



ARP GEOTECHNICAL LTD
CHARTERED CONSULTING ENGINEERS

STAGE 2 GEO-ENVIRONMENTAL REPORT

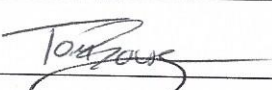
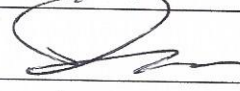
AT

LAND OFF WATH ROAD, BOLTON UPON DEARNE

ON BEHALF OF

ETON CONSTRUCTION LTD

DECEMBER 2016

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1.0 EXECUTIVE SUMMARY

The pertinent conclusions of the report are tabulated below. However, the information below is not exhaustive, and it is recommended the report is read in its entirety.

Proposed Development	Residential dwellings with private gardens.
Existing Site Description	The site has been cleared recently, but was occupied by a residential property with various metal outbuildings and sheds.
Site History	Used as residential and haulage yard. Old well on site.
Geology	Undifferentiated Pennine Middle Coal Measures (mudstone, siltstone and sandstone) on most of site. Mexborough Rock on northeastern corner, beyond a fault.
Coal Mining	Site can be considered stable.
Hydrogeology	Secondary A Aquifer. No abstractions within 1km.
Hydrology	Nearest watercourse is the River Dearne, 350m to the south. No sensitive abstractions within 1km.
Radon	No protection measures required.
Landfill Gas	Landfill 50m to north. So far, monitoring indicates CS2/Amber 1 protection required for carbon dioxide.
Ground Conditions	Up to 2.3m thickness of made ground overlying natural clay.
Contamination	Sporadic elevated benzo(b)flouranthene, benzo(a)pyrene, and Dibenzo(a,h)anthracene.
Remediation Strategy	0.6m thick cover blanket of topsoil and subsoil in soft areas.
Foundations	Strip/trench fill onto firm clay. Allowable bearing pressure 100kN/m ² . On northeast of site (within 20m of fault), 300mm thick and reinforced with two layers of B503 mesh.
Excavations	Unstable within made ground. Old well needs to be filled and capped. May be an old cess pit on site - excavate and remove. Party Wall Act may apply for excavations near boundaries.
Concrete	FND2 designation for unreinforced buried concrete, unless made ground is removed. Other mixes may apply for reinforced concrete.
Soakaways	Unlikely to be feasible on the site, given the presence of clays.

2.0 TERMS OF REFERENCE

- 2.1 Eton Construction Ltd is considering developing the site off Wath Road, Bolton Upon Dearne, with residential properties. It was considered appropriate to provide information to aid viability assessment and design of any subsequent development. In September 2016, ARP Geotechnical Ltd issued a Stage 1 Desk Study Report (Reference ECL/05r1). This involved an assessment of the geological and coal mining aspects, Ordnance Survey archive maps, radon gas, indicative flood risk, hydrogeology, landfill, and other environmental issues, primarily by assessment of a Landmark Envirocheck Report. In addition to comments and conclusions on a wide range of environmental and geotechnical issues, the report also provided recommendations for intrusive investigation and assessment.
- 2.2 ARP Geotechnical Ltd was appointed by Eton Construction Ltd to undertake the recommended further works, with the intrusive investigation comprising window samples to assess the ground conditions.
- 2.3 The investigation was implemented generally in accordance with BS 5930 : 1999 "Code of practice for site investigations", NHBC Standard Chapter 4.1 "Land quality - managing ground conditions", Environment Agency CLR 11 "Model Procedures for the Management of Land Contamination" and BS10175 : 2011 + A1 : 2013 "Investigation of potentially contaminated sites - Code of practice". This report is limited to the data obtained as part of this investigation. It should be noted that there is a possibility of variation in ground conditions between test locations and interpretation of strata is given for guidance only. No liability is accepted for changes to site conditions, including groundwater levels, after the preparation of this report.
- 2.4 The findings or contents of the Stage 1 Desk Study Report are not reproduced here in full, and it is recommended that this report is read in conjunction with the Stage 1 Report.

- 2.5 The general observation and assessment of the ground surface and the identification/classification of vegetation is made in general terms only. It would be prudent for a specialist to undertake a more detailed survey, including for any invasive/harmful weeds.
- 2.6 The assessment of any topsoil is carried out in terms of potential chemical effects on human health only, and no account is taken of aesthetic or horticultural properties. Such considerations should be referred to a horticulturist or landscape architect.
- 2.7 The Stage 2 Investigation was commenced in August 2016.
- 2.8 The report has been prepared for the use and reliance of the Client only. The report shall not be relied upon or transferred to any other parties without the written agreement of ARP Geotechnical Ltd. For the avoidance of any doubt, where ARP Geotechnical Ltd enters into a letter of reliance for the benefit of a third party, that third party will be permitted to rely on the report. No responsibility will be accepted where this report is used, either in its entirety or in part, by any other party without ARP Geotechnical Ltd.'s consent.

3.0 THE SITE

Site Location

- 3.1 The site, which is centred on Ordnance Survey Grid Reference 445210, 402500 is located off Wath Road, in Bolton Upon Dearne.
- 3.2 A site location plan, aerial photograph, and a site survey, are presented in Appendix A.

Site Description

- 3.3 The site is an irregular shaped piece of land extending to an area of 0.17 hectares, with overall dimensions of approximately 61m (north - south) by 41m (south west - north east). The site has been cleared of buildings, leaving a generally level area surfaced by a combination of rubble, concrete slabs and bituminous surfacing. Towards the southern boundary, the land slopes away and is retained at/near the boundary by a retaining wall approximately 1.5m high. Publicly available aerial and street view photographs show that, until recently, the site was occupied by a detached residential property, with various corrugated metal outbuildings and a yard area, probably in use for combined residential and commercial use such as haulage. There is also anecdotal evidence that cellars are present below the original building, a cess pit (location uncertain), and two backfilled vehicle inspection pits. An old box van body or goods container was still present on the east of the site, next to a mature tree. There was little other vegetation, comprising only sporadic weeds and small bushes.

Site History

- 3.4 Ordnance Survey archive maps show that the site has been the location of a residential property (originally Mount Pleasant) since at least 1854. The surrounding adjacent areas have been progressively developed for residential use. A well was once present in the middle of the northern half of the site, and an above-ground tank on the mid-east of the site, (probably diesel and now removed).

4.0 ENVIRONMENTAL SETTING

- 4.1 The environmental setting for the site was established by the Stage 1 Desk Study Report undertaken by ARP Geotechnical Ltd, under reference ECL/05r1 and dated September 2015. The findings of the Desk Study Report, updated and amended where deemed appropriate, are summarised below.

Geology

- 4.2 The maps show a fault to cross the northeastern corner of the site (approximately 9m into the site), trending northwest to southeast. To the northeast of the fault, Mexborough Rock is indicated to outcrop, whilst to the southwest of the fault, undifferentiated strata (mudstone, siltstone, and minor sandstone), are indicated to be present.

Coal Mining and Coal Recovery

- 4.3 The Coal Mining Report indicates the site is stable with regard to coal mining.
- 4.4 There will be no arisings of coal during proposed development works, and it will not be possible to win any coal from the site by open excavation before development.

Hydrogeology

- 4.5 The Landmark Envirocheck Report indicates the Bedrock Aquifer Designation to be Secondary A. These Aquifers comprise "permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers".
- 4.6 There are no groundwater abstractions within 1km of the site.

Hydrology

- 4.7 The general area slopes from north to south. The nearest downslope surface water feature is the River Dearne (classed as a Primary River) which lies 350m to the south of site.
- 4.8 There are four surface water abstractions within 1km of the site. The first lies 598m to the south and is utilised for general industrial purposes. The second lies 829m to the southeast and is used for dust suppression in the production of mineral products. A further abstraction lies 833m to the south east and is utilised as top up water for aquaculture. The fourth abstraction lies 913m to the southeast, and is for general use in mineral product manufacture.

Other Relevant Environmental Data

- 4.9 There are no discharge consents relating to, or adjacent to, the site.
- 4.10 There are no Pollution Control Authorisations within 250m of the site.
- 4.11 There is one recorded landfill within 250m of the site, located 51m to the north. The landfill received inert, non-hazardous industrial and commercial waste from 1979 to 1985.
- 4.12 No radon protective measures are stated to be necessary for new dwellings or extensions on the site, and the site is within a "lower probability radon area".
- 4.13 There are no active contemporary trade directories within 250m of site. The site itself is registered as the (inactive) location of a haulage company, as already anticipated from aerial photographs.

Potential Contamination

4.14 The site has been a residential property since at least 1854 and in later years has been used for a haulage company. Archive maps show a tank near the middle of the eastern boundary (probably a diesel tank), which is no longer evident, and has presumably been removed as part of the recent clearance of the site. There is anecdotal evidence that servicing of vehicles has been carried out on the site (two vehicle inspection pits). There is also the possibility that contamination may be present in any fill material used on the development. In the light of the above, the following potential sources of contamination are identified:

4.14.1 Possible made ground (including any residual rubble from demolition of buildings): - metals inorganics, TPH, PAH, phenol, asbestos.

4.14.2 Possible hydrocarbons from an above ground tank (probably diesel and now removed) shown on archive maps in the mid-east of the site, from parking and possible servicing of vehicles on the site.

4.14.3 Landfill 50m to the north: - methane and carbon dioxide.

5.0 SITE INVESTIGATION

5.1 The purpose of the investigation undertaken in August 2016 was to produce an assessment of the site in accordance with BS10175: 2011 + A1: 2013 "Investigation of potentially contaminated sites - Code of practice", and to provide geotechnical information to aid design of the development.

5.2 The site was gridded on a maximum 25m spacing and boreholes were sampled on the grid, to satisfy the requirements of the British Standard, along with any targeted locations. Six windowless sampling boreholes (WS1 - WS6) were drilled, by RP Drilling Ltd, on 2nd August 2016, to depths of between 3.35m and 3.45m. The boreholes were organised and supervised by an Engineer from ARP Geotechnical Ltd, and logged by the foreman driller. Justifications for the borehole locations are given below.

LOCATION	REASON
WS1 and WS2	Part of grid
WS3	Part of grid and adjacent to former tank shown on archive maps
WS4 to WS6	Part of grid

5.3 Three gas monitoring wells were installed in WS2, WS4 and WS5, and subsequently monitored by ARP Geotechnical Ltd. The wells were installed to 3m depth, with the bottom 2m comprising slotted pipe with gravel surround, and the upper 1m comprising plain pipe with bentonite seal and lockable flush cover.

5.4 The borehole location plan and logs are included in Appendix B.

5.5 Chemical analysis of six soil samples for metals, inorganics, speciated PAH, TPH, phenols, and asbestos was undertaken by the UKAS accredited Derwentside Environmental Testing Services (DETS) laboratory in Consett. Elevated determinands were tested further for leachability to determine the potential mobility of the contaminants. The test certificates are included in Appendix C.

were tested further for leachability to determine the potential mobility of the contaminants. The test certificates are included in Appendix C.

- 5.6 Analysis for Atterberg Limits and moisture content was undertaken by the UKAS accredited Professional Soils Laboratory (PSL) in Doncaster. Geochemical testing comprising pH and water soluble sulphate was undertaken by DETS. The test certificates are included in Appendix C.

