



Phase 2 Intrusive Site Investigation Report

LOCATION	Proposed Development – Land at Former King Arms, Joseph Street, Middleton M24 5SQ
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1. Introduction

In accordance with your instruction Geoinvestigate Ltd. has carried out a Phase 2 investigation at the former Kings Arms, Joseph Street, Manchester M24 5SQ. The site currently comprises a mostly flat and clear area, with some exposed hardstanding and some areas that are overgrown.

A brief overview of the historical maps suggests that the former uses of the site itself might present the greatest contamination risk to the site as well as made ground in nearby infilled reservoirs. It was also considered possible that an elevated risk could be posed to the site by the possible presence of shallow coal mine working associated with the “Half Yard” Coal seam. Drift deposits were expected to be between 17m and 39m thick.

The purpose of this Phase 2 investigation was to establish the true nature of the ground conditions at the site with regard to the potential contamination and hazardous gas risk on site, and to investigate the risk regarding the potential presence of shallow historical coal mine workings. Other possible geotechnical hazards and foundation design are also considered in this report.

It is proposed to construct 3 new dwellings with garden and parking space.

2. Scope of Phase 2 Investigation

2.1 Scope of Works

Given the above the following investigation was carried out to assess the potential risks highlighted in the previous desk study:

- The sinking of six (6) boreholes (BH1 to BH6) to depths of up to 4.00m with associated soil sampling and supervision of the works by a suitably qualified geo-environmental engineer. The boreholes were sunk by windowless sampling techniques using a Dando Terrier 2002 mini drilling rig.
- Three (3) hand excavated trial pits to depths of between 0.50m and 1.00m to further inspect soils and retrieve additional samples for contamination testing.
- Installation of three (3) gas wells across the site, with six (6) gas monitoring visits to test for potential hazardous gases (CO₂ and CH₄) at a range of high and low atmospheric pressures.
- The sinking of three (3) rotary open hole boreholes (RH1 to RH3) to a depth of 30.00m under licence from the Coal Authority to probe for shallow mine workings. The boreholes were sunk using Geoinvestigate's Microdrill® with water flush.
- Geotechnical testing on samples recovered from the site including forty-nine (49) moisture contents (where the ground conditions would permit), four (4) Atterberg limit tests, and water soluble sulphate concentrations and pH testing to allow suitable foundations and concrete design advice.

- Contamination analyses of six (6) samples of made ground and topsoil recovered at depths up to 0.50m to determine whether potential contaminants including trace metals, asbestos, polycyclic aromatic hydrocarbons (PAHs), petroleum hydrocarbons, and polychlorinated biphenyls (PCBs) are absent or within acceptable limits. Chemical analyses based on the attending engineer's assessment of soils and ground conditions at the site together with findings of preliminary research. Leachate from three (3) samples was tested to check the mobility of the contaminants.
- Provision of a factual and interpretative report including; site plan, borehole and trial pit logs and contamination analysis results, together with advice on the contamination, gas and coal mining situation at the site and, if required, remediation and validation.

The borehole and trial pit positions are shown on the plan provided in Appendix 1.

The excavations were sampled and logged at site by a geo-environmental engineer and the ground conditions encountered are described on the borehole and trial pit logs also provided in Appendix 1.

The moisture profiles and Atterberg limit tests are shown in Appendix 2.

The results of the contamination testing are presented in the Chemtech Report (ref. 84152(1)) and is included in Appendix 3.

The gas monitoring result spreadsheets for the gas monitoring exercise carried out at the site to date are included in Appendix 4.

The Coal Mining Risk Assessment Report is presented in Appendix 5 (Geoinvestigate report G19387).

2.2 Sampling Rationale

The borehole positions were chosen to give an indication of the ground conditions throughout the site, including some boreholes within the proposed building footprint. Samples were collected for chemical analysis in the areas proposed to be soft landscaping.

RH1, RH2 and RH3 were positioned across the site to explore for potential shallow historical mine workings below and close to the footprint of the proposed structure(s).

3. Phase 2 Investigation Findings

3.1 Encountered Ground Conditions

3.1.1 Windowless Sampling Boreholes (BH1 to BH6)

Made ground was encountered to quite variable depth; between 0.30m and 2.30m below ground level (BLG). This was underlain in most locations by natural sandy gravelly clay to termination save for at BH6 which encountered an infilled basement/cellar and met refusal at 2.30m BGL on what was inferred to be the concrete basement floor.

