of archaeological remains being present below the site. It is known that a Roman vicus (civilian settlement) has been identified in the local area which included cemeteries and is also believed to be the site of an unidentified port.

It is likely that any archaeological deposits that may have been present below the site may have been removed or heavily truncated within the former location of St. Aidan's Church. However, the Archaeology Department of Tyne & Wear Museums detail that there may be the possibility that Roman archaeological deposits survive to the north and south of the area of previous disturbance / development. Therefore, they recommend that a series of evaluation trenches are excavated on site in order to establish the presence, nature, extent and informative potential of surviving deposits. The Archaeology Department of Tyne & Wear Museums were contacted by Arc Environmental Limited prior to attending site to carryout the investigation works.

The intrusive investigation works comprised 5 no. windowless sampling boreholes (BH's 1 – 3, 3A, 4 and 4A), accompanied by a series of dynamic probes completed from surface and the base of the boreholes. The borehole positions can be seen on the Proposed Site Layout Plan, a copy of which can be seen in Appendix I. It should be noted that this plan is for orientating purposes only, as the positions shown are approximate, and the plan is to a non-standard scale.

2.0 Site Details

Table 2.1

N = north, S = south, E = east, W = west

Site Name:	Former St Aidan's Church.
Site Address:	Former St Aidan's Church, At Aidan's Road, South Shields, NE33 2RJ.
OS Grid Reference:	436810, 567610 (representative for the centre of the site).
Description of Location	The site is an open area of land (former church), located to the north of South Shields town centre.
Site boundaries:	N = St Aidan's Road with residential properties beyond, E = Unnamed road with residential properties and commercial property (Ambassador Home) beyond, S = Unnamed road with residential properties beyond, W = Henry Nelson Street with residential properties beyond.
Site Setting:	The site is located to the north of South Shields Town Centre within a predominantly residential setting with a park to the east.

3.0 Scope of Works

The information contained in this report is limited to the area of the site, as indicated on the Existing and Proposed Site Plan shown in Appendix I, and to those areas accessible during the ground investigation. The depths of strata on the record sheets are recorded from current ground levels. No additional topographical survey or walk over survey was requested or undertaken and therefore when considering the full scope of the development any features and / or issues not specifically mentioned in this report cannot be assumed to have been covered.

3.0 Scope of Works (Cont'd)

Table 3.1

Client:	St Aidan's Court (South Shields) Ltd.
Consultant:	Maughan Reynolds Partnership Limited.
Project type:	Proposed Residential Development.
Site Location plan:	See Appendix I.
Layout plan (existing):	See Appendix I.
Layout plan (proposed):	See Appendix I.
Intrusive Investigation Works:	6 no. windowless sampling boreholes (BH's 1 – 3, 3A, 4 & 4A) and 5 no. dynamic probes (BH's 2, 3, 3A, 4A & 5)
Laboratory Testing:	Geotechnical & Ground Contamination.
CLEA Classification:	<i>Residential with Plant Uptake.</i>
Reporting:	Factual & Interpretative.

4.0 Ground Conditions

For an accurate description of the ground conditions encountered at each investigation position, reference should be made to the borehole record sheets in Appendix II.

4.1 Soil Profile:-

A summary of the soil profile for this site can be found in Table 4.1, below.

Table 4.1

bgl = Below ground level * = BGS Sheet 15, Tynemouth, 1:50,000 Series Solid & Drift Editions

Type of Strata	Depths Recorded (BGL)	Description & General Comments
MADE GROUND: (Variable)	From 0.00m up to c.0.20m to c.2.70m	Comprising initial site surfacing of unmanaged grass overlying variable materials including sandy clayey gravels with ash/clinker and sand with anthropogenic debris including brick rubble, sandstone, slate and aluminium fragments. In BH4, a relic foundation may have been encountered.
DRIFT GEOLOGY: (Boulder Clay*)	From c.0.20m and c.2.70m up to c.5.00m to c.5.45m.	The initial drift deposits encountered below the site comprised variable deposits comprising both soft and firm to stiff slightly gravelly sandy CLAY and gravelly very sandy CLAY which were recorded from depths of between c.0.20m and c.2.70m down to depths of between c.1.45m and 3.65m. In addition, areas of predominantly loose very silty SAND and slightly gravelly slightly silty SAND with occasional fine decomposed rootlets was encountered from depths of between c.0.80m and c.2.70m down to depths of between c.1.30m and 5.45m.

It should be noted that BH's 3, 3A and 5 were terminated within made ground materials and therefore deeper areas of made ground cannot be discounted.

There was no visual and / or olfactory evidence of significant ground contamination (i.e. fuel-derived contaminants, etc.) present within any of the exploratory positions undertaken across the site; however occasional fragments of ash and clinker were noted within several of the exploratory positions.

4.0 Ground Conditions

4.2 Groundwater:-

Ingresses of water were recorded within three of the boreholes (BH's 1, 2 & 4A) at depths of between c.1.45m and c.3.65m. Upon completion of these boreholes, standing water levels of between c.4.65m and c.4.70m were recorded. The remaining boreholes were noted as being 'dry' during and upon completion.

These water strikes are anticipated to be representative of trapped surface drainage or the like as opposed to a continuous shallow groundwater surface (water table).

5.0 Insitu Testing

5.1 Insitu Standard Penetration Tests:-

Insitu standard penetration tests were carried out where possible, within the made ground and natural drift deposits encountered in the boreholes, in order to determine the relative strength and density of the materials tested. The results are shown as 'N' values on the graphic borehole record sheets, adjacent to the appropriate sample level and are also summarised in Table 5.1 below.

Where the full penetration depth, including seating blows (450mm), could not be achieved, the bottom sampling depth is indicated as less than 0.45m from the top (start of test), with the actual depth of penetration also being recorded.

Table 5.1

* = Limited Penetration

Strata	Range of N Values	Average N Value	Density / Strength(Average Density / Strength)
MADE GROUND : Granular Deposits	10 to 80*	34 (Dense)	Loose to Very Dense
DRIFT : Granular Deposits	1 to 16	9 (Loose)	Very loose / Medium Dense

It is felt that the higher 'N' values obtained within the made ground (i.e. 80* blows for limited penetration) materials have been influenced by the presence of rubble and relic foundations / obstructions.

5.2 Insitu Hand Vane Tests:-

Insitu hand vane tests were carried out using a portable Controls insitu hand vane tester the natural clay deposits encountered in the windowless sampling boreholes. The insitu hand vane tester takes direct readings of shear strength. Three vane sizes allow for the direct determination of undrained shear strength of soft to stiff clays. The peak vane value is determined by a calibrated scale ring built into the head assembly. The cross handle is used both to push the vane to the desired test depth and apply the shearing torque. The results are summarised in Table 5.2 below and the results can be found adjacent to the appropriate sample level, on the graphic borehole record sheets.

In summary the insitu hand vane test results for the natural clays suggest generally stiff strata, with an average of 79kN/m² being recorded (stiff). These results indicate the natural clay deposits appear capable of supporting light to moderate loadings, without the risk of failure or excessive settlements occurring.

Table 5.2

Type of Strata	Range of Shear Strength Values	Result Details
Stiff slightly sandy gravelly CLAY (Glacial Till)	75kN/m ² – 83kN/m ²	See Borehole Record Sheets attached in Appendix II

5.0 Insitu Testing (Cont'd)

5.3 Insitu Dynamic Probe Tests:-

Due to the underlying variable drift deposits and the presence and high level obstructions insitu dynamic probes were completed from surface at the location of BH's 3, 3A & 5 and from the base of BH's 2 and 4A. These were completed in order to gain some quantitative information relating to the relative densities of the deeper drift deposits.

In each case a 90 degree solid cone was driven into the ground to depths of between c.9.00m and c.11.00m bctl's, using a 63.5kg hammer, over a 750mm drop. The number of blows for each 100mm of penetration was recorded, and this value over 300mm has been calculated in order to obtain equivalent SPT 'N' value. The values are shown both graphically and numerically on the dynamic probe log sheets attached in Appendix II.

As can be seen from the results and subsequent relative density profiles the deeper drift deposits become competent between depths of c.7.00m and c.8.00m with equivalent SPT 'N' values ranging from 6 up to 16. Below these depths the underlying ground conditions become even more competent up to the terminal depth of the dynamic probes (i.e. c.10.00m bctl's) with the equivalent SPT 'N' values ranging from 19 up to 49.

It should be noted that the insitu dynamic probe completed within BH3 was terminated at a depth of c.1.00m due to the probe becoming off-line.

5.4 Geotechnical & Contamination Related Sampling & Site Protocols:-

All works associated with this ground investigation have been completed in accordance with BS5930: The Code of Practice for Site Investigations (1999) and BS10175: British Standard Code of Practice for the Investigation of Potentially Contaminated Land (2001), with the following precautions specific to this project.

5.3.1 Geotechnical Sampling:-

Samples collected for geotechnical testing (i.e. for Liquid & Plastic limit, PSD analysis) were placed within air tight plastic bags (max. c.20kg total weight).

5.3.2 Contamination Sampling:-

Samples of soil for chemical analysis were placed into either plastic containers or amber glass jars. All samples were stored at approximately 4°C using cool boxes and ice packs prior to delivery to a UKAS/MCERTS accredited laboratory.

5.3.3 Groundwater Sampling:-

No groundwater samples were recovered from this investigation, as no continuous groundwater surface (water table) was encountered on site, only trapped surface water was noted within the exploratory positions.

5.3.4 Avoiding Cross-Contamination between Sample Locations:-

To avoid cross-contamination of materials between soil horizons and exploratory positions, if visual and olfactory evidence of fuel/oil type contamination was noted the sampling tools used were rinsed with clean water and wiped prior to sampling.

6.0 Laboratory Testing

All geotechnical and contamination testing was carried out in accordance with BS1377:1990:Parts 1-9 by Professional Soils Laboratory (PSL) of Doncaster, South Yorkshire and Chemtech Environmental Limited of Consett, Co. Durham (UKAS and MCERTS accredited).

6.1 Determination of pH & SO₄:-

Representative samples of both the made ground and natural drift deposits recovered during the investigation, were tested in order to determine their acidic (pH), soluble sulphate (SO₄) and total Sulphur (S) levels. The results are shown in Table 6.1 below, and are also contained within the Chemtech Environmental Limited Analytical Report (ref no: ARC/38361(2)), a copy of which can be seen in Appendix III.

Table 6.1

Position	Depth (m)	pH	SO ₄ (mg/l)	Design SO ₄ Class	ACEC Class
BH1	0.00-0.20	7.9	46	DS-1	AC-1
BH2	0.00-0.20	8.0	18	DS-1	AC-1
BH3	0.28-1.00	8.6	294	DS-1	AC-1
BH5A	0.20-0.80	13.1	<10	DS-1	AC-1

ACEC = Aggressive Chemical Environment for Concrete site classification

From the results it can be seen that the pH values for the samples tested are 7.9 and 13.1 with the amount of soluble sulphate recorded falling within the negligible range (i.e. <500mg/l). Therefore, in accordance with BRE Special Digest 1: 2005 (3rd Edition), the site can be given a classification of Class DS-1. When considering the nature of the materials tested and assuming mobile groundwater the assessment of the Aggressive Chemical Environment for Concrete (ACEC) for the site overall, is AC-1, when taking into account the pH values of the soils tested.

6.2 Determination of Liquid & Plastic Limits:-

Representative samples of the natural clay deposits encountered across the proposed development area were tested in order to determine their liquid and plastic limits, so that these materials might be classified. The results can be seen in Table 6.2 below and also in Appendix III.