6.0 SUMMARY OF GROUND CONDITIONS

Strata and Groundwater

- 6.1 The site was found to have a covering layer of concrete between 0.08 and 0.21m depth, with the exception of WS5 & WS6 which had no concrete overlay. Beneath, all the boreholes revealed a layer of made ground to depths of between 0.48m and 2.3m. The made ground comprised a combination of cohesive and granular material, with contained inclusions of mainly sandstone and brick, with minor presence of wood, glass, ash, clinker, and plaster.
- 6.2 Underlying the made ground in WS4 was a thin (0.16m) layer of natural slightly gravelly clayey sand; the gravel consisting of sandstone. In WS5, 0.23m thickness of slightly gravelly sand, with the gravel consisting of sandstone and mudstone. The remainder of the natural strata encountered were found to comprise orange brown, mottled grey, gravelly clay with the gravel comprising mudstone. In WS3, gravel sized pockets of sand were also found within this layer. This clay was firm to stiff in consistency, except for localised softening in the upper zone.
- 6.3 No groundwater was encountered in any of the boreholes. There was no visual or olfactory evidence of hydrocarbon contamination.

Gas Assessment

- 6.4 Three gas wells have been installed by ARP Geotechnical Ltd as part of the recent investigation. Monitoring by ARP is ongoing, and will be reported fully by separate letter on completion. So far, monitoring indicates CS2/Amber 1 protection is required for proposed properties, against carbon dioxide, due to a maximum concentration of 12% (with no flow).

7.0 CONTAMINATION ANALYSIS

Screening Values - Soils

- 7.1 There is presently conflicting opinions with regard to the appropriate generic assessment criteria, or screening values, for soils which should be used in contamination assessment for proposed development. In March 2014, DEFRA published Category 4 Screening Levels (C4SLs) for six contaminants: arsenic, benzene, benzo(a)pyrene, cadmium, chromium VI and lead. The values are based on the toxicological benchmark of a "low level of toxicological concern" (LLTC) rather than the previous regulatory approach of "minimal or tolerable level of risk". As the C4SLs are less protective of health than the previous approach, the Chartered Institute of Environmental Health (CIEH) has advocated an alternative approach based on minimal risk, but with some adjustment of exposure parameters to more realistic scenarios than those previously used. To this end, the CIEH has collaborated with Land Quality Management to publish "Suitable 4 Use Levels" (S4ULs) "The LQM/CIEH S4ULs for Human Health Risk Assessment", November 2014 (LQM/CIEH). However, DEFRA has reiterated its intention that the C4SLs should be used in generic risk assessment for proposed development, and there is indication that other parties will collaborate, in the near future, to extend the range of C4SL determinands beyond the six published so far.
- 7.2 In the absence of a final resolution to the debate, soil contamination test results in this report have been compared first against the more conservative S4UL, and where a C4SL exists for the same determinand, consideration given to the use of the C4SL for any exceedences of the S4UL, within the site specific context. Where no S4UL exists for a determinand, for example lead, the C4SL has been used. The LQM/CIEH screening values have been calculated for soil organic matter contents of 1% and 2.5%, as well as 6%, and the appropriate screening value is used for the organic matter content of the soil. All the C4SL values published are for a soil organic matter content of 6%.
- 7.3 A table showing the screening values utilised is included in Appendix C.

Soils Analysis

- 7.4 Six samples of made ground were issued to DETS laboratory for the suite of testing (As, Cd, Cr (VI), Cr(III), Cu, Hg, Ni, Pb, Se, Zn, Total Sulphate, Water Soluble Sulphate, pH, Phenol-monohydric, Speciated PAH, Total TPH, Asbestos, and Organic Matter).
- 7.5 The testing revealed exceedances of screening values in WS2 only, from 0.37m to 0.6m, for:

Benzo(b)fluoranthene (BbF) of 7.6mg/kg (S4UL screening value 3.3mg/kg)

Benzo(a)pyrene (BaP) of 11mg/kg (S4UL screening value 2.7mg/kg)

Dibenzo(a,h)anthracene (DahA) of 0.9mg/kg (S4UL screening value 0.28mg/kg)

All the results for these three determinands are presented on the table below.

Borehole	Depth	BbF	BaP	DahA	Organic Matter
WS1	0.14 - 0.51m	<0.1	<0.1	<0.1	2.0
WS2	0.37 - 0.60m	7.6	11	0.9	2.8
WS2	0.80 - 1.0m	<0.1	<0.1	<0.1	4.9
WS3	1.67 - 0.90m	<0.1	<0.1	<0.1	2.1
WS5	1.0 - 1.50m	<0.1	<0.1	<0.1	2.7
WS6	0.2 - 0.80m	<0.1	<0.1	<0.1	1.3

Screening Value 3.3 2.7 0.28

Exceedence of screening value

- 7.6 Although the exceedance was only detected at one location, the made ground was variable, and usually comprised a number of interchangeable layers. Therefore, the made ground of the type found to contain elevated determinands is likely to be present at other locations on the site.
- 7.7 Extractable Petroleum Hydrocarbons (EPH) was also elevated above the in-house screening value (500mg/kg) above which speciation is carried out. However, the subsequent speciated results revealed no elevated determinands.

Updated Risk Assessment and Conceptual Model

7.8 The updated source - pathway - receptor matrix is presented below, taking into account the findings of the investigation. Any pathways in italics are deemed not to be viable and the reason given.

Source - Pathway - Receptor Matrix

Contamination Sources	Pathways	Receptors
Made ground - sporadic elevated BbF, BaP and DahA	• Ingestion and dermal contact with soil and dust • Fruit and vegetable intake, with soil • <i>Vapour inhalation outdoor – not significant for the relevant determinands</i> • <i>Vapour inhalation indoor - not significant for the relevant determinands</i>	Humans:- • Future occupants • Construction workers • Maintenance workers • Adjacent residents and general public
	• <i>Migration in surface water – leachability will be minimal for the concentrations present</i> • <i>Migration in groundwater, including via the on-site well, - leachability will be minimal for the concentrations present</i>	Controlled waters:- • Groundwater (Secondary A Aquifer, no abstractions within 1km). • Surface water (nearest is the River Dearne 350m to the south. No sensitive abstractions within 1km).
	• Root uptake	Vegetation:- • Landscape areas • Private gardens
	• Migration	Services/Utilities:- • Potable water supply
Landfill gas - methane and carbon dioxide	• Asphyxiation • Explosive risk	• Construction/demolition workers • Future occupants • Buildings

- 7.9 It can be seen from the above matrix that several pathways to receptors are operative, and this may affect users of the finished development. Some form of remedial action is, therefore, considered necessary to allow residential development without excess risk.

Risk Based Assessment of Remedial Options

Landfill Gases

- 7.10 To address the potential risk from landfill gases, monitoring of borehole wells is in progress. This will determine whether or not protection measures are likely to be necessary. This will be confirmed by separate letter report on completion of the monitoring. So far, monitoring indicates CS2/Amber 1 protection is required for carbon dioxide.

Pathways From the Made Ground - Ingestion, Dermal Contact, Dust Inhalation, Root Uptake, and Fruit and Vegetable Intake, With Soil

- 7.11 These pathways are automatically blocked where buildings or hardstanding are present above the material. However, in garden areas, provision of a cover blanket of a minimum 600mm thickness will be required, to reduce the risk to future users of the site to acceptable levels from these pathways. This assumes a worst case double dig scenario (i.e. 2 x spade depths).

Pathways From the Made Ground - Migration to Utilities

- 7.12 Any migration to utilities is unlikely to be significant. However, the local water company are likely to require details of the contaminants present on the site, to make a judgment on any requirement for protection of buried water supply pipes from chemical attack/ingress.

Risks During Construction Period

- 7.12 It is also necessary to consider the effects of the contamination present on the site in relation to the risks to adjacent residents, construction workers and the general public during construction. This is assessed in the following matrix.

Source	Pathway	Potential risk	Risk after employing suitable Health and Safety plan
Existing made ground	Inhalation	Moderate	Damping down of the site during dry periods and timely placement of the existing made ground below barriers should reduce the risk to LOW.
Existing made ground	Ingestion	Moderate	Provision of washing facilities and a clean mess room from which work boots and overalls are excluded should reduce the risk to LOW. Site fencing will exclude access to members of the public. Existing made ground will be contained within the site boundary, and placed below barriers as soon as possible.
Existing made ground	Contact	Moderate	Education of workers to use adequate hygiene and PPE should reduce the risk to LOW.
Existing made ground	Surface water	Moderate	Preventing surface water run off by minimising open exposure times of the existing made ground, and using bunds or cut off trenches as necessary will reduce the risk to LOW.

- 7.13 Provision of all the above measures will ensure that all the identified pathways for the contamination will be blocked.

Summary of Contamination Identified and Remedial Options

- 7.14 The site is covered by made ground to a depth of between 0.48m and 2.15m, overlying natural clay. Monitoring of ground gases, by means of borehole well installations, is in progress. This will determine whether or not protection measures are likely to be necessary. This will be confirmed by separate letter report on completion of the monitoring. So far, monitoring indicates CS2/Amber 1 protection is required for carbon dioxide.

- 7.15 The made ground was found to contain sporadic elevated concentrations of benzo(b)fluoranthene, benzo(a)pyrene, and Dibenzo(a,h)anthracene.
- 7.16 The contamination risk assessment, and assessment of remedial options, has indicated that, provided that the following remedial measures are adopted then the risks to the identified receptors are deemed acceptable for the proposed development of residential properties with private gardens.
- 7.16.1 Where any garden or landscape areas overlie the existing made ground, a minimum 600mm thickness of uncontaminated soils (topsoil and subsoil) should be provided. In areas of hardstanding or building footprints, the cover blanket is not required.
- 7.16.2 Any imported soils used within the cover blanket will need to be verified as suitable by inspection and testing, in accordance with guidance supplied in the document produced by the Yorkshire and Humberside Pollution Advisory Council (YAHPAC): "Guidance on the Verification Requirements for Cover Systems".
- 7.16.3 Alternatively, the made ground could be removed from site. Waste Acceptance Criteria (WAC) tests may be required by the receiver of the material.
- 7.17 The local water company are likely to require details of the contaminants present on the site, to make a judgment on any requirement for protection of buried water supply pipes from chemical attack/ingress.
- 7.18 A Contamination Remediation Statement is included in Appendix D.

8.0 GEOTECHNICAL TESTING

8.1 Selected samples of the natural strata were delivered to PSL in Doncaster for testing with regard to plasticity indices and moisture content. Test certificates are presented in Appendix C and a summary of the results, including Modified Plasticity Indices, is given below.