3.1.1.1 BH1 and BH2

BH1 encountered made ground of compact black gravel of asphalt and brick to 0.10m underlain by made ground comprising soft to firm very sandy gravelly clay with gravel of asphalt, sandstone and brick to 0.30m. Further made ground was then encountered to 1.20m consisting of soft very sandy clay with gravel and cobbles of sandstone, this is thought to be reworked natural material. Natural soft to firm gravelly clay then commenced from 1.20m to 2.00m followed by soft very sandy clay (borderline clayey sand) to termination at 4.00m.

BH2 initially encountered made ground of loose slightly clayey gravel with gravel of concrete, brick and sandstone to 0.10m followed by medium dense gravel fill containing asphalt to 0.20m. This was underlain by further made ground of soft to firm slightly sandy very gravelly clay with gravel of asphalt, brick and coal to 1.00m. Made ground of soft slightly gravelly clay with gravel of sandstone and coal was then encountered to 1.80m, which again may have comprised potentially reworked natural soils. Loose natural slightly silty sand then extended to 2.60m, which may also have comprised made ground resembling reworked natural soils, before a void of 200mm was encountered. Some pot or brick was recovered, perhaps suggesting the void was possibly an old drain pipe. This was underlain by natural soft to firm very sandy gravelly clay to termination at 4.00m.

Shear vane testing in natural soils returned vane values of between 18kNm^2 and 51kNm^2 at depths of between 1.50m and 4.00m, with a lower value of 9kNm^2 returned at 2.50m in BH1 in the borderline clayey sand / sandy clay.

In situ SPT testing (carried out with a solid cone sampler), where deemed necessary, returned testing results of $N=7$ at 1.00m in BH1, $N=10$ at 2.00m in BH1, and $N=6$ at 3.00m in BH2.

A ground gas monitoring well was installed in BH1 to 3.50m. No water was recorded in BH1 or BH2.

3.1.1.2 BH3, BH4 and BH5

BH3, BH4 and BH5 each encountered shallower made ground deposits above the natural strata.

BH3 initially encountered made ground of soft to firm very gravelly sandy clay with gravel of brick, concrete and coal to 0.30m followed by further made ground of soft to firm slightly gravelly sandy clay with gravel of brick and coal to 0.50m. This was underlain by natural firm sandy gravelly clay to 1.90m followed by soft gravelly sandy clay to termination at 4.00m.

BH4 initially encountered made ground comprising loose slightly sandy gravelly clay with gravel constituents of brick and concrete to 0.10m followed by made ground comprising medium dense gravel

of brick to 0.30m. This was underlain by made ground comprising soft to firm slightly gravelly clay with gravel of coal, sandstone and brick to 1.00m. Natural soft to firm slightly sandy gravelly clay was then encountered from 1.00m to termination at 4.00m.

BH5 initially encountered made ground comprising soft very gravelly sandy clay with gravel of brick, pot and concrete to 0.10m followed by made ground comprising soft slightly gravelly sandy clay with gravel of brick and concrete to 0.30m. This was underlain by natural soft to firm sandy gravelly clay to 2.00m which was followed by soft very sandy gravelly clay to termination at 4.00m.

Shear vane testing in natural soils returned vane values of between 12kNm² and 76kNm² at depths of between 0.50m and 4.00m, with the lowest values returned at 2.50m BGL in BH3 and BH4 and 2.00m BGL in BH5.

No SPT testing was undertaken in these boreholes.

A ground gas monitoring well was installed in BH3 to 3.30m. No water was recorded in these boreholes.

3.1.1.3 BH6

BH6 initially encountered made ground of loose sandy gravel of sandstone, concrete and brick to 0.10m. This was underlain by further made ground comprising loose gravel of brick, concrete and pot to 1.70m with poor sample recovery below 1.00m. A void was then encountered to 2.30m thought to be remnants of the basement/cellar of the public house which once occupied the site. Refusal was encountered at 2.30m, which was inferred to probably comprise the concrete base of the cellar.

No shear vane testing or SPT testing was undertaken in BH6.

A ground gas monitoring well was installed to 1.80m. The borehole remained dry on completion.

3.1.2 Trial Pits (TPA – TPC)

Trial Pits were excavated to further investigate near-surface ground conditions and to retrieve additional samples for contamination testing within areas of proposed soft landscaping. The trial pits were hand excavated and each trial pit encountered made ground to termination.

TPA initially encountered made ground of slightly sandy gravelly clay with gravel of brick and concrete to 0.10m followed by made ground comprising loose brick gravel to 0.50m then made ground comprising soft to firm slightly sandy gravelly clay with gravel of sandstone and coal to termination at 1.00m.