Table 6.2

M/C = Moisture Content, LL = Liquid Limit, PL = Plastic Limit, PI = Plasticity Index

Position	Depth(m)	M/C (%)	LL	PL	PI	Class	%Passing 425µm Sieve
BH1	0.50-1.00	21	41	19	22	CI	94
BH5A	1.30-1.80	25	33	18	15	CL	71

From the results it can be seen that the samples tested are generally of an inorganic nature and when plotted on the plasticity chart fall within the low and intermediate plasticity range, and from the resulting plasticity indices have a low and moderate volume change potential, when taking into account the percentage passing the 425µm sieve.

Therefore, these materials may undergo some changes in volume, if large changes in their natural moisture content were to occur due to seasonal variations or the like, and if new foundations are to be based within these materials, it is recommended that they are taken down to a minimum depth of c.0.90m below finished ground levels.

An increase in this minimum depth may be required, due to the depth to competent and suitable strata, and also if the proposed development is within close proximity to existing or envisaged vegetation, even if trees are to be removed, in order to ensure no additional future shrinkage and swelling of these materials occurs. Reference should be made to BS5837: 2005, "Trees in Relation to Construction".

6.0 Laboratory Testing (Cont'd)

6.3 Determination of Particle Size Distribution (PSD's):-

Two samples of the natural granular deposits encountered within the boreholes were tested in order to determine their particle size distribution, so these materials might be classified. The results of these tests are represented both graphically and numerically within the PSL Report no. PSL08/2332 a copy of which has been enclosed.

As can be seen from the results, the natural coarse drift deposits tested were found to be poorly graded, consisting of very silty sand and slightly gravelly slightly silty sand.

6.4 Contamination Screening: -

Representative samples of the made ground deposits recovered from across the site, were passed onto Chemtech Environmental Limited in Consett, Co. Durham, so that generic and targeted soil and leachate contamination screening could be carried out. The results of all the testing can be found in the Chemtech Environmental Limited report (Ref No. ARC/38430(2)), a copy of which is attached in Appendix III.

The samples chosen for contamination screening were placed within either plastic containers or amber glass jars (where organics were suspected / or ash debris was noted) and then stored and transported within refrigerated (cool boxes maintained at c.4°) boxes until delivery to a UKAS/MCERTS accredited laboratory.

4 no. soil samples were screened using a standard contamination suite (based on the current CLEA SGV listed analytes with historical additions), which is used to assess typical made ground (disturbed natural strata mixed with anthropogenic debris) of an unknown source. Although no significant evidence of any fuel /oil type contamination was noted within the exploratory positions carried out, for completeness and to aid in a preliminary assessment for offsite disposal classification representative samples (including limited ash) were targeted for Speciated PAH (Polycyclic Aromatic Hydrocarbons).

Following the results of the soil screening, representative samples were targeted for generic and organic leachability screening to allow an assessment to be made of the mobility of the generic and targeted organic contaminants and the potential impact on controlled waters and off-site migration.

The total analysis carried out to date is summarised below:

- 4 no. soil samples screened for a generic contamination suite (Arsenic, Cadmium, Chromium, Lead, Mercury, Nickel, Selenium, Free Cyanide, Total Sulphur and Total Organic Carbon (TOC)).
- 2 no. soil samples targeted for speciated PAH (USEPA 16).
- 2 no. soil samples targeted for Asbestos Containing Materials (ACM's)
- 2 no. soil samples screened for the generic leachate suite (Arsenic, Cadmium, Chromium, Copper, Lead, Mercury, Nickel, Selenium, Zinc, Sulphate, Boron, Free Cyanide and Sulphide).
- 2 no. soil samples tested for leachable speciated PAH.

Following the completion of the contamination screening a representative schematic cross section indicating the ground profile used for the Conceptual Site Model (CSM) can be found in Appendix IV. This model summarises the Conceptual Exposure Model (CEM) for this particular site post construction, assuming no remediation, additional protection or removal of the source contamination takes place.

7.0 Ground Contamination Risk Assessment

7.1 Human Health Risk Assessment:-

Representative samples of the made ground encountered in the boreholes were passed onto Chemtech

7.0 Ground Contamination Risk Assessment (Cont'd)

7.1 Human Health Risk Assessment (Cont'd):-

Environmental of Consett, Co. Durham so that soil contamination screening could be carried out. The results of the screening are contained within Chemtech Analytical Report ARC/38430(2). A summary of the results of the soil concentrations can be seen in Table 7.1 below.

Table 7.1

Analyte	Target Conc. (C _T) mg/kg	No. of Samples Screened	Max. Conc. (C _M) recorded	Has C _T been exceeded	No. of Samples > C _T
Generic Suite					
Arsenic	20 ⁽¹⁾	4	14	NO	0
Cadmium	8 ⁽²⁾	4	8	NO	0
Chromium	130 ⁽¹⁾	4	21	NO	0
Copper	130⁽⁴⁾	4	2959	YES	1
Lead	450 ⁽¹⁾	4	178	NO	0
Mercury	8 ⁽¹⁾	4	0.5	NO	0
Nickel	50 ⁽¹⁾	4	26	NO	0
Selenium	35 ⁽¹⁾	4	0.9	NO	0
Zinc	330 ⁽⁴⁾	4	235	NO	0
Cyanide (free)	34 ⁽³⁾	4	2	NO	0
Asbestos	~	4	NAF	~	~
Speciated PAH's					
Naphthalene	17.0 ⁽⁴⁾	2	0.2	NO	0
Acenaphthylene	NV	2	<0.1	NO	0
Acenaphthene	391 ⁽³⁾	2	<0.1	NO	0
Fluorene	184 ⁽⁴⁾	2	<0.1	NO	0
Phenanthrene	NV	2	1.3	NO	0
Anthracene	19.3 ⁽³⁾	2	0.3	NO	0
Fluoranthene	2643 ⁽³⁾	2	2.0	NO	0
Pyrene	1969 ⁽³⁾	2	1.7	NO	0
Benzo(a)anthracene	7.19 ⁽³⁾	2	1.1	NO	0
Chrysene	1.22 ⁽³⁾	2	0.9	NO	0
Benzo(b)fluoranthene	12 ⁽³⁾	2	1.8	NO	0
Benzo(k)fluoranthene	14.3 ⁽³⁾	2	1.3	NO	0
Benzo(a)pyrene	1.09 ⁽⁴⁾	2	0.9	NO	0
Indeno(123cd)pyrene	15.93 ⁽³⁾	2	0.8	NO	0
Dibenz(ah)anthracene	1.1 ⁽⁴⁾	2	0.2	NO	0
Benzo(ghi)perylene	1.54 ⁽³⁾	2	0.6	NO	0

⁽¹⁾ - CLEA SGV values (residential with plant uptake). ⁽²⁾ - CLEA SGV value (residential with plant uptake – pH = 8). ⁽³⁾ - Atkins ATRISK^{SOIL} SSV for residential with plant uptake. ⁽⁴⁾ = LQM CIEH GAC value for residential with plant uptake @ 5% SOM (CLEA UK software). **BOLD** – result exceeds target concentration. NV = no data available.

In summary, the generic and 'organic' type contamination screening carried out for the Landfill Site has highlighted the following;

- The maximum concentration for Copper exceeds the chosen targeted concentration values for this site.
- However, none of the remaining maximum concentration values for any of the other metal, non-organic or speciated PAH's screened exceed the chosen C_T values for this site.
- The elevated level of Copper is considered to pose a risk to the end users (i.e. future residents).
- None of the samples screened indicated any asbestos fibres present.

7.0 Ground Contamination Risk Assessment (Cont'd)

7.1 Human Health Risk Assessment (Cont'd):-

- Consequently, it can be seen that whilst the majority of the analytes screened do not represent a risk to the end users, the levels of Copper present represent a potential risk to the end users where exposure pathways are available, and therefore either treatment, removal, protection measures and/or further detailed quantitative risk assessment (DQRA) may be required for this site.

It should be noted that due to the lack of visual and olfactory evidence of petroleum hydrocarbons i.e. fuel/oil derived contamination; there was no requirement for additional targeted organic screening on this site.

7.2 Controlled Waters (Leachate) Risk Assessment:-

The samples have been screened in order to assess the potential impact on any sensitive receptors that may be within a plausible migration distance of this site, in accordance with Remedial Targets Methodology, Hydrological Risk Assessment for Land Contamination, Environment Agency 2006. Leachate screening for generic contaminants has been carried out on 2 no. representative sample and an additional 2 no. samples for speciated PAH contaminants.

Table 7.2

Analyte		Site Data		EA Soil Remedial Targets	
LEVEL 1	Target Conc. C_T ($\mu\text{g/l}$)	Max. Leachate Conc. ($\mu\text{g/l}$)	Has max. C_T Value Been Exceeded	STC ₁ (mg/kg)	LTC ₁ ($\mu\text{g/l}$)
Arsenic	50 ⁽¹⁾	7	NO	~	50 ⁽¹⁾
Cadmium	5 ⁽¹⁾	<1	NO	~	5 ⁽¹⁾
Chromium	5-250 ⁽¹⁾	9	NO	~	5-250 ⁽¹⁾
Lead	4-250 ⁽¹⁾	11	NO	~	4-250 ⁽¹⁾
Mercury	1 ⁽¹⁾	<1	NO	~	1 ⁽¹⁾
Selenium	10 ⁽¹⁾	<1	NO	~	10 ⁽¹⁾
Copper	1-28 ⁽¹⁾	23	NO	~	1-28 ⁽¹⁾
Nickel	50-200 ⁽¹⁾	5	NO	~	50-200 ⁽¹⁾
Zinc	8-500 ⁽¹⁾	230	NO	~	8-500 ⁽¹⁾
Boron	2000 ⁽¹⁾	<30	NO	~	2000 ⁽¹⁾
Cyanide (free)	50 ⁽²⁾	<20	NO	~	50 ⁽²⁾
Sulphide	0.25mg/l ⁽¹⁾	<100	NO	~	0.25mg/l ⁽¹⁾
Sulphate	400mg/l ⁽¹⁾	<10	NO	~	400mg/l ⁽¹⁾
PAH (total)	0.1 ⁽³⁾	<0.1	NO	~	0.1 ⁽³⁾

⁽¹⁾ - Environmental Quality Standards (EQS) value for Freshwater. ⁽²⁾ - UK Drinking Water Standard. ⁽³⁾ - Analytical detection limit. **BOLD** – result exceeds target concentration. STC₁ = Soil Target Concentration, LTC₁ = Leachate Target Concentration. Where a range is given the value is dependant upon water hardness.

The results illustrated in Table 7.2 above, have identified the following;

- None of the C_M values for any of generic or speciated PAH analytes screened exceed the chosen maximum C_T values for this site.
- Subsequently it is felt that the generic and speciated PAH contaminants present within the made ground are not sufficiently mobile to represent a significant risk to controlled waters and adjacent sites.

8.0 Conclusions & Recommendations

8.1 Ground Conditions: -

The site is overlain by made ground, recorded to depths of between c.0.20m and c.2.70m below current ground levels, comprising variable materials including sandy clayey gravels with ash/clinker and sand with anthropogenic debris including brick rubble, sandstone, slate and aluminium fragments.

8.0 Conclusions & Recommendations (Cont'd)

8.1 Ground Conditions (Cont'd): -

It should be noted that BH's 3, 3A and 5 were prematurely terminated within made ground materials and therefore deeper areas of made ground cannot be discounted at this stage. In BH5, a possible relic foundation / buried structure may have been encountered.