Borehole	Depth (m)	MC	LL	PL	PI	<425µm	I _p
WS01	1.4 - 1.6	21	49	24	25	100	25.0
WS02	2.3 - 2.6	21	48	24	24	100	24.0
	No. of results	2	2	2	12	2	12
	Min.	21	48	24	0	100	0.0
	Max.	21	49	24	25	100	25.0

I _p	VCP
>40%	High
20% - <40%	Medium
10% - <20%	Low

MC= Moisture Content (%) LL= Liquid Limit (%) PL= Plastic Limit (%)
 PI= Plasticity Index (%) I_p= Modified PI (%) VCP= NHBC Standard Chapter 4.2
 Volume Change Potential

8.2 The plasticity test data shows the clay strata to be of intermediate plasticity, in accordance with BS 5930 (1999) "Code of Practice for Site Investigations". When the percentage retained on the 425 micron BS sieve is considered, the Modified Plasticity Index, in accordance with NHBC Standard Chapter 4.2 "Building Near Trees" is a maximum of 25. In accordance with the Standard, this equates to medium Volume Change Potential.

- 8.3 Geochemical testing (water soluble sulphate and pH) was undertaken on selected samples by PSL, comprising two samples of natural clay. In addition, six samples of made ground were tested for pH and water soluble sulphate as part of the contamination suite reported by DETS. In accordance with the BRE Special Digest 1 "Concrete in aggressive ground", the characteristic values for the two materials are given below:

Characteristic Values

Material	pH	SO₄
Made Ground	7.9	1575
Natural Clay	7.7	74

SO₄ = Sulphate content in mg/l on a 2:1 water : soil extract pH = Acidity

- 8.4 The geochemical analyses show the made ground to have slightly alkaline pH and elevated sulphate. The Aggressive Chemical Environment for Concrete (ACEC) class is AC-2s. Therefore, the use of FND2 designated concrete will be necessary for unreinforced buried concrete, in accordance with BS 8500-1:2006, if the existing made ground is to be retained on site. If the existing made ground was to be removed from site, the use of GEN 1 designation would be satisfactory for unreinforced buried concrete.

9.0 COMMENTS AND CONCLUSIONS

Site Description

- 9.1 At the time of the investigation, the site had been cleared of buildings, leaving a generally level area surfaced by a combination of rubble, concrete slabs and bituminous surfacing.
- 9.2 Towards the southern boundary, the land slopes away and is retained at/near the boundary by a retaining wall approximately 1.5m high. Publicly available aerial and street view photographs show that, until recently, the site was occupied by a detached residential property, with various corrugated metal outbuildings and a yard area, probably in use for combined residential and commercial use such as haulage. There is also anecdotal evidence that cellars are present below the original building, a cess pit (location uncertain), and two backfilled vehicle inspection pits. An old box van body or goods container was still present on the east of the site, next to a mature tree. There was little other vegetation, comprising only sporadic weeds and small bushes.

Site History

- 9.3 Ordnance Survey archive maps show that the site has been a residential property since at least 1854 and in later years has been used for a haulage company. Archive maps show a tank near the middle of the eastern boundary (probably a diesel tank), which is no longer present, and has presumably been removed as part of the recent clearance of the site. A well (marked by "P" for pump) was once present in the middle of the northern half of the site. There is also anecdotal evidence that servicing of vehicles has been carried out on the site (two vehicle inspection pits).

Geology

- 9.4 The maps show a fault to cross the northeastern corner of the site (approximately 9m into the site), trending northwest to southeast. To the northeast of the fault, Mexborough

Rock is indicated to outcrop, whilst to the southwest of the fault, undifferentiated strata (mudstone, siltstone, and minor sandstone), are indicated to be present.

Coal Mining and Coal Recovery

- 9.5 The Coal Mining Report indicates the site is stable with regard to coal mining.
- 9.6 There will be no arisings of coal during proposed development works, and it will not be possible to win any coal from the site by open excavation before development.

Environmental Data

- 9.7 The Bedrock Aquifer Designation is Secondary A. There are no groundwater abstractions within 1km of the site.
- 9.8 The nearest downslope surface water feature is the River Dearne (classed as a Primary River) which lies 350m to the south of site.
- 9.9 There are no sensitive water abstractions within 1km of the site.
- 9.10 No radon protective measures are required for properties constructed on the site. However, a risk from other gases has been identified (see section 9.11 below).
- 9.11 There is one recorded landfill within 250m of the site, located 51m to the north. The landfill received inert, non-hazardous industrial and commercial waste from 1979 to 1985. Gas monitoring is on-going at the site. So far, monitoring indicates CS2/Amber 1 protection is required for carbon dioxide.
- 9.12 The site is not at risk from river flooding. The risks of flooding from other causes such as adverse topography or insufficient surface water drainage are not considered here, and a

separate specialist Flood Risk and Drainage Report should be commissioned if such risk needs to be quantified.

Ground Conditions Encountered

- 9.13 The site was found to have a covering layer of concrete between 0.08 and 0.21m depth, with the exception of WS5 & WS6 which had no concrete. Beneath, all the boreholes revealed a layer of made ground to depths of between 0.48m and 2.3m. The made ground comprised a combination of cohesive and granular material, with contained inclusions of mainly sandstone and brick, with minor presence of wood, glass, ash, clinker, and plaster.
- 9.14 The underlying natural strata encountered were found to comprise mainly gravelly clay with the gravel comprising mudstone. The clay was firm to stiff in consistency, except for localised softening in the upper zone. Locally, thin (0.23m thickness) bands of sand were present above the clay. No groundwater was encountered in any of the boreholes.

Contamination Assessment

- 9.15 The made ground was found to contain sporadic elevated concentrations of benzo(b)fluoranthene, benzo(a)pyrene, and Dibenzo(a,h)anthracene.
- 9.16 Provided that the following remedial measures are adopted, then risks to the identified receptors are deemed acceptable for the proposed residential usage.
- 9.16.1 Where any garden or landscape areas overlie the existing made ground, a minimum 600mm thickness of uncontaminated soils (topsoil and subsoil) should be provided. In areas of hardstanding or building footprints, the cover blanket is not required. The measures will need to be confirmed by inspection/excavation once the soils have been placed.

- 9.16.2 Any imported soils used within the cover blanket will need to be verified as suitable by inspection and testing, in accordance with guidance supplied in the document produced by the Yorkshire and Humberside Pollution Advisory Council (YAHPAC): "Guidance on the Verification Requirements for Cover Systems".
- 9.16.3 Alternatively, the made ground could be removed from site. Waste Acceptance Criteria (WAC) testing may be required by the waste receiver.
- 9.17 A Contamination Remediation Statement is included in Appendix D.
- 9.18 This Report should be issued to the local water company for it to make a judgment on any requirement for protection of buried water supply pipes from chemical attack/ingress.

Foundations

- 9.19 The existing made ground is considered unsuitable to support foundation loads. The underlying natural clays of at least firm consistency are considered suitable for the use of traditional strip/trench fill foundations. An allowable bearing pressure of 100kN/m^2 is considered applicable. It should be noted that soft zones were found to be present in the upper level of the natural clays, for example in WS1. Foundation should be taken through any such soft material to reach clays which are reliably firm or stiff.
- 9.20 Within 20m of the conjectured fault location, the foundations should be reinforced using two layers of B503 mesh on the northeastern half of the site, to mitigate the risks of differential settlement associated with potential deeply weathered or disturbed zones.
- 9.21 The foundations will need to be taken below any existing made ground and buried structures, to bear onto the natural strata. There may also be a legacy of buried services. Foundation loads should not be allowed to impinge on any retaining walls, and should be taken below a line drawn upslope at 1 in 3 (in cross section), from the base of any slope.

Excavations

- 9.22 It is likely that excavations into the natural strata will remain stable in the short term, requiring minimal trench support, in accordance with the prevailing statutory guidance. However, instability may be anticipated within the made ground present on site.
- 9.23 No groundwater seepages were encountered in the boreholes. If any are encountered during excavations on the site, these should be controllable by pumping from an artificial sump.
- 9.24 Excavations should be readily achieved using conventional hydraulic plant. However, excavations into intact bedrock, or any buried foundations and structures, are likely to require a hydraulic breaker.

Chemical Precautions

- 9.25 The Aggressive Chemical Environment for Concrete (ACEC) class is AC-2s for the made ground. Therefore, the use of FND2 designated concrete will be necessary for unreinforced buried concrete, in accordance with BS 8500-1:2006, if the existing made ground is to be retained on site. If the existing made ground was to be removed from site, the use of GEN 1 designation would be satisfactory. For any reinforced concrete (such as within 20m of the fault), other design-specific mixes may apply.

Road Pavement Construction

- 9.26 Due to the depth of existing made ground on the site, a formation for adoptable road pavement on natural strata is likely to be impractical. A commonly used solution in this situation is to either fully or partially excavate the made ground and replace with granular material compacted in layers, with the thickness of the required works possibly minimised by the use of geogrid layers. If the road is adoptable, the proposed measures will need to be agreed with the adopting authority and, therefore, consultations with the relevant authority should be undertaken at the earliest stage.

Soakaways

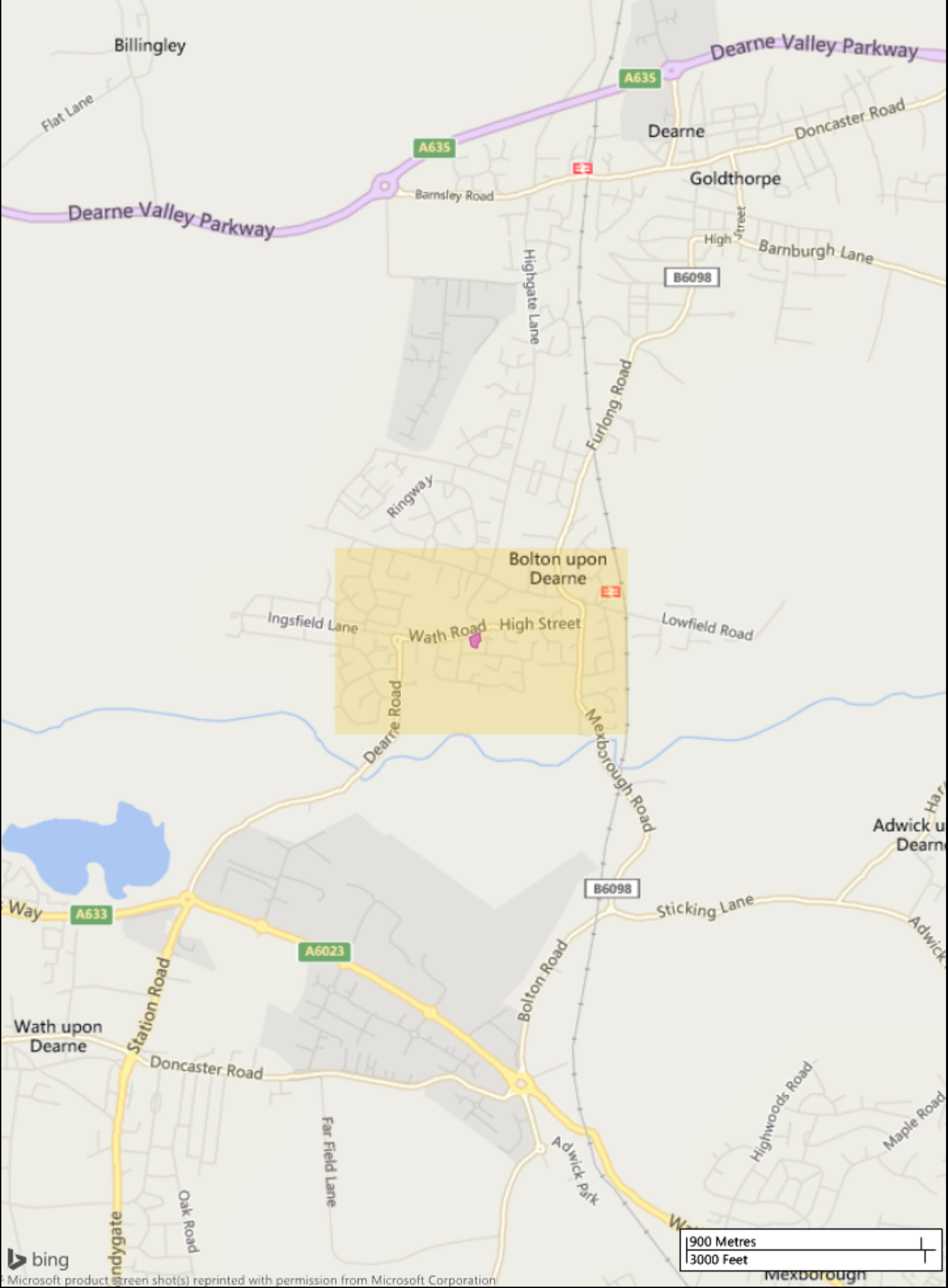
- 9.27 The disposal of surface water using soakaways is unlikely to be feasible on the site, given the presence of clays.