TPB initially encountered made ground of loose asphalt gravel to 0.10m followed by made ground comprising soft very sandy very gravelly clay with gravel of asphalt, brick, coal and sandstone to 0.60m. Further made ground was then encountered comprising soft sandy gravelly clay with gravel of coal, sandstone and brick to termination at 0.80m

TPC initially encountered turf and topsoil comprising soft sandy gravelly clay with gravel of brick, sandstone and coal to 0.20m followed by made ground of loose slightly clayey gravel of brick and concrete to termination at 0.50m

All trial pits remained stable and dry.

3.1.3 Moisture content and Vegetation Influence

Four (4) samples were subjected to Atterberg Limit tests. The results of the tests returned plasticity indices (PIs) between 8.5% and 9.9% classifying the cohesive soils as Clay of Low (CL) Plasticity according to BS 5930. These would equate to NHBC Low Shrinkage Soils.

No roots were recorded in the cores recovered from the boreholes and no significant vegetation was within an influencing distance of the proposed development. Therefore, the risk at the site from seasonal vegetation-induced shrinkage and swelling is considered as Low and no consideration to this end will be required with regard to foundation design.

3.1.4 Rotary Open Hole Boreholes

3.1.4.1 Coal Mining Report Summary

The site is within a coal mining reporting area and is located close to a Development High Risk Area (DHRA). The Coal Mine Risk Assessment (CMRA) presented in Appendix 5 concluded that the site could be underlain by the Half Yard Coal seam (HY) at a potentially workable depth.

Therefore, it was concluded that further intrusive investigation was necessary to determine the actual nature of the risk posed by historical shallow coal mining to ground stability beneath the site.

3.1.4.2 Drilling Technique

The rotary open-hole boreholes were undertaken using Geoinvestigate's Microdrill®, a custom built tracked mini rotary drill designed specifically for probing for shallow mine workings using water flush. The condition of the ground with respect to strength and rock type was assessed by the driller using variation in drilling progress, drilling flush pressure, "feel", and the nature of the arisings (drill debris) returned to surface in the water flush and whether or not the flush itself was returned. Microdrilling is a probing technique and no cores were recovered from the boreholes to verify these findings though at several times during excavation the drill-string is withdrawn from the ground to inspect the composition of the build-up on the drill bit.

The primary purpose of the boreholes was to highlight possible mining related geotechnical hazards such as voids or broken / weak strata which might be indicative of abandoned mine workings or upward void migration.

3.1.4.3 Encountered Ground Conditions (RH1, RH2 and RH3)

The holes were located below the proposed building footprints. The rock descriptions are tentative and generally based on the above identification techniques.

Gas readings were taken in the boreholes during and following drilling. These are shown on the logs in Appendix 1 (no hazardous gas concentrations were detected).

All three boreholes (RH1 to RH3) encountered similar ground conditions comprising what was inferred to be dark brown drift (a generalised description for all superficial deposits above the bedrock) to depths of 21.30m (RH1), 21.60m (RH2) and 20.80m (RH3), becoming orangish brown below 1.40m (RH1), 2.40m (RH2) and 1.80m (RH3), then becoming grey below 7.90m (RH1), 6.80m (RH2) and 7.40m (RH3).

Below the superficial deposits, all rotary boreholes encountered grey silty sandstone in which all three

boreholes terminated at 30.00m. No coal seams, voids or broken ground indicative of shallow coal mine workings were encountered in any of the open hole rotary boreholes. Water flush was maintained throughout the drilling exercise.

3.1.4.4 Conclusions with respect to Coal Mining Risk

The site is located close to an area of probable shallow historical mine working and is within the Coal Authority (CA) reporting area. As such a Coal Mining Risk Assessment (CMRA) was produced by Geoinvestigate dated 18th October 2019 (ref. G19387) to infer the potential risk from coal mining legacy at the site and suggest preferable mitigation strategies.

A summary of the coal mining risk assessment for the site follows:

- The Half Yard Coal seam may underlie to site at workable depth.
- Probable shallow unrecorded workings cannot be discounted.
- It was unclear whether the Half Yard Seam might underlie the site and at what depth, and it was possible that the seam had been 'weathered out'.

Therefore, given the above it was concluded that *"exploratory drilling is required to investigate possible underground coal and fireclay mine workings within shallow depth beneath this site"*

Subsequently, Geoinvestigate Ltd. were instructed by the client to drill rotary boreholes to confirm the presence, depth, thickness and condition of mine workings (if any) in the Half Yard seam beneath the site.