The underlying natural drift deposits were variable and comprised both soft through to stiff clays which were recorded from depths of between c.0.20m and c.2.70m down to depths of between c.1.45m and 3.65m. In addition, areas of predominantly loose very silty sand / slightly gravelly slightly silty sand were encountered from depths of between c.0.80m and c.2.70m down to depths of between c.1.30m and 5.45m.

Due to the underlying variable drift deposits and the presence and high level obstructions insitu dynamic probes were completed from surface at the location of BH's 3, 3A & 5 and from the base of BH's 2 and 4A. These were completed in order to gain some quantitative information relating to the relative densities of the deeper drift deposits.

The dynamic probe record sheets and the relative density profiles indicate that the deeper drift deposits, at depths of between c.7.00m and c.8.00m become more competent with equivalent SPT 'N' values ranging from 6 up to 16. From these depths the materials become even more competent up until the terminal depth of the dynamic probes (i.e. c.10.00m bctl's) with equivalent SPT 'N' values ranging from 19 up to 49.

8.2 Groundwater: -

Water ingresses were recorded within three of the completed boreholes (BH's 1 – 2 and 4A) at depths of between c.1.45m and c.3.65m. Upon completion of these boreholes, standing water levels of between c.4.65m and c.4.70m were recorded. The remaining boreholes were noted as being 'dry' during and upon completion.

These water strikes are likely to be representative of trapped surface drainage or the like as opposed to representing continuous shallow water surface (water table). However it would be prudent to allow for the possible introduction of temporary groundwater control measures, i.e. pumping equipment, in order to take care of any surface water ingresses and pockets of trapped surface drainage within the made ground and natural strata particularly during the wetter periods of the year.

8.3 Foundation Options: -

Due to the ground conditions identified, the following foundation options are available;

- 1) With regards to new foundations for the proposed building structure it is considered that conventional foundations (i.e. strip or pad foundations) extending to deep trench fill where necessary and based 'wholly' within the underlying natural sand deposits based at a minimum depth of 0.60m below finished ground levels.

This foundation type can be designed to a maximum allowable bearing pressure of 75kN/m². It should be noted that if the site levels are not reduced then the depth of the foundations will vary in depth and will be between c.1.45m and c.3.65m, and would need to be "stepped" in order to ensure foundations are located in a suitable bearing medium.

Care and attention must be taken to avoid foundations being "straddled" between varying natural deposits (i.e. clay and sand) and made ground in order to prevent differential settlement occurring. It should be noted that since there is a possibility that the depth to the recommended bearing strata may vary below the proposed building footprint it is recommended that foundation exposures be inspected by a suitably qualified Engineer to confirm that the appropriate ground conditions have been reached.

8.0 Conclusions & Recommendations (Cont'd)

8.3 Foundation Options (Cont'd): -

- 2) If a greater allowable bearing pressure is required then the utilisation of piled foundations, based within the underlying and more competent deeper drift deposits could be utilised. Due to the numerous types of pile, and methods of installation available, the information contained within this report, should be passed onto specialist piling contractors, so they could if required begin to design and price a suitable scheme, particularly as a detailed pile design lies outwith the scope of ARC Environmental work. It is likely that deeper boreholes will be required in order to verify the ground conditions present, as the dynamic probes did not recover samples for identification purposes.
- 3) Due to the excavation restraints associated with possible archaeological issues, the above foundation options may not be suitable and therefore a suitably reinforced rafted foundation could be utilised, based on a minimum of 300mm of subbase and geotextile reinforcement. However, further works will be required in order to confirm the nature of the obstructions noted below the site, to determine if this option will be suitable.

Due to the potential presence of large and shallow obstructions (i.e. as possibly identified within BH5) an allowance for appropriate plant and equipment should be made for excavation purposes particularly for drains, services runs and foundations, etc.

8.4 Ground Contamination: -

When considering the results of the leachability screening carried out, none of the generic or 'organic' analytes screened appear to be sufficiently mobile to represent a significant risk to controlled waters or adjacent sites, and therefore no additional protection or treatment measures are considered necessary.

However, when considering the generic made ground, a single elevated level of Copper has been recorded at the location of BH1 which is deemed to pose a risk to the proposed end users (i.e. future residents) where exposure pathways are available and in this instance it is recommended that removal will be required. It should be noted that as the copper is not leachable the levels will not represent a risk where present below areas of hardstanding.

A Remediation Strategy should be prepared, and agreed with the LA prior to undertaking the required remediation works. The most suitable form of remediation is considered to be the delineation and removal of the elevated level of copper identified at the location of BH1 by undertaking a further set of laboratory testing to determine the volume of material that needs to be excavated and removed.

As BH1 is in an area where a future basement feature is to be constructed and is therefore in an area of a 'reduced dig', these works should be undertaken prior to the development works commencing. In addition, once the delineated material has been removed, the remainder of the made ground can be utilised on site, if required.

Any laboratory results can be compiled as part of a validation report to ensure that all affected materials are removed in strict accordance with the agreed Remediation Strategy.

When considering the risks to the construction workforce, adequate PPE will be required to provide protection against the levels of contaminants recorded during these investigation works. Similarly, the results can also be used by the Main Contractor / Project Coordinator, when devising an adequate Site Health & Safety Plan, in accordance with current CDM Regulations.

8.0 Conclusions & Recommendations (Cont'd)

8.4 Ground Contamination (Cont'd): -

At this stage, provision should be made for a DS-1 / AC-1 concrete specification for all foundation and buried concrete.

8.5 Off-Site Disposal: -

When considering the removal of any materials from the site as a waste, to be disposed of at a landfill, it can be seen that where the uncontaminated natural strata (excluding any 'topsoil' or 'peat' materials) can be kept separate from the made ground, then these materials can be considered as 'inert' and taken to an Inert Landfill Site. Prior to disposal of these materials, full WAC screening may need to be undertaken, with the number of samples to be screened dependant upon the volume of the material to be disposed of.

Where made ground and/or potentially contaminated materials are to be removed off both sites as a 'waste', a preliminary assessment, regarding off-site disposal, can be made utilising the generic and 'organic' contamination screening undertaken as part of Section 7.0.

Therefore, as generally low levels of contamination were recorded across the site area, it is likely that these materials can be classified as non-hazardous and could be disposed at a Non-Hazardous Landfill, without the need for further WAC screening, although some further preliminary screening may be required.

Prior to removal of materials off-site, it is recommended that the volume to be disposed of is calculated, as the amount of additional screening required will be based upon the volume of material to be disposed of. Upon completion of this testing, it is then recommended that these additional results are passed on to landfill operators for their comments.

If possible, removal of materials from site as a 'waste' should be kept to a minimum, however, if materials have to be removed to accommodate finished ground levels etc., then once these have been fully identified, and the volumes estimated, it is possible that full WAC screening may need to be carried out before they are taken to landfill.

8.6 General Comments: -

For future site works, adequate lateral trench support will be required for excavations, in order to prevent trench wall collapse or over excavations, as well as to create a safe working environment below a depth of 1.20m, and any excavations on this site should remain open for as short a period as possible, since some of these materials may be susceptible to deterioration, if left open to the natural elements for any significant period of time.

It is also recommended for any new developments, adequate surface drainage should be designed and installed by a competent contractor, in order to prevent surface water 'ponding' or collection, during and post construction, particularly where the existing surface drainage system is disrupted or damaged.

In addition, for deeper excavations, drainage, service runs or the like that may pass close to or beneath any proposed new foundations, these should be undertaken with care and completed prior to the preparation of any new foundations, so as not to allow any loose or granular material to move or 'flow', thus causing settlement to occur to any new foundations based at a higher level.

From the Phase 1: Desk Top Study Report it can be seen that this site is not located within an area that requires radon protective measures within proposed new developments.

8.0 Conclusions & Recommendations (Cont'd)

8.6 General Comments (Cont'd): -

In addition, the site is not considered to be at risk from shallow coal mining activities due to there being no coal seams present within c.>30m below rockhead. In addition, a Coal Mining Report procured as part of the DTS indicated that the shallowest recorded worked coal seam below the site is that of the Hutton at a depth of c.155m below ground level with a seam thickness of c.0.89m.

An “observational technique” can be applied to the design and construction of this site, and where ground conditions seem to vary from that indicated from the conceptual ground model derived from works to date, including the presence of any rootlets or plant material identified during the foundation construction period then advice from a suitably qualified Engineering Geologist/Geotechnical Engineer should be sought.

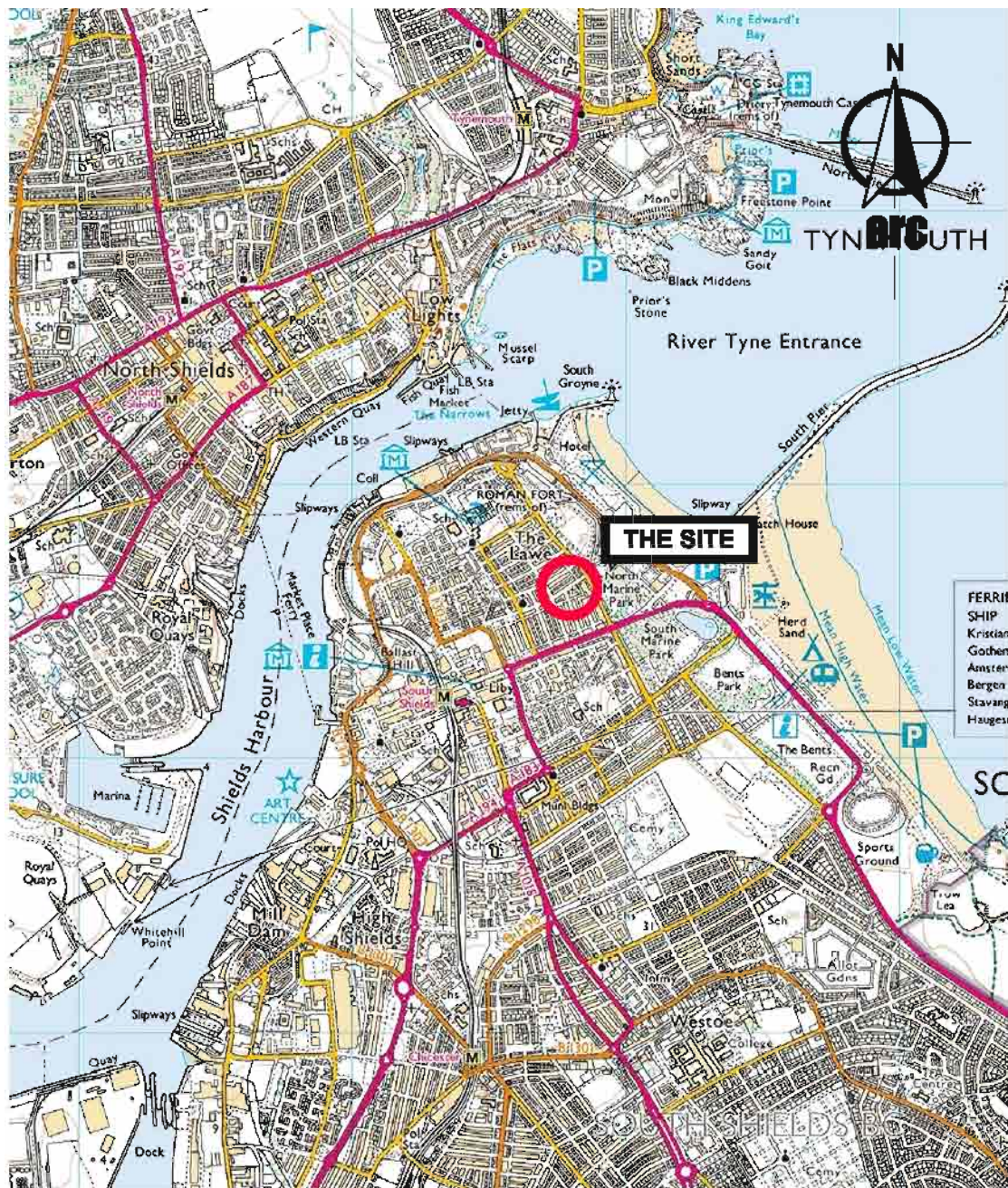
END OF REPORT

APPENDIX I

Site Location Plan

Aerial Photograph

**Former Site Layout Plan (St. Aiden's Church) overlain with
Proposed Site Layout Plan (Residential Development) and Existing Site Layout Plan**



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0m 200m 400m 600m 800m 1000m

Client:

**ST AIDAN'S COURT
(SOUTH SHIELDS) LIMITED**

Project Title:

**Former St Aidan's Church
South Shields
Tyne and Wear**

Drawing Title:

Location Plan

Job Reference:

08-494

Drawing Number:

-

Revision:

-

Drawn by:

P.D

Date:

16.01.09

Scale at A4:

1:25,000 @ A4

Checked by:

A.H

Approved by:

A.H

The contractor shall check all dimensions on site before commencement of any works. No dimensions to be scaled off this drawing.