Other Issues

- 9.28 A well is indicated to have once been present on the north of the site (marked "P" on the 1892 archive map at 1:2,500 scale), in the previously prepared Stage 1 Desk Study Report, ref ECL/05r1. The well should be located, filled with single sized stone, and provided with a reinforced concrete cap.
- 9.29 There is anecdotal evidence that a cess pit may be present on the site, although its presence is not certain. If encountered, it should be emptied, and the structure excavated and removed from site. The faces and base should be inspected to ensure that no organic material remains, as this has the potential to generate localised landfill gas.
- 9.30 Any requirements of the Party Wall Act will need to be considered, in relation to excavations in close proximity to third party property.

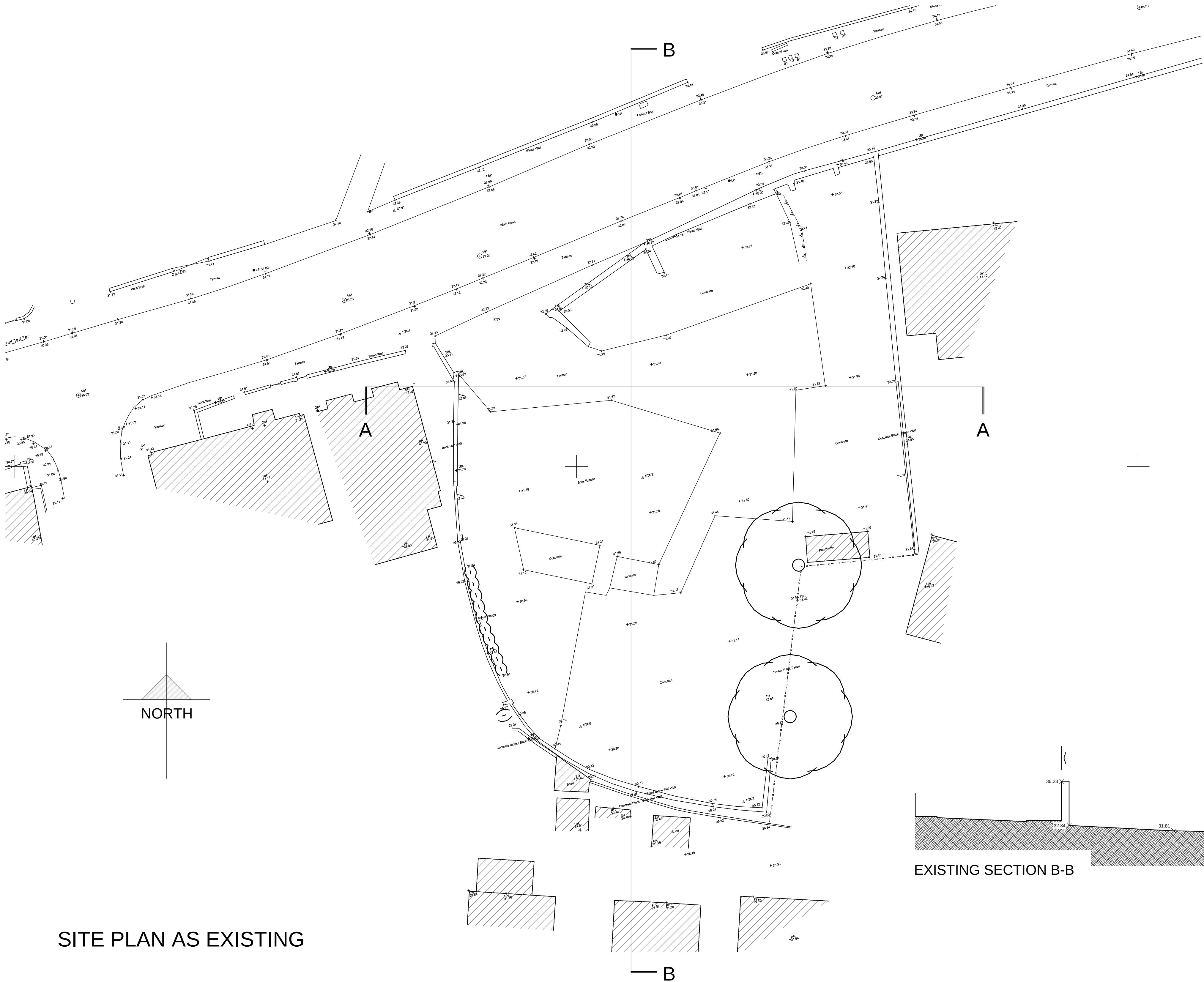
A P P E N D I X A

SITE LOCATION PLAN, AERIAL PHOTOGRAPH AND SITE SURVEY

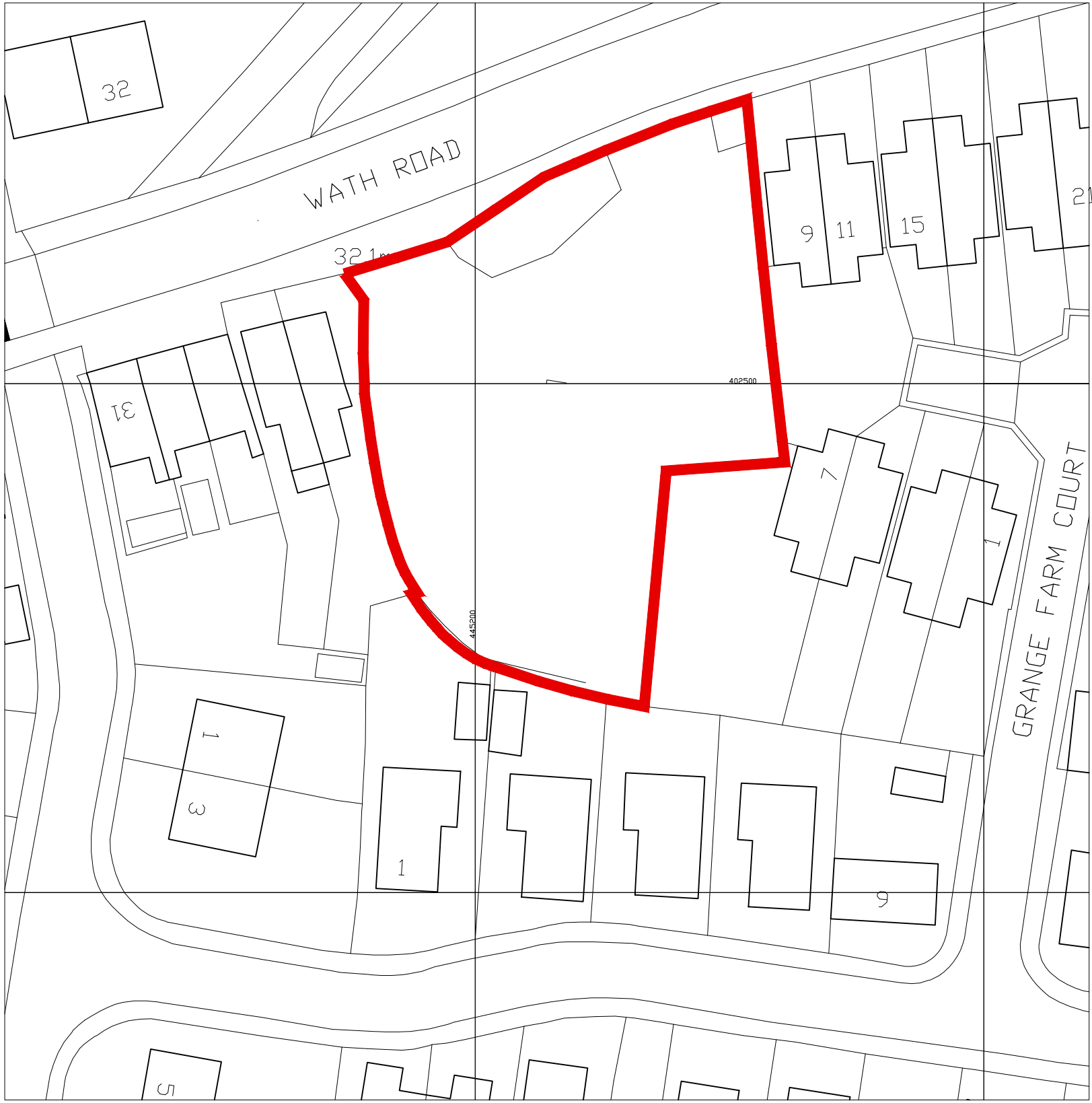


Project Id: ECL/05 Title: AERIAL PHOTOGRAPH
Project Title: Wath Road Scale: 1:1000
Location: Bolton Upon Dearne Engineer: ARP Geotechnical Ltd
Client: Eton Construction Limited Contractor:

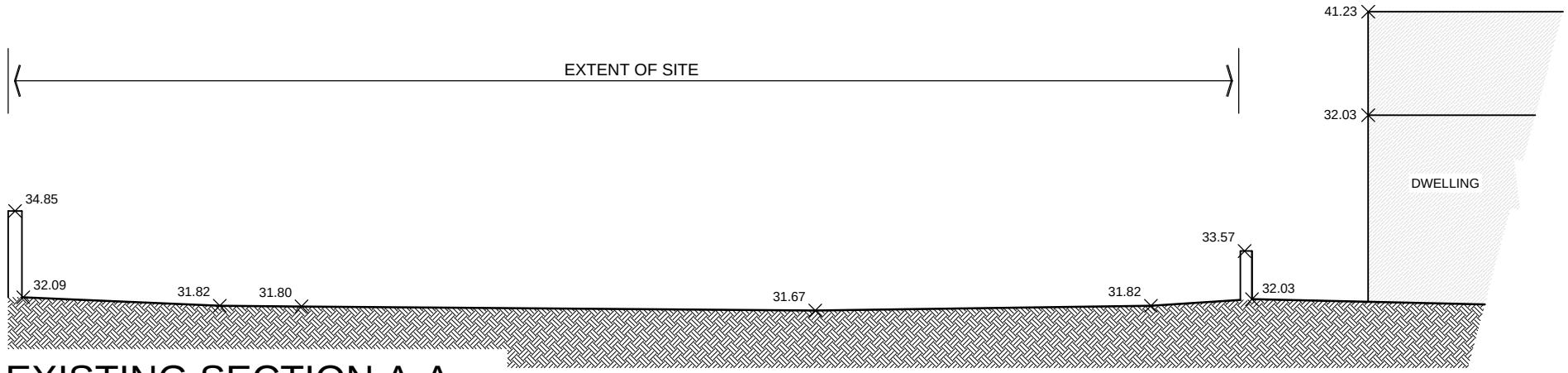




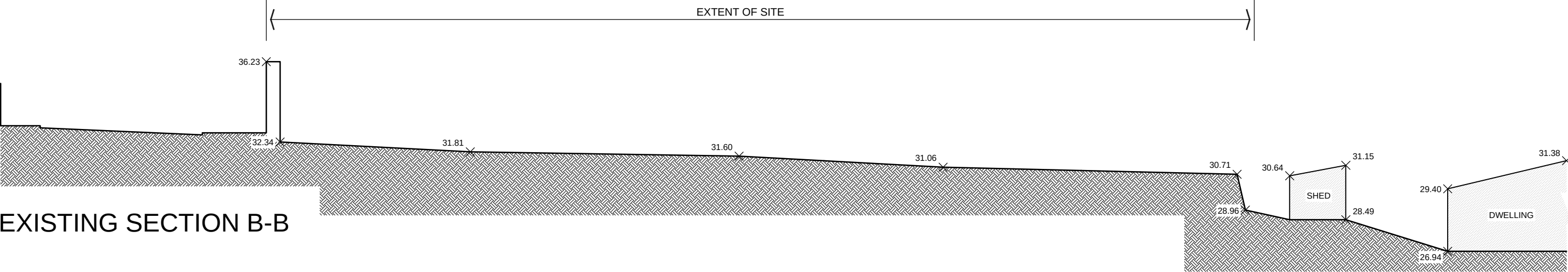
SITE PLAN AS EXISTING



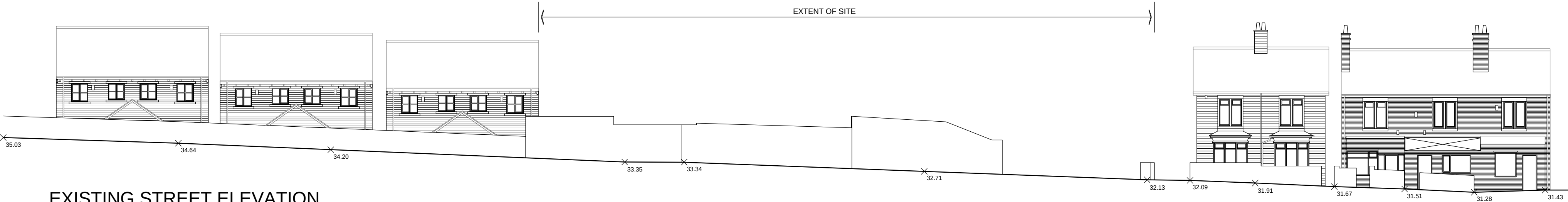
SITE LOCATION PLAN



EXISTING SECTION A-A



EXISTING SECTION B-B



EXISTING STREET ELEVATION

All work to be carried out in accordance with the requirements of the Building Regulations, Water Authority and the Construction (Design and Management) Regulations currently in force.

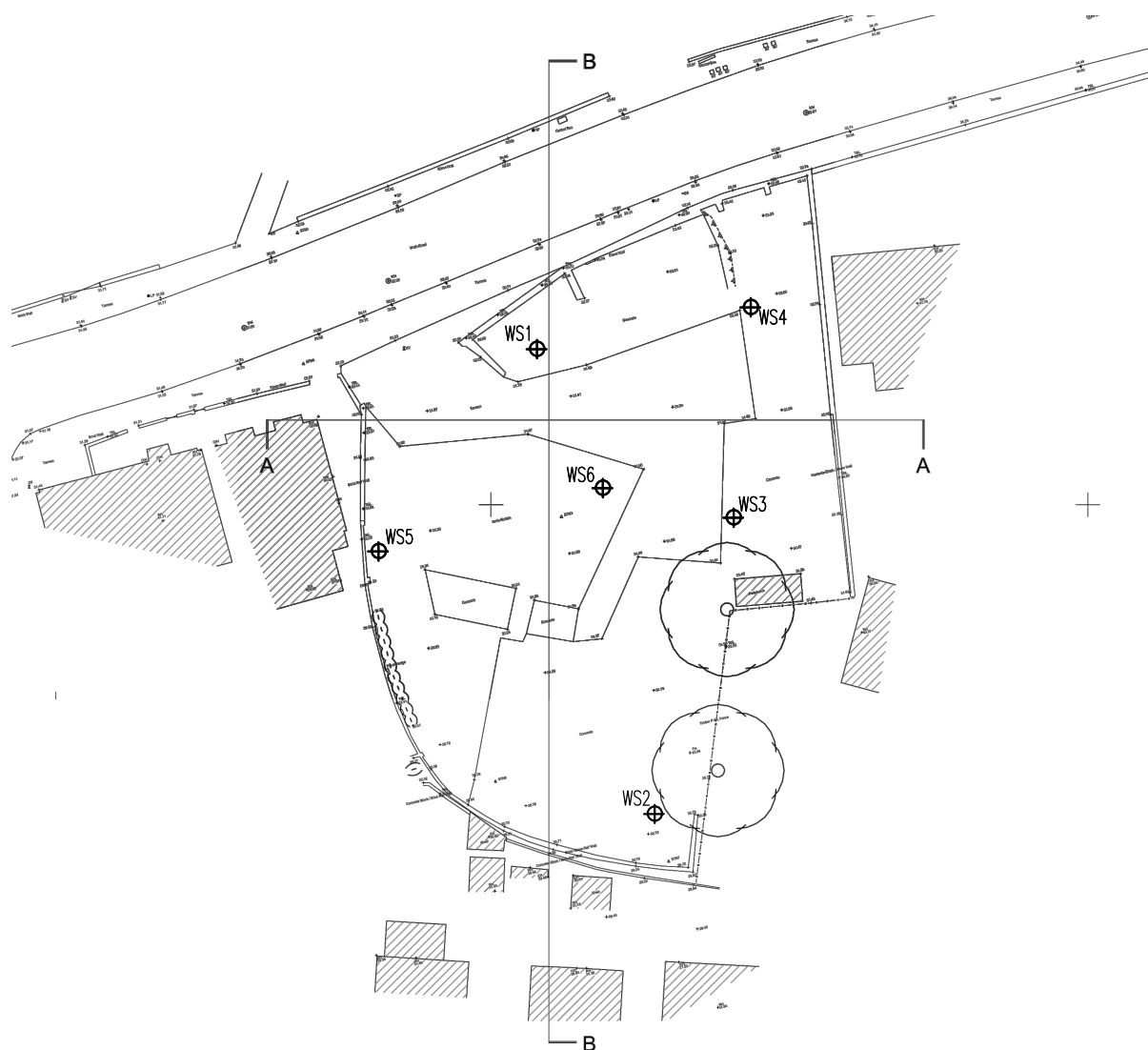
Do not scale from this drawing. Architect to be notified of any discrepancies.

Verify relevant dimensions on site before commencing work or preparing shop drawings.

Rev.	Description:	By:	Date:
Drawing Status : PRELIMINARY			
 79A WELLGATE, ROTHERHAM, S60 2LZ Tel: 01709 365 964 Website: www.etonconstruction.com			
Project: Development of land off Wath Road, Bolton upon Dearne			
Drawing: Site as Existing			
Client: Eton Homes Ltd			
COPYRIGHT – This drawing is subject to copyright and cannot be reproduced without the permission of the Company. ©			
Scales: 1:200, 1:500 @A1		Date:	
Drawing Number: EC06-10		Revision: -	Drawn by: MW

APPENDIX B

BOREHOLE LOCATION PLAN AND LOGS



Title

WINDOW SAMPLE LOCATION PLAN

Project/ Client

Wath Road, Bolton Upon Dearne
Eton Construction Ltd



ARP GEOTECHNICAL LTD
CHARTERED CONSULTING ENGINEERS
Northwest House • 5/6 Northwest Business Park
Servia Hill • Leeds LS6 2QH
Telephone : 0113 245 8498 • Fax : 0113 244 3864
E-Mail : leeds@arpassociates.co.uk

Scale

NTS

Drawn

JMG

Date

SEPT'16

Chk.

TRR

Drg. No.

ECL/05/SI.03

Rev.



Borehole Log

Borehole No.

WS1

Sheet 1 of 1

Project Name: Wath Road

Project No.
ECL/05

Co-ords: 445203.84 - 402515.02

Hole Type
WLS

Location: Bolton Upon Dearne

Level:

Scale
1:25

Client: Eton Construction Limited

Dates: 02/08/2016 -

Logged By

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.08			CONCRETE	
					0.20			MADE GROUND: Dark brown and grey slightly clayey angular GRAVEL of sandstone and concrete.	
					0.41			MADE GROUND: Dark brown and grey sandy angular GRAVEL of sandstone and concrete.	
					0.51			MADE GROUND: Multicoloured slightly clayey gravelly SAND. Gravel is angular, of sandstone and brick. Rare angular gravel of glass and clinker.	
		1.00		N=8 (1,2/2,2,2,2)	1.20			MADE GROUND: Soft (low strength) multicoloured slightly gravelly sandy CLAY. Gravel is angular of sandstone. Rare angular gravel of brick.	1
								Soft (low strength) orange brown mottled grey slightly gravelly CLAY. Gravel is angular, of mudstone.	
		2.00		N=28 (3,5/5,5,8,10)				Becomes stiff (high strength).	2
		3.00		N=50 (11,11/11,15,20,4)				Becomes very stiff (very high strength).	3
					3.39			End of borehole at 3.39 m	
									4
									5

Remarks

No groundwater entries.

Backfilled with arisings on completion.

Co-ordinates are approximate and determined by logging software via Bing Maps.



Borehole Log

Borehole No.

WS2

Sheet 1 of 1

Project Name: Wath Road

Project No.
ECL/05

Co-ords: 445211.85 - 402477.65

Hole Type
WLS

Location: Bolton Upon Dearne

Level:

Scale
1:25

Client: Eton Construction Limited

Dates: 02/08/2016 -

Logged By

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.15			CONCRETE	
					0.30			MADE GROUND: Dark grey slightly clayey slightly sandy angular GRAVEL of sandstone and concrete.	
					0.37			MADE GROUND: Dark grey slightly sandy clayey angular GRAVEL of mudstone, sandstone and brick.	
					0.80			MADE GROUND: Soft/firm multicoloured slightly gravelly sandy CLAY. Gravel is angular, of sandstone, mudstone, clinker and plaster.	
		1.00		N=4 (1,1/1,1,1,1)	1.00			MADE GROUND: Soft dark brown slightly gravelly sandy CLAY. Gravel is fine, angular, of sandstone, chert, coal and brick. High organic content.	1
								MADE GROUND: Soft (low strength) brown slightly gravelly sandy CLAY. Gravel is fine, angular to rounded, of mudstone, coal and clinker. Fine gravel sized pockets of ash.	
		2.00		N=12 (1,2/2,2,4,4)					2
					2.30			Firm to stiff (medium strength) orange mottled grey slightly gravelly CLAY. Gravel is fine, angular to subangular, of mudstone. Rare rootlets.	
		3.00		N=39 (4,5/6,7,10,16)				Becomes very stiff (very high strength).	3
					3.45			End of borehole at 3.45 m	4
									5

Remarks

No groundwater entries.