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rev.	date	amendments	drawn	checked	



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LEGEND

—— SITE BOUNDARY

Client:

**ST AIDAN'S COURT
(SOUTH SHIELDS) LIMITED**

Project Title:

**Former St Aidan's Church
South Shields
Tyne and Wear**

Drawing Title:

Aerial Photograph

rev.	date	amendments	drawn	checked

Job Reference:

08-494

Drawing Number:

-

Revision:

-

Drawn by:

P.D

Date:

16.01.09

Scale at A4:

NTS @ A4

Checked by:

A.H

Approved by:

A.H

The contractor shall check all dimensions on site before commencement of any works.
No dimensions to be added off this drawing.

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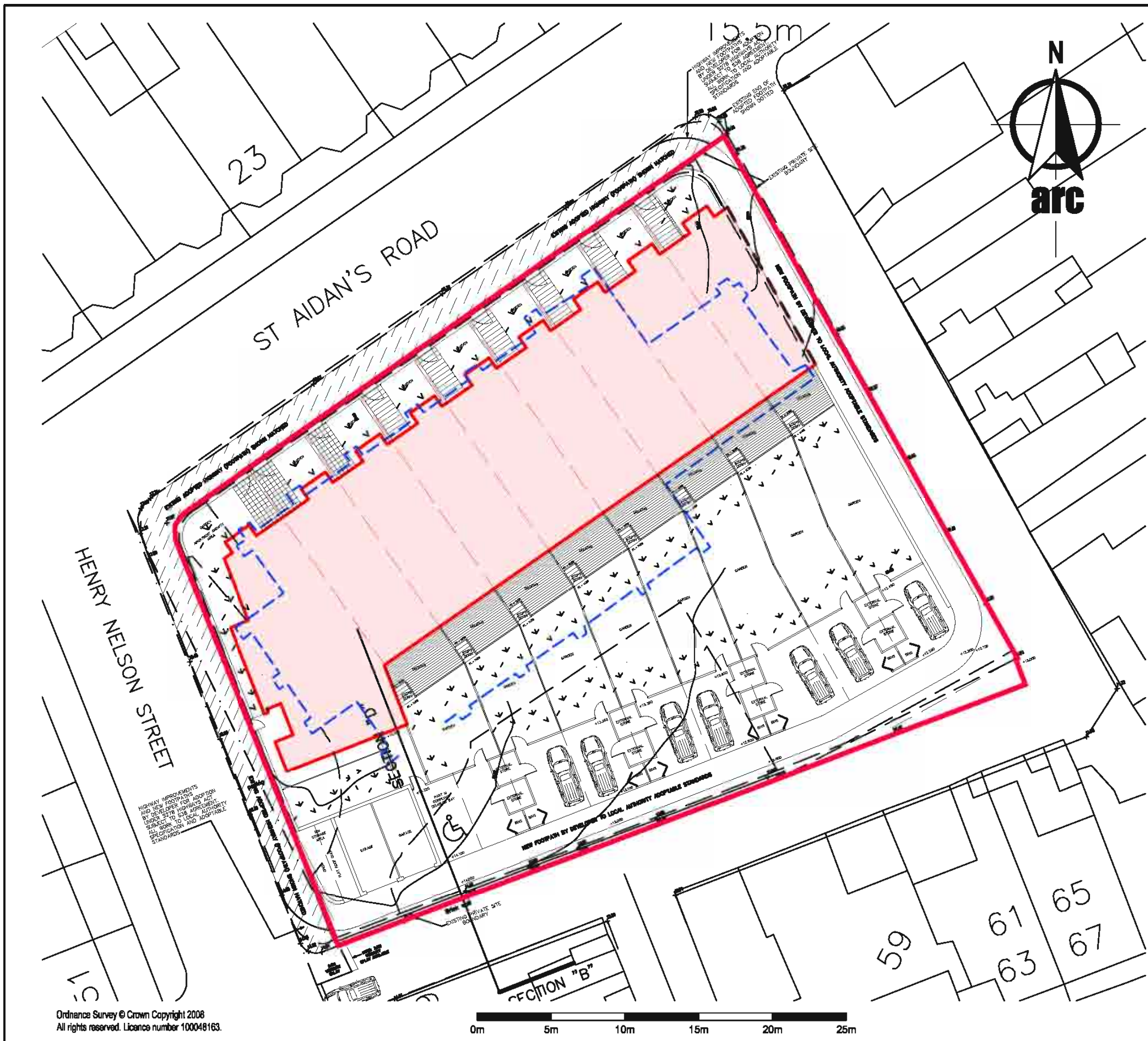
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LEGEND

- APPROXIMATE SITE BOUNDARY
- PROPOSED BUILDING FOOTPRINT
- FOOTPRINT OF FORMER CHURCH

rev.	date	amendments	drawn	chckd

Client: **ST AIDAN'S COURT
(SOUTH SHIELDS) LIMITED**

Project Title:
**Former St Aiden's Church
South Shields
Tyne and Wear**

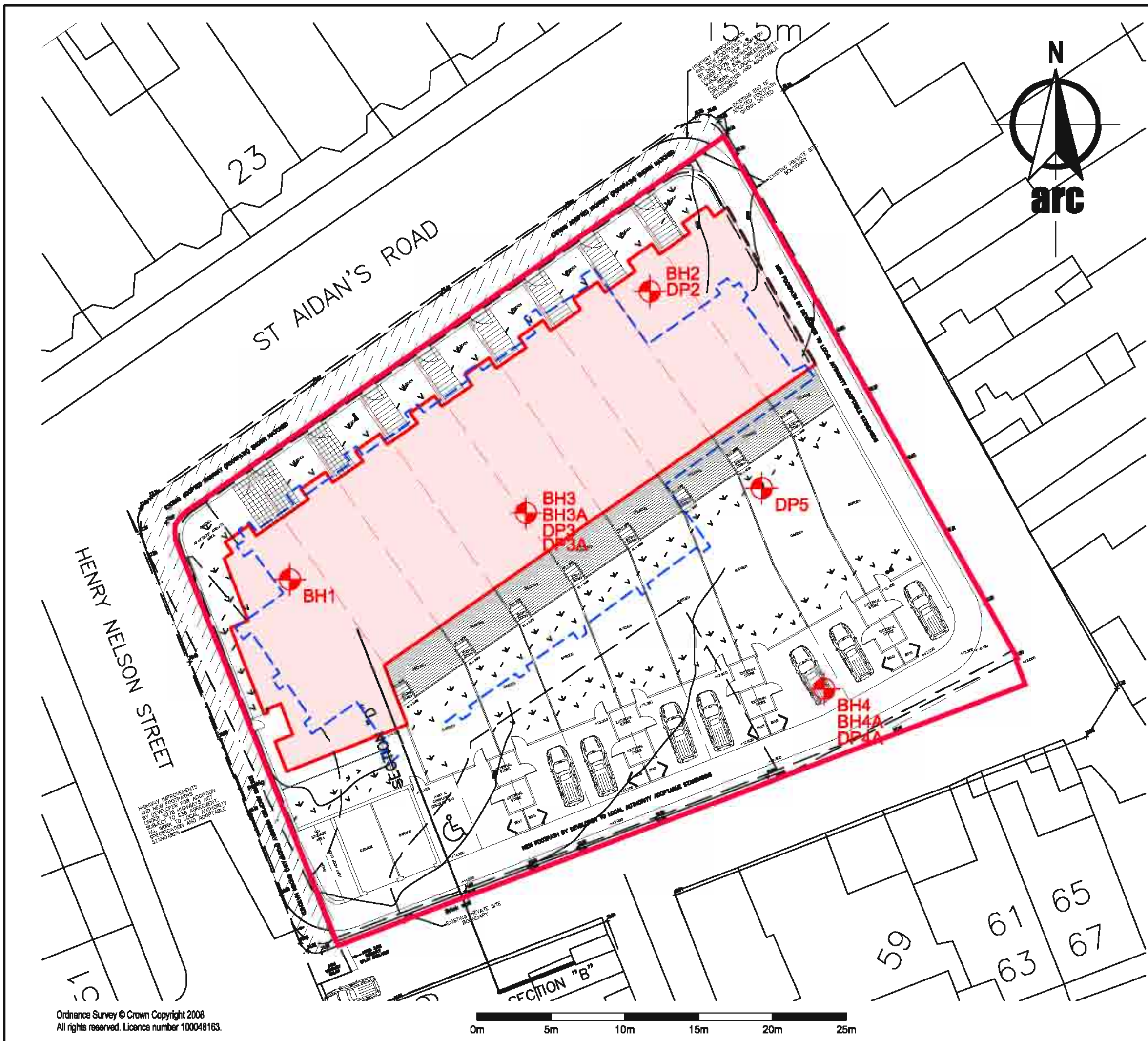
Drawing Title:
Proposed Development Layout

Scale at A3: 1:250 @ A3	Date: 16.01.09	Drawn by: P.D	Approved by: A.H
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Job Ref: 08-494	Drg no: -	Rev: -
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APPENDIX II

Borehole Location Plan, Borehole and Dynamic Probe Record Sheets



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- LEGEND**
- APPROXIMATE SITE BOUNDARY
 - PROPOSED BUILDING FOOTPRINT
 - FOOTPRINT OF FORMER CHURCH
 - BOREHOLE AND DYNAMIC SAMPLING POSITION

rev.	date	amendments	drawn	chckd

Client: **ST AIDAN'S COURT (SOUTH SHIELDS) LIMITED**

Project Title:
Former St Aidans Church
South Shields
Tyne and Wear

Drawing Title:
Borehole Location Plan

Scale at A3: 1:250 @ A3	Date: 16.01.09	Drawn by: P.D	Approved by: A.H
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Job Ref: 08-494	Drg no: -	Rev: -
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Telephone: 0191 383 7381

BOREHOLE LOG

Project St. Aidens Church, South Shields				BOREHOLE No BH1
Job No 08-494	Date 02-12-08 02-12-08	Ground Level (m)	Co-Ordinates ()	
Contractor Arc Environmental Ltd				Sheet 1 of 1

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thickness)	DESCRIPTION		
0.00	B					0.20	MADE GROUND: Unmanaged grass overlying loose black sandy clayey gravels with rootlets and anthropogenic debris including ash and clinker Firm, brown / grey sandy slightly gravelly CLAY Stiff, brown / grey slightly sandy gravelly CLAY.		
0.20	B					(0.30)			
0.50	B					0.50			
1.00	V	75kN/m ²				(0.95)			
1.00	B		↓			1.45			
1.45	B						Initially medium dense becoming loose (c.4.00m) brown silty SAND with occasional clay lenses.		
2.00	SPT	2,2,3,3 N=10							
2.00	B								
2.50	B								
3.00	CPT	4,4,4,4 N=16							
3.00	B					(4.00)			
3.50	B								
4.00	CPT	0,0,0,1 N=1							
4.00	B								
4.50	B		↓						
5.00	CPT	1,1,1,2 N=5							
						5.45			
							Borehole terminated due to sand and water coming up and jamming the casing.		