Co-ordinates are approximate and determined by logging software via Bing Maps.

Well installed to 3m on completion. Top metre plain pipe, bottom 2m slotted pipe. Bentonite seal, and lockable flush cover used.



Borehole Log

Borehole No.

WS3

Sheet 1 of 1

Project Name: Wath Road

Project No.
ECL/05

Co-ords: 445220.33 - 402502.40

Hole Type
WLS

Location: Bolton Upon Dearne

Level:

Scale
1:25

Client: Eton Construction Limited

Dates: 02/08/2016 -

Logged By

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.13			CONCRETE	
					0.40			MADE GROUND: Black and orange slightly clayey sandy angular GRAVEL of mudstone and sandstone. Rare gravel of ceramic.	
					0.60			MADE GROUND: Pale grey brown slightly clayey slightly gravelly SAND. Gravel is angular to rounded of sandstone and mudstone. Rare gravel of wood.	
					0.67			MADE GROUND: Very dark grey clayey SILT. Low rootlet content. High organic content.	
		1.00		N=9 (1,2/2,2,2,3)	0.90			MADE GROUND: Brown clayey SAND.	1
					1.36			MADE GROUND: Yellow orange brown slightly clayey gravelly SAND. Gravel is angular, of sandstone and mudstone.	
		2.00		N=23 (3,4/5,5,6,7)				Stiff (high strength) orange brown mottled grey slightly sandy slightly gravelly CLAY. Gravel is fine, angular, of mudstone. Gravel sized pockets of fine sand.	2
		3.00		N=43 (7,9/10,10,10,13)				Becomes very stiff (very high strength).	3
					3.45			End of borehole at 3.45 m	4
									5

Remarks

No groundwater entries.

Backfilled with arisings on completion.

Co-ordinates are approximate and determined by logging software via Bing Maps.



Borehole Log

Borehole No.

WS4

Sheet 1 of 1

Project Name: Wath Road

Project No.
ECL/05

Co-ords: 445219.10 - 402518.89

Hole Type
WLS

Location: Bolton Upon Dearne

Level:

Scale
1:25

Client: Eton Construction Limited

Dates: 02/08/2016 -

Logged By

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.21			CONCRETE	
					0.35			MADE GROUND: Brown slightly clayey sandy angular GRAVEL of sandstone.	
					0.48			MADE GROUND: Pale grey brown gravelly SAND. Gravel is angular and subangular of sandstone.	
					0.64			Orange brown mottled grey slightly gravelly clayey SAND. Gravel is angular to subrounded of mudstone and sandstone.	
		1.00		N=9 (2,2/2,2,2,3)	1.00			Stiff orange brown mottled grey slightly sandy slightly gravelly CLAY. Gravel is angular to subangular of mudstone.	1
								Firm (medium strength) orange brown mottled grey slightly gravelly CLAY. Gravel is angular, of mudstone.	
		2.00		N=20 (3,2/4,6,4,6)				Becomes stiff (high strength).	2
		3.00		N=50 (8,10/50 for 285mm)				Becomes very stiff (very high strength).	3
					3.44			End of borehole at 3.44 m	4
									5

Remarks

No groundwater entries.

Co-ordinates are approximate and determined by logging software via Bing Maps.

Well installed to 3m on completion. Top metre plain pipe, bottom 2m slotted pipe. Bentonite seal, and lockable flush cover used.



Borehole Log

Borehole No.

WS5

Sheet 1 of 1

Project Name: Wath Road

Project No.
ECL/05

Co-ords: 445190.67 - 402497.15

Hole Type
WLS

Location: Bolton Upon Dearne

Level:

Scale
1:25

Client: Eton Construction Limited

Dates: 02/08/2016 -

Logged By

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		1.00		N=6 (2,1/1,1,2,2)	1.00			MADE GROUND: Dark grey gravelly sand TOPSOIL. Gravel is subangular and subrounded of sandstone and brick. Low angular gravel content of glass. <i>No recovery between 0.3 and 1.0 due to cobble of brick stuck in the sampler.</i>	1
		2.00		N=13 (2,2/3,2,4,4)	1.84 2.07			MADE GROUND: Soft brown slightly gravelly sandy CLAY. Gravel is angular to subangular of sandstone, mudstone and coal. Gravel sized pockets of ash.	2
		3.00		N=50 (11,11/50 for 170mm)	3.35			Pale brown slightly clayey slightly gravelly SAND. Gravel is fine, subangular of sandstone and mudstone.	3
								Firm (medium strength) orange mottled grey slightly gravelly CLAY. Gravel is angular to rounded, of mudstone. <i>Becomes very stiff (very high strength).</i>	4
								End of borehole at 3.35 m	5

Remarks

No groundwater entries.

Co-ordinates are approximate and determined by logging software via Bing Maps.

Well installed to 3m on completion. Top metre plain pipe, bottom 2m slotted pipe. Bentonite seal, and lockable flush cover used.



Borehole Log

Borehole No.

WS6

Sheet 1 of 1

Project Name: Wath Road

Project No.
ECL/05

Co-ords: 445208.57 - 402504.59

Hole Type
WLS

Location: Bolton Upon Dearne

Level:

Scale
1:25

Client: Eton Construction Limited

Dates: 02/08/2016 -

Logged By

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		1.00		N=4 (1,1/1,1,1,1)	1.00			MADE GROUND: Multicoloured gravelly SAND with cobbles of brick. Gravel is angular to rounded of mixed lithologies, brick, plaster and clinker. Low ash content. Gravel/cobbles of wood at 0.67m and 0.95m.	1
					1.55			MADE GROUND: Soft (low strength) brown slightly gravelly sandy CLAY. Gravel is angular of sandstone. Fine gravel sized pockets of ash.	
					1.83			Firm orange mottled grey slightly gravelly sandy CLAY. Gravel is subangular, of sandstone.	
		2.00		N=11 (2,2/2,2,3,4)				Stiff (medium strength) orange mottled grey slightly gravelly CLAY. Gravel is angular to subrounded of mudstone.	2
		3.00		N=39 (7,8/8,8,10,13)				Becomes very stiff (very high strength).	3
					3.45			End of borehole at 3.45 m	4
									5

Remarks

No groundwater entries.

Co-ordinates are approximate and determined by logging software via Bing Maps.

Backfilled with arisings on completion.

APPENDIX C

LABORATORY TEST CERTIFICATES AND SCREENING VALUES



ARP GEOTECHNICAL LIMITED
SOIL CONTAMINANT SCREENING VALUES
RESIDENTIAL WITH HOME-GROWN PRODUCE

Determinand	S4UL (mg/kg)			C4SL (mg/kg)		
Arsenic	37			37		
Cadmium	11			22		
Chromium (trivalent)	910					
Chromium (hexavalent)	6			21		
Lead				200		
Inorganic Mercury	40					
Selenium	250					
Copper	2400					
Nickel	130					
Zinc	3700					
Acidity (pH)	*Should be Greater Than 5			*Should be Greater Than 5		
	1% SOM	2.5% SOM	6% SOM	1% SOM	2.5% SOM	6% SOM
Acenaphthene	210	510	1,100			
Acenaphthylene	170	420	920			
Anthracene	2,400	5,400	11,000			
Benzo(a)anthracene	7.2	11	13			
Benzo(a)pyrene	2.2	2.7	3			5
Benzo(b)fluoranthene	2.6	3.3	3.7			
Benzo(g,h,i)perylene	320	340	350			
Benzo(k)fluoranthene	77	93	100			
Chrysene	15	22	27			
Dibenzo(a,h)anthracene	0.24	0.28	0.3			
Fluoranthene	280	560	890			
Fluorene	170	400	860			
Indeno(1,2,3-cd)pyrene	27	36	41			
Naphthalene	2.3	5.6	13			
Phenanthrene	95	220	440			
Pyrene	620	1,200	2,000			
Phenols	120	200	380			
Total TPH	*Above 500, speciate and compare with values below:					
C5 to C6 Aliphatic	42	78	160			
C6 to C8 Aliphatic	100	230	530			
C8 to C10 Aliphatic	27	65	150			
C10 to C12 Aliphatic	130	48	760			
C12 to C16 Aliphatic	1100	2,400	4,300			
C16 to C35 Aliphatic	65,000	92,000	110,000			
C35 TO C44 Aliphatic	65,000	92,000	110,000			
C5 to C7 Aromatic (Benzene)	70	140	300			
C7 to C8 Aromatic (Toluene)	130	290	660			
C8 to C10 Aromatic	34	83	190			
C10 to C12 Aromatic	74	180	380			
C12 to C16 Aromatic	140	330	660			
C16 to C21 Aromatic	260	540	930			
C21 TO C35 Aromatic	1100	1,500	1,700			
C35 TO C44 Aromatic	1100	1,500	1,700			
Asbestos	*Should be None Detected			*Should be None Detected		

* In House Value/Approach S4UL = Suitable 4 Use Level, CIEH/LQM 2014 C4SL = Cat 4 Screening Level, DEFRA, 2014

Blank cell indicates no published value or in-house value. Some values presented are above saturation limits.

S4ULs: Copyright Land Quality Management Ltd reproduced with permission; Publication No. S4UL3378. All rights reserved.



Certificate of Analysis

Certificate Number 16-75246-1

22-Aug-16

Client ARP Geotechnical
5/6 Northwest Business Park
Servia Hill
Leeds
LS6 2QH

Our Reference 16-75246-1

Client Reference ECL/05

Order No (not supplied)

Contract Title Wath Road, Bolton Upon Dearne

Description 6 Soil samples.

Date Received 06-Aug-16

Date Started 06-Aug-16

Date Completed 22-Aug-16

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

Notes This report supersedes 16-75246. Extra testing.

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

Approved By

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

Rob Brown
Business Manager



Summary of Chemical Analysis

Soil Samples

Our Ref 16-75246-1

Client Ref ECL/05

Contract Title Wath Road, Bolton Upon Dearne

Lab No	1034786	1034787	1034788	1034789	1034790	1034791
Sample ID	WS05	WS06	WS01	WS03	WS02	WS02
Depth	1.00-1.50	0.20-0.80	0.41-0.51	0.67-0.90	0.80-1.00	0.37-0.60
Other ID						
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sampling Date	02/08/16	02/08/16	02/08/16	02/08/16	02/08/16	02/08/16
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units						
Metals									
Arsenic	DETSC 2301#	0.2	mg/kg	8.2	7.7	25	8.1	23	11
Cadmium	DETSC 2301#	0.1	mg/kg	0.1	0.3	0.2	0.3	0.3	0.3
Chromium III	DETSC 2301*	0.15	mg/kg	9.8	14	18	33	16	14
Chromium, Hexavalent	DETSC 2204*	1	mg/kg	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Copper	DETSC 2301#	0.2	mg/kg	12	18	33	19	35	31
Lead	DETSC 2301#	0.3	mg/kg	31	110	230	29	130	41
Mercury	DETSC 2325#	0.05	mg/kg	< 0.05	0.10	0.08	< 0.05	0.22	0.06
Nickel	DETSC 2301#	1	mg/kg	16	14	19	19	21	27
Selenium	DETSC 2301#	0.5	mg/kg	< 0.5	< 0.5	< 0.5	0.7	0.7	< 0.5
Zinc	DETSC 2301#	1	mg/kg	42	82	95	78	86	88
Inorganics									
pH	DETSC 2008#			8.1	9.0	8.2	7.9	8.0	8.5
Organic matter	DETSC 2002#	0.1	%	2.7	1.3	2.0	2.1	4.9	2.8
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l	41	3000	120	150	37	94
Sulphate as SO4, Total	DETSC 2321#	0.01	%	0.03	1.0	0.05	0.07	0.08	0.08
Petroleum Hydrocarbons									
Aliphatic C5-C6	DETSC 3321*	0.01	mg/kg						< 0.01
Aliphatic C6-C8	DETSC 3321*	0.01	mg/kg						< 0.01
Aliphatic C8-C10	DETSC 3321*	0.01	mg/kg						< 0.01
Aliphatic C10-C12	DETSC 3072#	1.5	mg/kg						< 1.5
Aliphatic C12-C16	DETSC 3072#	1.2	mg/kg						< 1.2
Aliphatic C16-C21	DETSC 3072#	1.5	mg/kg						< 1.5
Aliphatic C21-C35	DETSC 3072#	3.4	mg/kg						< 3.4
Aliphatic C5-C35	DETSC 3072*	10	mg/kg						< 10
Aromatic C5-C7	DETSC 3321*	0.01	mg/kg						< 0.01
Aromatic C7-C8	DETSC 3321*	0.01	mg/kg						< 0.01
Aromatic C8-C10	DETSC 3321*	0.01	mg/kg						< 0.01
Aromatic C10-C12	DETSC 3072#	0.9	mg/kg						< 0.9
Aromatic C12-C16	DETSC 3072#	0.5	mg/kg						< 0.5
Aromatic C16-C21	DETSC 3072#	0.6	mg/kg						< 0.6
Aromatic C21-C35	DETSC 3072#	1.4	mg/kg						< 1.4
Aromatic C5-C35	DETSC 3072*	10	mg/kg						< 10
TPH Ali/Aro Total	DETSC 3072*	10	mg/kg						< 10
EPH (C10-C40)	DETSC 3311#	10	mg/kg	< 10	< 10	16	< 10	< 10	910

Summary of Chemical Analysis

Soil Samples

Our Ref 16-75246-1

Client Ref ECL/05

Contract Title Wath Road, Bolton Upon Dearne

Lab No	1034786	1034787	1034788	1034789	1034790	1034791
Sample ID	WS05	WS06	WS01	WS03	WS02	WS02
Depth	1.00-1.50	0.20-0.80	0.41-0.51	0.67-0.90	0.80-1.00	0.37-0.60
Other ID						
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sampling Date	02/08/16	02/08/16	02/08/16	02/08/16	02/08/16	02/08/16
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units						
PAHs									
Naphthalene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	1.6
Acenaphthylene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.6
Acenaphthene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	9.1
Fluorene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	12
Phenanthrene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	57
Anthracene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	14
Fluoranthene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	0.4	< 0.1	0.3	39
Pyrene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	0.4	< 0.1	0.3	33
Benzo(a)anthracene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	13
Chrysene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	11
Benzo(b)fluoranthene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	7.6
Benzo(k)fluoranthene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	4.6
Benzo(a)pyrene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	11
Indeno(1,2,3-c,d)pyrene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	6.4
Dibenzo(a,h)anthracene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.9
Benzo(g,h,i)perylene	DETSC 3301	0.1	mg/kg	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	5.6
PAH Total	DETSC 3301	1.6	mg/kg	< 1.6	< 1.6	< 1.6	< 1.6	< 1.6	230
Phenols									
Phenol - Monohydric	DETSC 2130#	0.3	mg/kg	< 0.3	0.5	< 0.3	< 0.3	< 0.3	< 0.3

Summary of Asbestos Analysis

Soil Samples

Our Ref 16-75246-1

Client Ref ECL/05

Contract Title Wath Road, Bolton Upon Dearne

Lab No	Sample ID	Material Type	Result	Comment*	Analyst
1034786	WS05 1.00-1.50	SOIL	NAD	none	Colin Patrick
1034787	WS06 0.20-0.80	SOIL	NAD	none	Colin Patrick
1034788	WS01 0.41-0.51	SOIL	NAD	none	Colin Patrick
1034789	WS03 0.67-0.90	SOIL	NAD	none	Colin Patrick
1034790	WS02 0.80-1.00	SOIL	NAD	none	Colin Patrick
1034791	WS02 0.37-0.60	SOIL	NAD	none	Colin Patrick

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

Information in Support of the Analytical Results

Our Ref 16-75246-1
Client Ref ECL/05
Contract Wath Road, Bolton Upon Dearne

Containers Received & Deviating Samples

Lab No	Sample ID	Date Sampled	Containers Received	Holding time exceeded for tests	Inappropriate container for tests
1034786	WS05 1.00-1.50 SOIL	02/08/16	GJ 60ml, PG		
1034787	WS06 0.20-0.80 SOIL	02/08/16	GJ 60ml, PG		
1034788	WS01 0.41-0.51 SOIL	02/08/16	GJ 60ml, PG		
1034789	WS03 0.67-0.90 SOIL	02/08/16	GJ 60ml, PG		
1034790	WS02 0.80-1.00 SOIL	02/08/16	GJ 60ml, PG		
1034791	WS02 0.37-0.60 SOIL	02/08/16	GJ 60ml, PG		

Key: G-Glass P-Plastic J-Jar G-Bag

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

Soil Analysis Notes

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

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

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

Disposal

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

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



LABORATORY REPORT



4043

Contract Number: PSL16/3669

Report Date: 18 August 2016
Client's Reference: ECL/05
Client Name: ARP Associates
Northwest House
5/6 Northwest Business Park
Servia Hill
Leeds
LS6 2QH

For the attention of: TNRR

Contract Title: Wath Road, Bolton Upon Dearne
Date Received: 8/8/2016
Date Commenced: 8/8/2016
Date Completed: 18/8/2016

Notes: Opinions and Interpretations are outside the UKAS Accreditation

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

Checked and Approved Signatories:

R Gunson
(Director)

A Watkins
(Director)

R Berriman
(Quality Manager)

D Lambe
(Senior Technician)

S Royle
(Senior Technician)

L Knight
(Senior Technician)

5 – 7 Hexthorpe Road, Hexthorpe,
Doncaster DN4 0AR
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fax: +44 (0)844 815 6642
e-mail: rgunson@prosoils.co.uk
awatkins@prosoils.co.uk

Page 1 of

SUMMARY OF LABORATORY SOIL DESCRIPTIONS

[illegible]

  Professional Soils Laboratory	Checked / Approved <i>[Signature]</i>	Date	18/08/16	Contract No:
	Wath Road, Bolton Upon Dearne			PSL16/3669
				Client Ref:
				ECL/05

SUMMARY OF SOIL CLASSIFICATION TESTS

(BS1377 : PART 2 : 1990)

[illegible]

SYMBOLS : NP : Non Plastic

*** : Liquid Limit and Plastic Limit Wet Sieved.**



PSL
Professional Soils Laboratory

Checked / Approved

~~Lucretia~~

Date _____

18/08/16

Contract No:

PSL16/3669

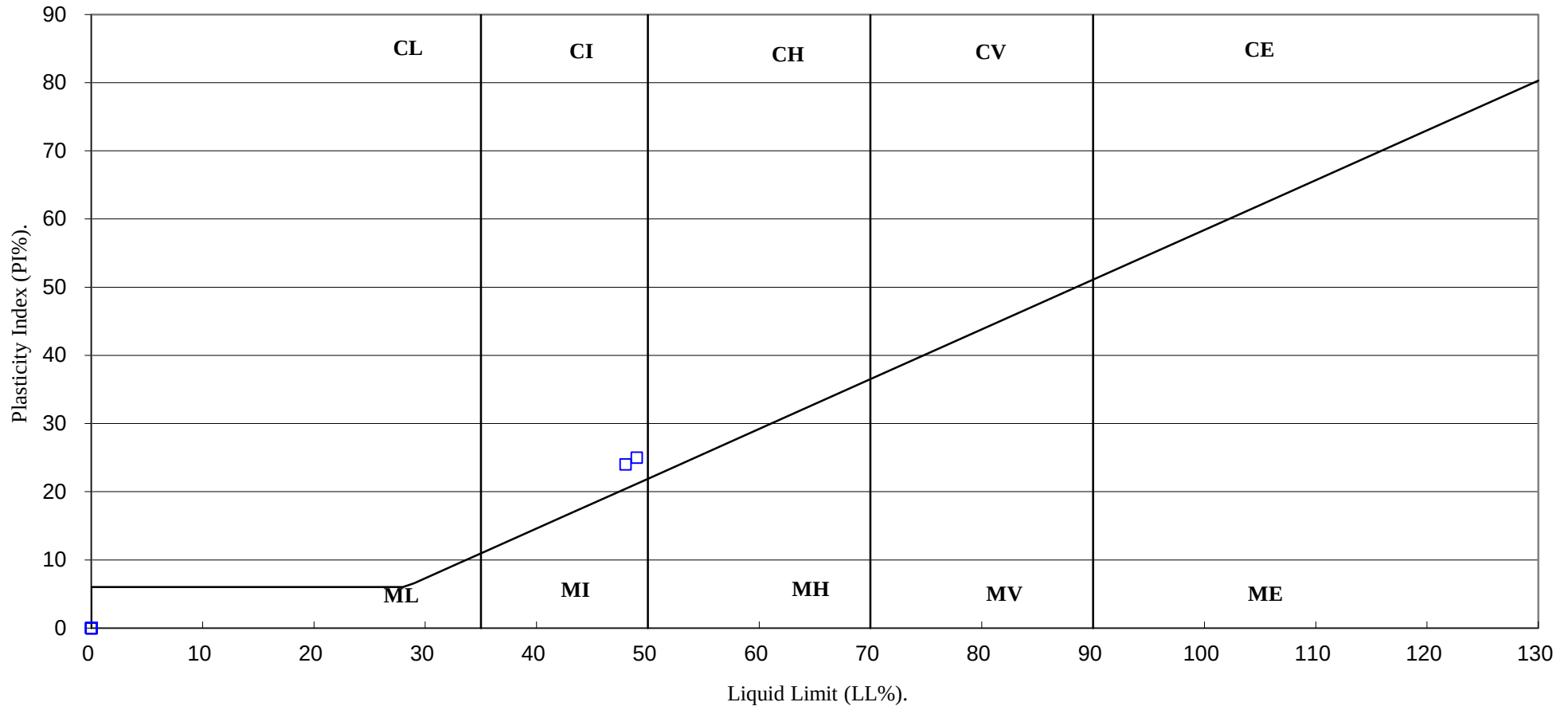
Client Ref:

ECL/05

Wath Road, Bolton Upon Dearne

PLASTICITY CHART FOR CASAGRANDE CLASSIFICATION.