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Date	Time	Depth	Casing Depth	Casing Dia. mm	Water Dpt	From	To	Hours	From	To	
02-12-08	00.00	5.45	5.00	115mm							
All dimensions in metres Scale 1:37.5						Client Harrison Properties Ltd			Method/ Plant Use Windowless Sampling (C130)		Logged By SW

AGS3 UK BH BOREHOLES GPJ AGS3 ALL GDT 5/12/08



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BOREHOLE LOG

Project St. Aidens Church, South Shields				BOREHOLE No BH2
Job No 08-494	Date 02-12-08 02-12-08	Ground Level (m)	Co-Ordinates ()	
Contractor Arc Environmental Ltd				Sheet 1 of 1

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thickness)	DESCRIPTION		
0.00	B					0.20	MADE GROUND: Unmanaged grass overlying soft dark brown sandy gravely clay with rootlets and anthropogenic debris including ash and clinker		
0.20	B						MADE GROUND: Loose, yellow brown / red sand with sandstone and slate fragments.		
1.00	B					(1.80)			
1.00	CPT	2,2,3,3 N=10							
1.00	B								
1.00	CPT	2,2,3,3 N=10							
1.50	B								
2.00	CPT	2,8,10,2 N=22				2.00	MADE GROUND: Medium dense, brown sand with anthropogenic debris including sandstone, brick and aluminium fragments.		
2.00	B					(0.70)			
2.70	B					2.70			
3.00	V	83kN/m ²					Stiff, brown / grey slightly sandy gravely CLAY.		
3.00	B					(0.95)			
3.65	B		↓			3.65	Loose, brown silty SAND with occasional clay lenses.		
4.00	CPT	2,2,2,3 N=9				(1.35)			
4.00	B								
4.50	B		↓			5.00			

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Date	Time	Depth	Casing Depth	Casing Dia. mm	Water Dpt	From	To	Hours	From	To	
02-12-08	00.00	5.00	5.00	115mm							Sides stable and a water ingress was noted at c.3.65m. Upon completion, a standing water level of c.4.70m was recorded.
All dimensions in metres Scale 1:37.5			Client Harrison Properties Ltd			Method/ Plant Use Windowless Sampling (C130)			Logged By SW		

AGS3 UK BH BOREHOLES GPJ AGS3 ALL GDT 5/12/08



BOREHOLE LOG

Project St. Aidens Church, South Shields				BOREHOLE No BH3
Job No 08-494	Date 02-12-08 02-12-08	Ground Level (m)	Co-Ordinates ()	
Contractor Arc Environmental Ltd				Sheet 1 of 1

[illegible]

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Date	Time	Depth	Casing Depth	Dia. mm	Water Dpt	From	To	Hours	From	To	
02-12-08	00.00	1.60	1.60	115mm							Borehole stable and 'dry'.



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BOREHOLE LOG

Project St. Aidens Church, South Shields				BOREHOLE No BH3A	
Job No 08-494	Date 02-12-08 02-12-08	Ground Level (m)	Co-Ordinates ()		
Contractor Arc Environmental Ltd				Sheet 1 of 1	

SAMPLES & TESTS			Water	STRATA				Geology	Instrument/ Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thickness)	DESCRIPTION		
1.00	CPT	8,4,18,50 N=80				0.18	MADE GROUND: Unmanaged grass overlying firm dark brown sandy gravely clay with roots.		
						(1.22)	MADE GROUND: Dense, brown sandy brick and sandstone rubble.		
						1.40			
							Borehole terminated due to casing going offline.		

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Date	Time	Depth	Depth	Casing Dia. mm	Water Dpt	From	To	Hours	From	To	
02-12-08	00.00	1.40	1.40	115mm							Borehole stable and 'dry'.

All dimensions in metres Scale 1:37.5	Client Harrison Properties Ltd	Method/ Plant Used Windowless Sampling (C130)	Logged By SW
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AGS3 UK BH BOREHOLES.GPJ AGS3 ALL.GDT 5/12/08



BOREHOLE LOG

Project St. Aidens Church, South Shields				BOREHOLE No BH5
Job No 08-494	Date 02-12-08 02-12-08	Ground Level (m)	Co-Ordinates ()	
Contractor Arc Environmental Ltd				Sheet 1 of 1

[illegible]

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Date	Time	Depth	Depth	Casing Dia. mm	Water Dpt	From	To	Hours	From	To	
02-12-08	00.00	0.90	0.90	115mm							Borehole stable and 'dry'.

All dimensions in metres Scale 1:37.5	Client Harrison Properties Ltd	Method/ Plant Use Windowless Sampling (C130)	Logged By SW
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BOREHOLE LOG

Project St. Aidens Church, South Shields				BOREHOLE No BH5A
Job No 08-494	Date 02-12-08 02-12-08	Ground Level (m)	Co-Ordinates ()	
Contractor Arc Environmental Ltd				Sheet 1 of 1

SAMPLES & TESTS			Water	STRATA			Geology	Instrument/ Backfill				
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)			DESCRIPTION			
0.00-0.20	B	4,2,1,1 N=8				0.20	MADE GROUND: Unmanaged grass overlying loose soft black / dark brown sandy clayey gravels with rootlets.					
0.20-0.80	B					(0.60)	MADE GROUND: Dense, dark brown sand with occasional anthropogenic debris including brick and timber fragments.					
0.80-1.00	B					0.80	Loose, dark brown SAND.					
1.00-1.45	CPT					(0.50)						
1.00-1.30	B	2,2,2,2 N=8					1.30	Soft, orange brown / grey mottled sandy CLAY. Noted as being 'damp'.				
1.30-1.80	B						(0.50)					
1.80-2.00	B						1.80	Loose, dark brown SAND. Noted as being saturated.				
2.00-2.45	CPT						2.00	Loose, dark orange brown silty SAND. Noted as being saturated.				
2.00-2.50	B	3,3,3,3 N=12						(1.50)				
2.50-3.00	B											
3.00-3.45	CPT											
3.00-3.50	B							3.50				
3.50-4.00	B	1,2,2,2 N=7									Loose, brown silty slightly gravelly SAND with occasional decomposed rootlets noted from c.4.00m.	
4.00-4.45	CPT									(1.50)		
4.00-4.50	B											
4.50-5.00	B									5.00		
										Borehole terminated due to sand and water coming up and jamming the casing.		

Boring Progress and Water Observations						Chiselling			Water Added		GENERAL REMARKS
Date	Time	Depth	Casing Depth	Casing Dia. mm	Water Dpt	From	To	Hours	From	To	
02-12-08	00.00	5.00	5.00	115mm							Sides stable and a water ingress was noted at c.1.80m. Upon completion, a standing water level of c.4.70m was recorded.
All dimensions in metres Scale 1:37.5		Client Harrison Properties Ltd		Method/ Plant Used Windowless Sampling (C130)		Logged By SW					

AGS3 UK BH BOREHOLES GPJ AGS3 ALL GDT 5/12/08

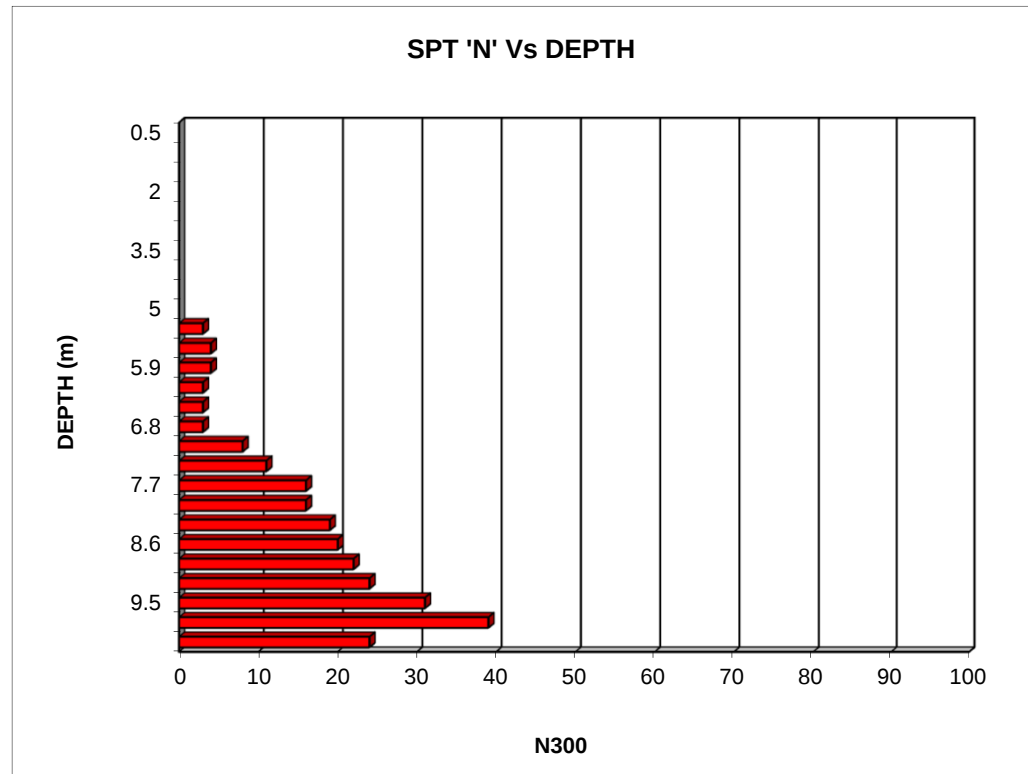
DYNAMIC PROBE RECORD SHEET

CLIENT:- Harrison Properties Ltd
 SITE:- St. Aidens Church, South Shields
 POSITION:- BH2
 Ref 08-494
 Test carried out to BS 1377 : Part 9 : 1990 : 3.2

SHT 1 of 1

DEPTH (m)	SPT 'N'
0.5	
1	
1.5	
2	
2.5	
3	
3.5	
4	
4.5	
5	
5.3	3
5.6	4
5.9	4
6.2	3
6.5	3
6.8	3
7.1	8
7.4	11
7.7	16
8	16
8.3	19
8.6	20
8.9	22
9.2	24
9.5	31
9.8	39
10.1	24

(for 200mm penetration)



TORQUE
(N.m)

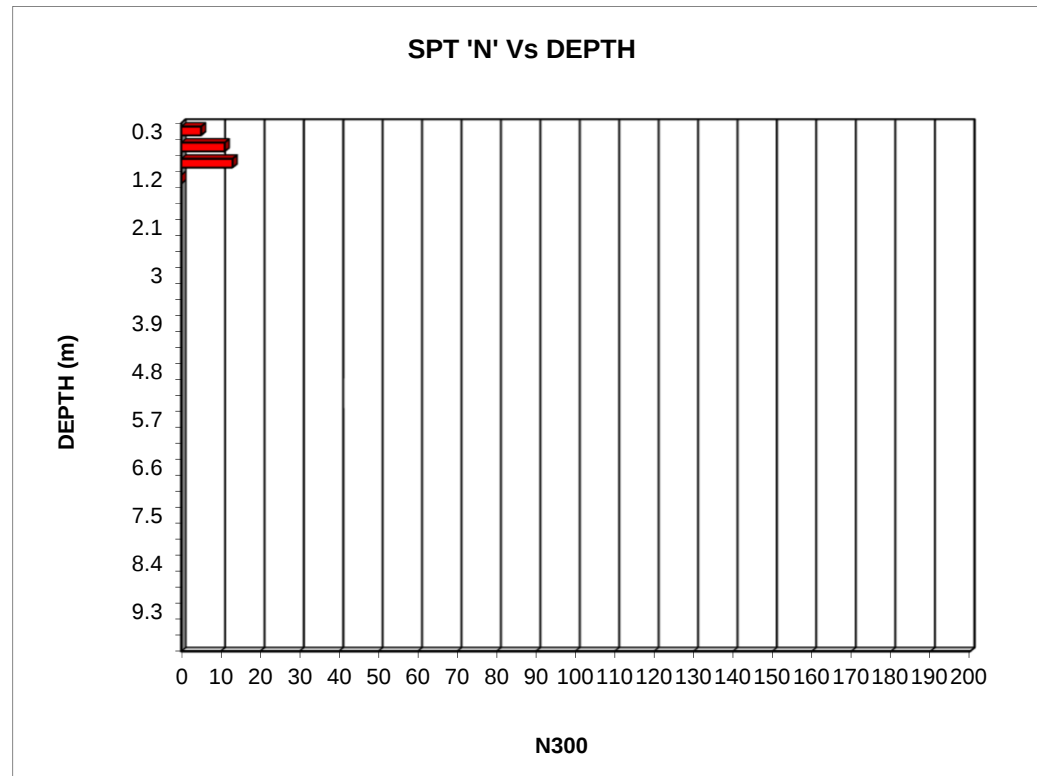
Hammer : Type/mass - DPH/50kg Cone : Type/diameter - 90 deg/35mm Cone left in hole : yes/no*
 Standard drop - 500mm Rod type/diameter - To BS 4019/32mm Damper - yes/no* Hole filled : yes/no*

DYNAMIC PROBE RECORD SHEET

CLIENT:- Harrison Properties Ltd
SITE:- St. Aidens Church, South Shields
POSITION:- BH3
Ref 08-494
Test carried out to BS 1377 : Part 9 : 1990 : 3.2

SHT 1 of 1

DEPTH (m)	SPT 'N'
0.3	5
0.6	11
0.9	13
1.2	8 for 100mm
1.5	
1.8	
2.1	
2.4	
2.7	
3	
3.3	
3.6	
3.9	
4.2	
4.5	
4.8	
5.1	
5.4	
5.7	
6	
6.3	
6.6	
6.9	
7.2	
7.5	
7.8	
8.1	
8.4	
8.7	
9	
9.3	
9.6	
9.9	



TORQUE
(N.m)

Hammer : Type/mass - DPH/50kg Cone : Type/diameter - 90 deg/35mm Cone left in hole : yes/no*
Standard drop - 500mm Rod type/diameter - To BS 4019/32mm Damper - yes/no* Hole filled : yes/no*

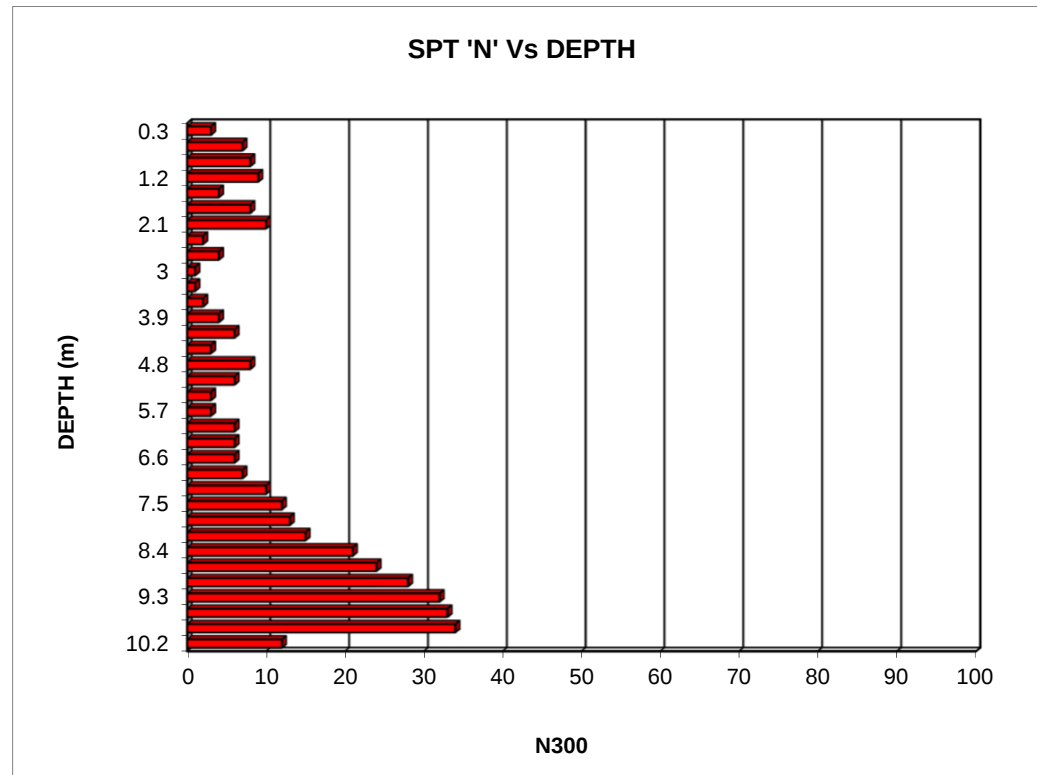
DYNAMIC PROBE RECORD SHEET

CLIENT:- Harrison Properties Ltd
 SITE:- St. Aidens Church, South Shields
 POSITION:- BH3A
 Ref 08-494
 Test carried out to BS 1377 : Part 9 : 1990 : 3.2

SHT 1 of 1

DEPTH (m)	SPT 'N'
0.3	3
0.6	7
0.9	8
1.2	9
1.5	4
1.8	8
2.1	10
2.4	2
2.7	4
3	1
3.3	1
3.6	2
3.9	4
4.2	6
4.5	3
4.8	8
5.1	6
5.4	3
5.7	3
6	6
6.3	6
6.6	6
6.9	7
7.2	10
7.5	12
7.8	13
8.1	15
8.4	21
8.7	24
9	28
9.3	32
9.6	33
9.9	34
10.2	12

(for 100mm penetration)



TORQUE
(N.m)

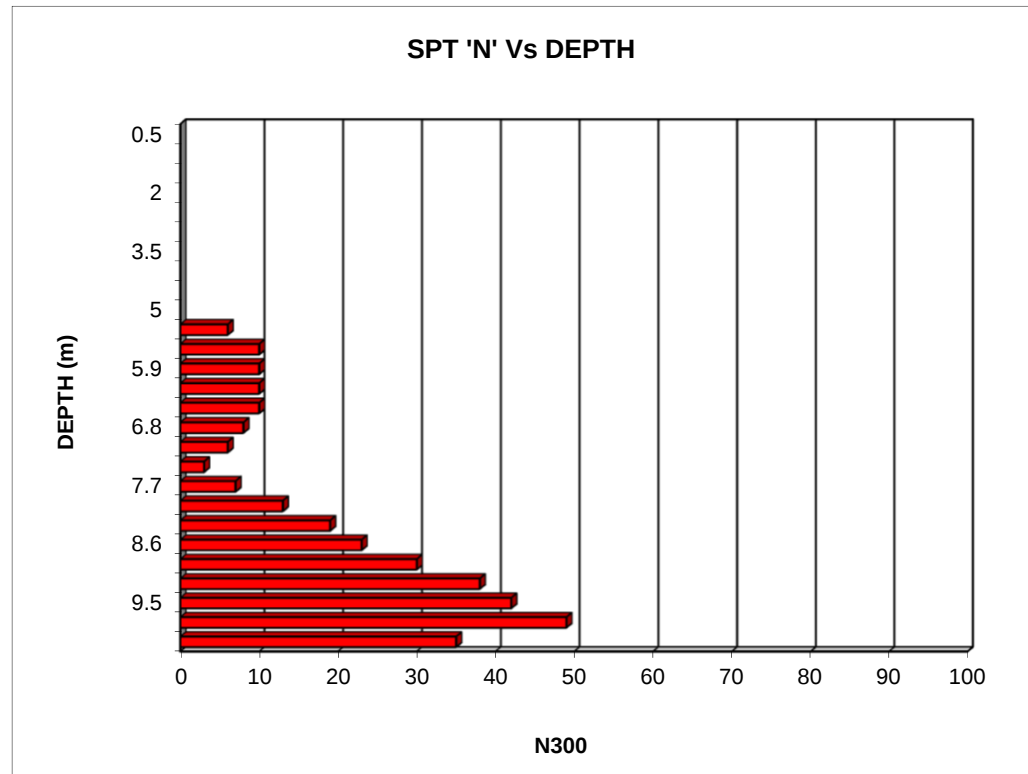
Hammer : Type/mass - DPH/50kg Cone : Type/diameter - 90 deg/35mm Cone left in hole : yes/no*
 Standard drop - 500mm Rod type/diameter - To BS 4019/32mm Damper - yes/no* Hole filled : yes/no*

DYNAMIC PROBE RECORD SHEET

CLIENT:- Harrison Properties Ltd
 SITE:- St. Aidens Church, South Shields
 POSITION:- BH4A
 Ref 08-494
 Test carried out to BS 1377 : Part 9 : 1990 : 3.2

SHT 1 of 1

DEPTH (m)	SPT 'N'
0.5	
1	
1.5	
2	
2.5	
3	
3.5	
4	
4.5	
5	
5.3	6
5.6	10
5.9	10
6.2	10
6.5	10
6.8	8
7.1	6
7.4	3
7.7	7
8	13
8.3	19
8.6	23
8.9	30
9.2	38
9.5	42
9.8	49
10.1	35
(for 200mm penetration)	



TORQUE
(N.m)