(BS5930 :2015)



PSL
Professional Soils Laboratory

Checked /Approved

[Signature]

Date

18/08/16

Contract No:

PSL16/3669

Client Ref:

ECL/05

Wath Road, Bolton Upon Dearne



Certificate of Analysis

Certificate Number 16-75873

17-Aug-16

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

Our Reference 16-75873

Client Reference PSL16/3669

Order No (not supplied)

Contract Title Wath Road, Bolton Upon Dearne

Description 2 Soil samples.

Date Received 13-Aug-16

Date Started 13-Aug-16

Date Completed 17-Aug-16

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

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

Approved By

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

Rob Brown
Business Manager



Summary of Chemical Analysis

Soil Samples

Our Ref 16-75873

Client Ref PSL16/3669

Contract Title Wath Road, Bolton Upon Dearne

Lab No	1038096	1038097
Sample ID	WS01	WS02
Depth	1.40-1.60	2.30-2.60
Other ID		
Sample Type	C	C
Sampling Date	n/s	n/s
Sampling Time	n/s	n/s

Test	Method	LOD	Units		
Inorganics					
pH	DETSC 2008#			7.7	7.9
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l	19	74

Information in Support of the Analytical Results

Our Ref 16-75873
Client Ref PSL16/3669
Contract Wath Road, Bolton Upon Dearne

Containers Received & Deviating Samples

Lab No	Sample ID	Date Sampled	Containers Received	Holding time exceeded for tests	Inappropriate container for tests
1038096	WS01 1.40-1.60 SOIL		PT 500ml	Sample date not supplied, Anions 2:1 (365 days), pH + Conductivity (7 days)	
1038097	WS02 2.30-2.60 SOIL		PT 500ml	Sample date not supplied, Anions 2:1 (365 days), pH + Conductivity (7 days)	

Key: P-Plastic T-Tub

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Disposal

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

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

A P P E N D I X D

CONTAMINATION REMEDIATION STATEMENT



ARP GEOTECHNICAL LTD
CHARTERED CONSULTING ENGINEERS

CONTAMINATION REMEDIATION STATEMENT

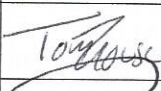
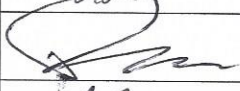
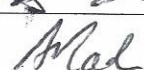
AT

LAND OFF WATH ROAD, BOLTON UPON DEARNE

ON BEHALF OF

ETON CONSTRUCTION LTD

DECEMBER 2016

Doc. No: ECL/05rem	Name	Signature	Date
Prepared By:	T N R-Rouse BSc MGeol FGS		7/12/16
Reviewed By:	J Race BSc CGeol FGS EurGeol		7/12/16
Authorised By:	A Radcliffe BEng CEng MStructE		7/12/16

ETON CONSTRUCTION LTD

LAND OFF WATH ROAD, BOLTON UPON DEARNE

DECEMBER 2016

CONTAMINATION REMEDIATION STATEMENT

1.0 Introduction

- 1.1 This document has been prepared to provide information for the Client and other interested parties, such as the Regulatory Authorities, outlining how contamination encountered on the site will be managed to ensure that the site is environmentally suitable for the intended residential use. The document should be agreed, prior to implementation, with the relevant Regulatory Authorities, usually the local Planning Authority and NHBC or other building control provider.

2.0 The Site

- 2.1 The ARP Geotechnical Ltd Stage 2 Geo-environmental Report, dated December 2016 under reference ECL/05r2, makes an assessment of contamination, along with other aspects.
- 2.2 The conceptual site model is for residential properties with private gardens.
- 2.3 At the time of the investigation, the site had been cleared of buildings, leaving a generally level area surfaced by a combination of rubble, concrete slabs and bituminous surfacing. Until recently, the site was occupied by a detached residential property, with various corrugated metal outbuildings and a yard area, probably in use for combined residential and commercial use such as haulage. There is also anecdotal evidence that cellars are present below the original building, a cess pit (location uncertain), and two backfilled vehicle inspection pits. An old box van body or goods container was still present on the east of the site, next to a mature tree. There was little other vegetation, comprising only sporadic weeds and small bushes. Towards the southern boundary, the land slopes away and is retained at/near the boundary by a retaining wall approximately 1.5m high.
- 2.4 The geological maps show a fault to cross the northeastern corner of the site (approximately 9m into the site), trending northwest to southeast. To the northeast of the fault, Mexborough Rock is indicated to outcrop, whilst to the southwest of the fault, undifferentiated strata (mudstone, siltstone, and minor sandstone), are indicated to be present.

- 2.5 The strata beneath the site are classed as a Secondary A Aquifer. There are no groundwater abstractions within 1km of the site.
- 2.6 No radon protective measures are required for properties constructed on the site. However, a risk from other gases has been identified; there is one recorded landfill within 250m of the site, located 51m to the north. The landfill received inert, non-hazardous industrial and commercial waste from 1979 to 1985. Gas monitoring is ongoing at the site. So far, monitoring indicates CS2/Amber 1 protection is required for carbon dioxide.
- 2.7 Ordnance Survey archive maps show that the site has been a residential property since at least 1854 and in later years has been used for a haulage company. Archive maps show a tank near the middle of the eastern boundary (probably a diesel tank), which is no longer evident, and has presumably been removed as part of the recent clearance of the site. A well (marked by "P" for pump) was once present in the middle of the northern half of the site. There is also anecdotal evidence that servicing of vehicles has been carried out on the site (two vehicle inspection pits).
- 2.8 The ground investigation revealed a covering layer of concrete between 0.08m and 0.21m depth, with the exception of WS5 & WS6 which had no concrete. Beneath, all the boreholes revealed a layer of made ground to depths of between 0.48m and 2.3m. The made ground comprised a combination of cohesive and granular material, with contained inclusions of mainly sandstone and brick, with minor presence of wood, glass, ash, clinker, and plaster.
- 2.9 The underlying natural strata encountered were found to comprise mainly gravelly clay with the gravel comprising mudstone. The clay was firm to stiff in consistency, except for localised softening in the upper zone. Locally, thin (0.23m thickness) bands of sand were present above the clay. No groundwater was encountered in any of the boreholes.
- 2.10 The made ground was found to contain sporadic elevated concentrations of benzo(b)fluoranthene, benzo(a)pyrene, and Dibenzo(a,h)anthracene.

3.0 Remediation Strategy

- 3.1 Where any garden or landscape areas overlie the existing made ground, a minimum 600mm thickness of uncontaminated soils (topsoil and subsoil) should be provided. In areas of hardstanding or building footprints, the cover blanket is not required. The cover blanket must be clean and uncontaminated, and at least 0.6m thick. Details are provided below.

Thickness mm	Description
Minimum 100	Topsoil
Minimum 500	Subsoil

- 3.2 Alternatively, the material could simply be removed from site to licensed landfill, with its validated removal rendering the site uncontaminated. Waste Acceptance Criteria testing would probably be required by the receivers of the material. Independent validation inspection will be required, to verify removal of all the affected material. The disposal/transfer documents should be retained for inclusion in the Validation Report.

4.0 Validation

- 4.1 To satisfy the Regulatory Authorities, verification that the above measures have been successfully implemented needs to be independently confirmed, in accordance with the guidance supplied in the document produced by the Yorkshire and Humberside Pollution Advisory Council (YAHPAC): "Guidance on the Verification Requirements for Cover Systems". The measures described below will be required to ensure compliance with the document.

Off - Site Disposal

- 4.2 If the contaminated made ground is to be removed from site, to leave an uncontaminated site, then the surface will need to be inspected by an Engineer, and sampled and tested on a maximum 25m spacing to confirm its uncontaminated status. The area will be photographed and all the details included within a Validation Letter Report. The disposal/transfer documents should be retained for inclusion in the Validation Report.

Retention On-Site

- 4.3 Where the contaminated made ground is retained on site, then it will be necessary to take samples from one per every two plots, to confirm the required 600mm cover of uncontaminated material has been placed. The trial pits will be photographed, to include a reference scale, and the photographs included within any report to enable the location on site to be identified.

5.0 Laboratory Testing

- 5.1 For any imported subsoil and topsoil used in the cover blanket, the source will need to be confirmed, and the material tested for the attached suite of contaminants, to comply with the maximum screening values listed. The frequency of testing is given on the table below.

Material Type	Number of Samples
Topsoil or subsoil from greenfield site	Minimum 3No. or 1 per 250m ³ (whichever is greater)
Topsoil or subsoil from brownfield site	Minimum 6No. or 1 per 100m ³ (whichever is greater)

- 5.2 The material should be placed in quarantined stockpiles and once a stockpile has been approved by the Engineer, no further material should be added to the stockpile, and any further import should be stockpiled separately. Any cross contamination of materials should be avoided, and further testing carried out where any cross contamination is suspected to have occurred.
- 5.3 If space is insufficient on the site to store quarantined stockpiles, cover blanket materials can be placed directly into the appropriate gardens/landscape areas, but samples of each material would need to be tested from each of the validation trial pits discussed in Section 4.3.

- 5.4 The results of all the laboratory analysis, excavation logs, plans, photographs, and import/disposal documents will form part of the Remediation Validation Report.
- 5.5 In order to enable the scheme to progress and sales of properties to continue throughout the construction of the development, interim Validation Reports may be prepared for specific plots, if required, showing how the contamination has been dealt with. This will enable enquiries during the sales of the properties to be satisfied. On completion of the development, the discharge of any associated planning condition may be achieved by submission of all the interim validation letters, or issuing the information as a single combined Validation Report.

6.0 Unexpected Contamination

- 6.1 Any unexpected contamination uncovered during the works shall be inspected, sampled and analysed in laboratory for the suite of determinands appended to this Remediation Statement, and compared to the maximum concentration levels listed on the enclosure. Works on the affected materials shall cease until the appraisal is complete and, if necessary, a revised Remediation Statement is to be prepared and approved by the Planning Authority before work is recommenced.

7.0 Protection of Workers and the Public During Development Works

- 7.1 Damping down of the site should be implemented during dry periods, and timely placement of contaminated fill below barriers.
- 7.2 Washing facilities and a clean mess room from which work boots and overalls are excluded, should be provided.
- 7.3 Site fencing will be provided to exclude access to members of the public, and contaminated material will be contained within the site boundary, and placed below barriers as soon as possible.
- 7.4 Workers will be educated to use adequate hygiene and PPE.
- 7.5 Surface water run off should be prevented by minimising open exposure times of contaminated material and using bunds or cut off trenches as necessary.
- 7.6 Movement of contamination off site on vehicle wheels shall be minimised by cleaning of vehicle wheels and/or use of road sweeper, as required.