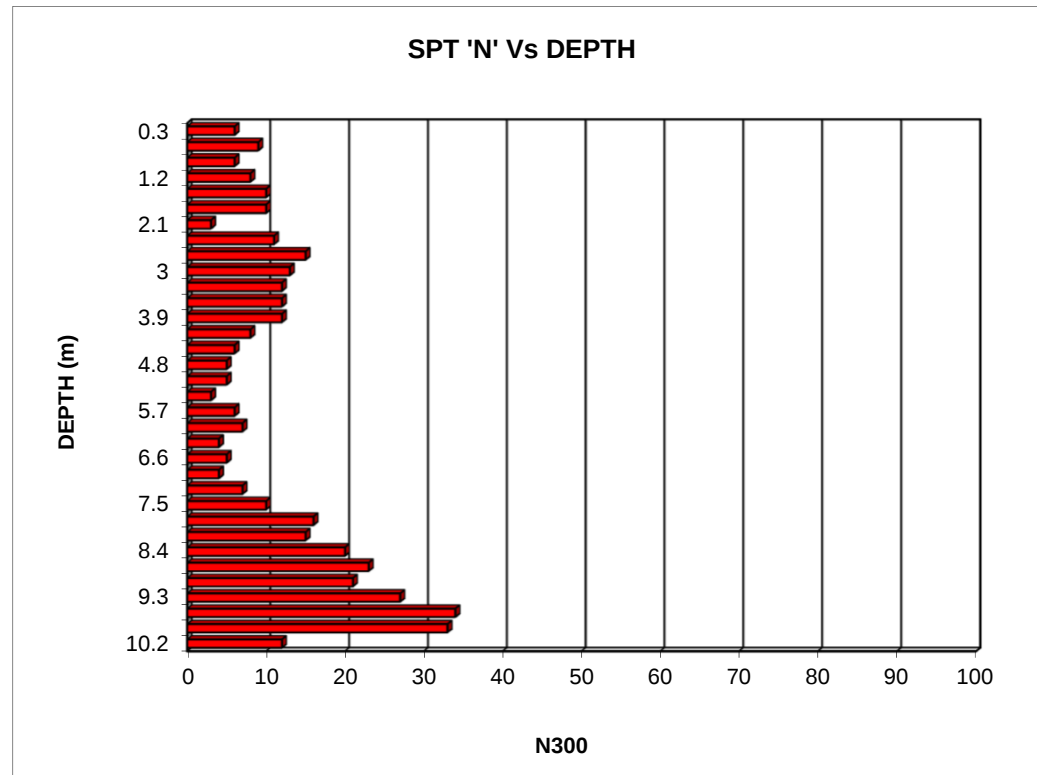
DYNAMIC PROBE RECORD SHEET

CLIENT:- Harrison Properties Ltd
 SITE:- St. Aidens Church, South Shields
 POSITION:- BH5
 Ref 08-494
 Test carried out to BS 1377 : Part 9 : 1990 : 3.2

SHT 1 of 1

DEPTH (m)	SPT 'N'
0.3	6
0.6	9
0.9	6
1.2	8
1.5	10
1.8	10
2.1	3
2.4	11
2.7	15
3	13
3.3	12
3.6	12
3.9	12
4.2	8
4.5	6
4.8	5
5.1	5
5.4	3
5.7	6
6	7
6.3	4
6.6	5
6.9	4
7.2	7
7.5	10
7.8	16
8.1	15
8.4	20
8.7	23
9	21
9.3	27
9.6	34
9.9	33
10.2	12

(for 100mm penetration)



TORQUE
(N.m)

APPENDIX III

Laboratory Results (Geotechnical & Contamination)



2531



ANALYTICAL TEST REPORT

Contract no: ARC/38430(2)

Contract name: St. Aidan's Church, South Shields

Client reference: 08-494

Clients name: ARC Environmental

Clients address: The Rivergreen Centre
Aykley Heads
Durham
DH1 5TS

Date received: 03 December 2008

Date started: 04 December 2008

Date of issue: 21 January 2009

This is a supplementary report to report number ARC/38430(1) issued 15 December 2008.

Notes: Opinions and interpretations expressed herein are outside the UKAS accreditation scope.
Unless otherwise stated, Chemtech Environmental Ltd were not responsible for sampling.
Methods, procedures and performance data are available on request.
Results reported herein relate only to the material supplied to the laboratory.
All results are reported on a dry basis. Samples dried at no more than 30°C in a drying cabinet.
Analytical results are exclusive of stones.
This report shall not be reproduced except in full, without prior written approval.
Samples will be disposed of 8 weeks from initial receipt unless otherwise instructed.

Key: U UKAS accredited test
M MCERTS & UKAS accredited test
\$ Test carried out by an approved subcontractor
NAF Non asbestos fibres

Approved by:

Karan Campbell

Director

John Campbell

Director

Chemtech Environmental Limited

SAMPLE DESCRIPTIONS

MCERTS (Soils):

Soil descriptions are only intended to provide a log of sample matrices with respect to MCERTS validation.

They are not intended as full geological descriptions.

MCERTS accreditation applies for sand, clay and loam/topsoil, or combinations of these whether these are derived from naturally occurring soils or from made ground, as long as these materials constitute the major part of the sample.

Other materials such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

Lab number	Sample id	Depth (m)	Description	Moisture (%)
38430-1	BH 1	0.00-0.20	Loamy Sandy Clay	21.1
38430-2	BH 2	0.00-0.20	Sandy Loam	18.0
38430-3	BH 3	0.28-1.00	Gravelly Sand	10.1
38430-4	BH 4A	0.20-0.80	Gravelly Sandy Clay	12.1

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SAMPLE DESCRIPTIONS

MCERTS (Soils):

Chemtech Environmental Limited

SOILS

Lab number Sample id Depth (m)			38430-1 BH 1 0.00-0.20	38430-2 BH 2 0.00-0.20	38430-3 BH 3 0.28-1.00	38430-4 BH 4A 0.20-0.80
Test	Method	Units				
Arsenic (total)	CE054 ^M	mg/kg	14	13	5	14
Cadmium (total)	CE054 ^M	mg/kg	0.3	0.3	<0.2	<0.2
Chromium (total)	CE054 ^M	mg/kg	21	16	9	10
Copper (total)	CE054 ^M	mg/kg	2959	47	7	29
Lead (total)	CE054 ^M	mg/kg	178	174	11	97
Mercury (total)	CE054	mg/kg	<0.5	<0.5	<0.5	<0.5
Nickel (total)	CE054 ^M	mg/kg	26	15	8	13
Selenium (total)	CE054 ^M	mg/kg	0.5	0.4	<0.3	0.9
Zinc (total)	CE054 ^M	mg/kg	235	138	29	89
pH	CE004 ^M	units	7.9	8.0	8.6	13.1
Sulphate (2:1 water soluble)	CE049 ^U	mg/l	46	18	294	<10
Sulphur (total)	CE061	mg/kg	769	1028	1344	982
Cyanide (free)	CE077	mg/kg	<2	<2	<2	<2
Total Organic Carbon	CE005 ^M	% w/w	2.39	4.92	1.78	0.54
PAH						
Naphthalene	CE032	mg/kg	0.1	0.2	-	-
Acenaphthylene	CE032	mg/kg	<0.1	<0.1	-	-
Acenaphthene	CE032	mg/kg	<0.1	<0.1	-	-
Fluorene	CE032	mg/kg	<0.1	<0.1	-	-
Phenanthrene	CE032	mg/kg	1.3	1.0	-	-
Anthracene	CE032	mg/kg	0.3	0.2	-	-
Fluoranthene	CE032	mg/kg	2.0	1.8	-	-
Pyrene	CE032	mg/kg	1.7	1.4	-	-
Benzo(a)anthracene	CE032	mg/kg	1.1	0.9	-	-
Chrysene	CE032	mg/kg	0.9	0.9	-	-
Benzo(b)fluoranthene	CE032	mg/kg	1.8	1.4	-	-
Benzo(k)fluoranthene	CE032	mg/kg	1.3	0.2	-	-
Benzo(j)fluoranthene	CE032	mg/kg	0.8	<0.1	-	-
Benzo(a)pyrene	CE032	mg/kg	0.9	0.7	-	-
Indeno(123cd)pyrene	CE032	mg/kg	0.8	0.7	-	-
Dibenz(ah)anthracene	CE032	mg/kg	0.2	0.1	-	-
Benzo(ghi)perylene	CE032	mg/kg	0.6	0.5	-	-
PAH (total)	CE032	mg/kg	14	10	-	-
Subcontracted analysis						
Asbestos	\$	-	NAF	-	-	NAF

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SOILS

Lab number			38430-1	38430-2	38430-3	38430-4
Sample id			BH 1	BH 2	BH 3	BH 4A
Depth (m)			0.00-0.20	0.00-0.20	0.28-1.00	0.20-0.80
Test	Method	Units				

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LEACHATES

Lab number Sample id Depth (m)			38430-1L BH 1 0.00-0.20	38430-2L BH 2 0.00-0.20
Test	Method	Units		
Arsenic	CE055	mg/l	0.005	0.007
Boron	CE063	mg/l	<0.03	<0.03
Cadmium	CE055 ^u	mg/l	<0.001	<0.001
Chromium	CE055 ^u	mg/l	0.009	0.005
Copper	CE055 ^u	mg/l	0.023	0.011
Lead	CE055 ^u	mg/l	0.006	0.011
Mercury	CE055	mg/l	<0.001	<0.001
Nickel	CE055 ^u	mg/l	0.005	<0.003
Selenium	CE055	mg/l	<0.001	<0.001
Zinc	CE055 ^u	mg/l	0.230	0.100
pH	CE004	units	7.8	7.7
Sulphate	CE049 ^u	mg/l	<10	<10
Sulphide	CE079	mg/l	<0.1	<0.1
Cyanide (free)	CE077	mg/l	<0.02	<0.02
PAHs				
Naphthalene	CE051	mg/l	<0.0001	<0.0001
Acenaphthylene	CE051	mg/l	<0.0001	<0.0001
Acenaphthene	CE051	mg/l	<0.0001	<0.0001
Fluorene	CE051	mg/l	<0.0001	<0.0001
Phenanthrene	CE051	mg/l	<0.0001	<0.0001
Anthracene	CE051	mg/l	<0.0001	<0.0001
Fluoranthene	CE051	mg/l	<0.0001	<0.0001
Pyrene	CE051	mg/l	<0.0001	<0.0001
Benzo(a)anthracene	CE051	mg/l	<0.0001	<0.0001
Chrysene	CE051	mg/l	<0.0001	<0.0001
Benzo(b)fluoranthene	CE051	mg/l	<0.0001	<0.0001
Benzo(k)fluoranthene	CE051	mg/l	<0.0001	<0.0001
Benzo(j)fluoranthene	CE051	mg/l	<0.0001	<0.0001
Benzo(a)pyrene	CE051	mg/l	<0.0001	<0.0001
Indeno(123cd)pyrene	CE051	mg/l	<0.0001	<0.0001
Dibenz(ah)anthracene	CE051	mg/l	<0.0001	<0.0001
Benzo(ghi)perylene	CE051	mg/l	<0.0001	<0.0001
PAH (total)	CE051	mg/l	<0.0001	<0.0001

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LEACHATES

Lab number			38430-1L	38430-2L
Sample id			BH 1	BH 2
Depth (m)			0.00-0.20	0.00-0.20
Test	Method	Units		

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METHOD DETAILS

METHOD	SOILS	METHOD SUMMARY	STATUS	LOD	UNITS
CE054	Arsenic (total)	Aqua regia digest, ICP-OES	M	1	mg/kg
CE054	Cadmium (total)	Aqua regia digest, ICP-OES	M	0.2	mg/kg
CE054	Chromium (total)	Aqua regia digest, ICP-OES	M	1	mg/kg
CE054	Copper (total)	Aqua regia digest, ICP-OES	M	1	mg/kg
CE054	Lead (total)	Aqua regia digest, ICP-OES	M	1	mg/kg
CE054	Mercury (total)	Aqua regia digest, ICP-OES		0.5	mg/kg
CE054	Nickel (total)	Aqua regia digest, ICP-OES	M	1	mg/kg
CE054	Selenium (total)	Aqua regia digest, ICP-OES	M	0.3	mg/kg
CE054	Zinc (total)	Aqua regia digest, ICP-OES	M	3	mg/kg
CE004	pH	BS 1377, pH Meter	M	0.1	units
CE049	Sulphate (2:1 water soluble)	Aqueous extraction, IC-COND	U	10	mg/l
CE061	Sulphur (total)	Acid extraction, ICP-OES		100	mg/kg
CE077	Cyanide (free)	Extraction, Continuous Flow Colorimetry		2	mg/kg
CE005	Total Organic Carbon	BS 1377, Colorimetry	M	0.01	% w/w
CE032	PAH (EPA 16)	Solvent extraction, GC-MS		0.1	mg/kg
CE032	PAH (total)	Solvent extraction, GC-MS		5	mg/kg
\$	Asbestos (qualitative)	HSG 248, Microscopy	U	-	-

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METHOD DETAILS

METHOD	SOILS	METHOD SUMMARY	STATUS	LOD	UNITS
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METHOD DETAILS

METHOD	LEACHATES	METHOD SUMMARY	STATUS	LOD	UNITS
CE055	Arsenic	ICP-OES		0.001	mg/l
CE063	Boron	ICP-OES		0.03	mg/l
CE055	Cadmium	ICP-OES	U	0.001	mg/l
CE055	Chromium	ICP-OES	U	0.003	mg/l
CE055	Copper	ICP-OES	U	0.004	mg/l
CE055	Lead	ICP-OES	U	0.009	mg/l
CE055	Mercury	ICP-OES		0.001	mg/l
CE055	Nickel	ICP-OES	U	0.003	mg/l
CE055	Selenium	ICP-OES		0.001	mg/l
CE055	Zinc	ICP-OES	U	0.02	mg/l
CE004	pH	BS 1377, pH Meter		0.1	units
CE049	Sulphate	Ion Chromatography	U	10	mg/l
CE079	Sulphide	Continuous Flow Colorimetry		0.1	mg/l
CE077	Cyanide (free)	Continuous Flow Colorimetry		0.02	mg/l
CE051	PAH (EPA 16)	Solvent extraction, GC-MS		0.0001	mg/l
CE051	PAH (total)	Solvent extraction, GC-MS		0.0001	mg/l

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METHOD DETAILS

METHOD	LEACHATES	METHOD SUMMARY	STATUS	LOD	UNITS
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ANALYTICAL TEST REPORT

Contract no: ARC/38454(1)

Contract name: St Aidens Church, South Shields

Client reference: 08-494

Clients name: ARC Environmental

Clients address: The Rivergreen Centre
Aykley Heads
Durham
DH1 5TS

Date received: 11 December 2008

Date started: 12 December 2008

Date of issue: 20 January 2009

This is a supplementary report to report number ARC/38454 issued 16 December 2008.

Notes: Opinions and interpretations expressed herein are outside the UKAS accreditation scope. Unless otherwise stated, Chemtech Environmental Ltd were not responsible for sampling. Methods, procedures and performance data are available on request. Results reported herein relate only to the material supplied to the laboratory. All results are reported on a dry basis. Samples dried at no more than 30°C in a drying cabinet. Analytical results are exclusive of stones. This report shall not be reproduced except in full, without prior written approval. Samples will be disposed of 8 weeks from initial receipt unless otherwise instructed.

Key: U UKAS accredited test
M MCERTS & UKAS accredited test
\$ Test carried out by an approved subcontractor
NAF Non asbestos fibres

Approved by:

Karan Campbell

Director

John Campbell

Director

Chemtech Environmental Limited

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Other materials such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

Lab number	Sample id	Depth (m)	Description	Moisture (%)
38454-1R	BH 5	4.00-4.50	Clayey Sand	17.9

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SOILS

Lab number			38454-1R
Sample id			BH 5
Depth (m)			4.00-4.50
Test	Method	Units	
Organic matter content	CE005 ^M	% w/w	3.28

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METHOD DETAILS

METHOD	SOILS	METHOD SUMMARY	STATUS	LOD	UNITS
CE005	Organic matter content	BS 1377, Colorimetry	M	0.01	% w/w

Chemtech Environmental Limited

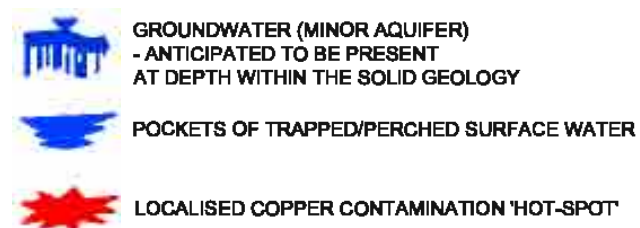
METHOD DETAILS

METHOD	SOILS	METHOD SUMMARY	STATUS	LOD	UNITS
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APPENDIX IV

Conceptual Site Model (CSM)

	MADE GROUND
	GRAVELLY SANDY CLAY
	SILTY SAND/GRAVELLY SILTY SAND
	CARBONIFEROUS MIDDLE COAL MEASURES (MCM) (MUDROCKS RECORDED AT ROCKHEAD)



 SOURCES:

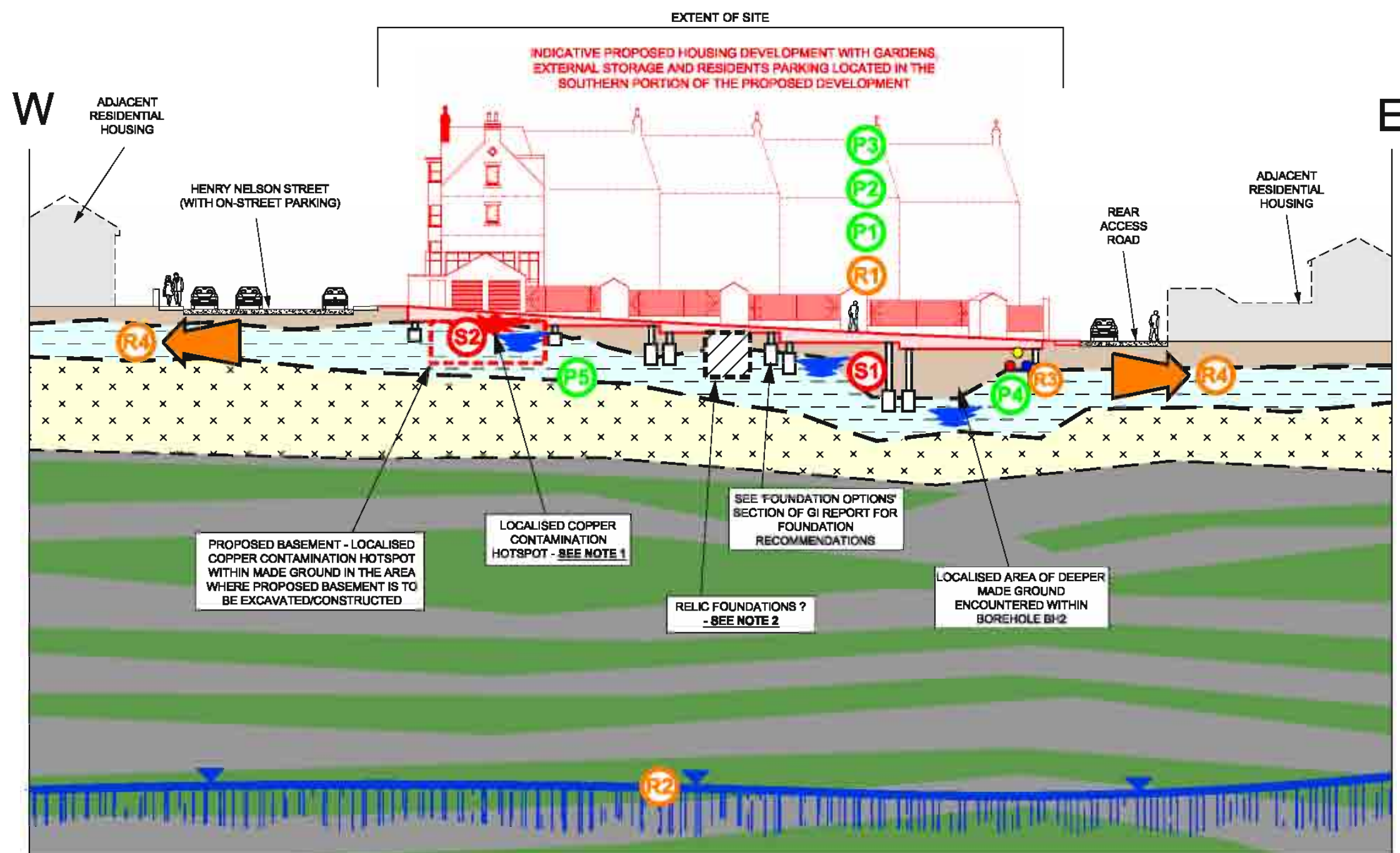
S1 - MADE GROUND - SEE NOTE 1
S2 - LOCALISED COPPER CONTAMINATION HOTSPOT - SEE NOTE 1

 PATHWAYS:

P1 - INGESTION
P2 - INHALATION OF INDOOR/OUTDOOR AIR
P3 - DERMAL CONTACT
P4 - MIGRATION THROUGH SERVICES
P5 - POTENTIAL LEACHING OF CONTAMINANTS - SEE NOTE 1

 RECEPTORS:

R1 - HUMAN HEALTH (END USERS)
R2 - GROUNDWATER (MINOR AQUIFER)
**R3 - PROPOSED BUILDING MATERIALS - FLOOR SLABS,
FOUNDATIONS AND BURIED SERVICES**
R4 - ADJACENT SITES



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e-mail: admin@arc-environmental.com
web: www.arc-environmental.com

The contractor shall check all dimensions on site before commencement of any works. No dimensions to be scaled off this drawing.

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1. GENERIC AND TARGETED PAH CONTAMINATION SCREENING CARRIED OUT ON SAMPLES RECOVERED DURING THE PHASE II GROUND INVESTIGATION HAS INDICATED THAT THERE ARE NO GROSSLY CONTAMINATED MATERIALS ACROSS THE MAJORITY OF THE SITE, AND NO LEACHABLE CONTAMINANTS PRESENT BENEATH THE SITE. HOWEVER, A COPPER 'HOT-SPOT' (i.e. ELEVATED CONTAMINATION) HAS BEEN IDENTIFIED WITHIN THE MADE GROUND MATERIALS ENCOUNTERED WITHIN BH1 ONLY. IT IS RECOMMENDED THAT THIS LOCALISED 'HOT-SPOT' AREA REQUIRES FURTHER INVESTIGATION (i.e FURTHER DELINEATION AND REMOVAL).
2. IN BOREHOLE BH4, A RELIC FOUNDATION MAY HAVE BEEN ENCOUNTERED. ALTHOUGH NO RELIC FOUNDATIONS WERE ENCOUNTERED WITHIN THE REMAINDER OF THE BOREHOLES, THEY MAY BE PRESENT IN AREAS NOT TARGETED IN THE GROUND INVESTIGATION.

rev.	date	amendments	drawn	check

Client: **ST. AIDAN'S COURT
(SOUTH SHIELDS) LIMITED**

Project Title:
Former St. Aidan's Church
St Aidan's Road, South Shields
Tyne and Wear

Drawing Title:

Conceptual Site Model

Scale at A3:	Date:	Drawn by:	Approved by:
NTS @ A3	23.01.09	P.D	A.H

Job Ref:	Drg no:	Rev:
08-494	-	-