Site works were undertaken on the 21 January 2020 in which three boreholes (RH1, RH2 and RH3) were sunk at the site to 30.00m depth.

In each borehole drift of variable depth 20.80m to 21.30m was encountered followed by silty sandstone to termination. No coal seams, voids or broken ground were encountered at any point in any boreholes.

The absence of coal, mudstone (that could be mined as fireclay), and the significant depth of drift suggests that the Half Yard Seam is not present below the site, and is certainly not present at shallow depth.

Records suggest that the Half Yard Seam was named for its thickness and was up to 20 inches thick and not often worked. As such even if it were present below the 30m depth of the boreholes it would be unlikely to have been mined due to its depth and its apparent low value and limited thickness. Additionally, the 8.7m to 9.2m solid rock strata that has been proven at the base of each borehole would constitute more than ten times the Half Yard seam thickness (assuming a 20"/0.51m thickness), and would therefore provide sufficient rock cover between the site and the seam – if it did underlie the site – to enable a very low likelihood of potentially damaging collapse to be concluded.

Therefore, the potential risk from historical coal mining legacy, particularly working within the Half Yard Coal, can be discounted as rotary drilling investigation has confirmed it is not present at shallow depth beneath the site.

4. Contamination Testing

The site was largely undeveloped before the Kings Arms pub was built, and this has now been demolished. The most credible source of contamination was any made ground that might have been present, of which the composition and depth were unknown prior to this investigation. An electricity substation is present adjacent to the site which is old enough to have potentially used PCB coolants before they were banned. A potential ground gas risk associated with made ground or potential shallow coal mine workings was also identified and deemed worthy of investigation (see Section 6 later).

It was assumed that potential contaminants could be present throughout the full thickness of the made ground recovered in all boreholes. Soils close to surface would be the most relevant regarding human health risk assessment though representative samples of deeper made ground were also analysed as part of this work (such as the samples analysed from BH2 and BH4 which were of materials found to extent to 1.00m BGL). Leachate analyses were also undertaken to investigate the potential risk to local ground and surface waters through potential contaminant leaching and mobilisation.

Generally, the made ground horizons did not show any obvious visual or olfactory evidence of potential contamination or contaminative materials, though some asphalt was encountered in places. Made ground extended to a maximum depth of (presumably) 2.30m at BH6 but was otherwise quite variable in thickness, ranging from just 0.30m deep to 1.80m deep. Given the presence of made ground generally throughout the site, a potential contamination risk was inferred to exist at the site.

Based on the findings of the site works six (6) samples comprising near surface made ground and topsoil were recovered from across the site and tested for a range of substances with testing based on the potential risks and the encountered ground conditions at the discretion of the attending engineer. These included common contaminants such as Arsenic, Lead and Cadmium which are normally included in a general human health contamination suite together with analysis for Speciated PAHs, PCBs, petroleum hydrocarbons and Asbestos. Leachate from three (3) of the samples was analysed also.

The results of the contamination testing are included in Appendix 3 of this report (Chemtech Environmental Ltd. report 84152(1)) and have been used in the contamination risk assessment, set out in the following sections.

5. Risk Assessment

5.1 Method

Geoinvestigate Ltd. uses a combination of assessment criterion provided by the Environment Agency, DEFRA and by the Chartered Institute of Environmental Health in order to assess the presence of potentially harmful chemicals within soils and water. These include; Environment Agency Environmental Quality Standards (EQSs), Soil Guideline Values (SGVs), and Site Specific Assessment Criteria (SSAC) generated using CLEA software version 1.06 site specific risk assessment modelling; DEFRA Category 4 Screening Levels (C4SLs); and Land Quality Management / Chartered Institute of Environmental Health (LQM/CIEH) Safe for Use Levels (S4ULs).

As the site is to be developed as a residential development, it falls within the residential end-use category. It is understood that development plans include soft landscaping areas and therefore it is possible that

the cultivation of vegetables / fruit for consumption will occur and so this possibility needs to be considered in the risk assessment.

No site-specific assessment criteria (SSAC) have been created for the site as no unusual circumstances (i.e. occupation periods etc.) are considered to be present/likely at the site that would render the generic residential assessment criteria unsuitable.

The results of the contamination testing that has been carried out have been compared to the soil quality values from the above sources. Where they fall below these limit values they have been deemed safe for a residential end use. In the cases where results are above the intervention values, an assessment of the available pathways and receptors has been carried out to determine whether further investigation or remediation is necessary.

An appraisal of the chemical results and relevant limits is set out in the Contamination Risk Assessment that follows.

5.2 Contamination Risk to Identified Receptors

5.2.1 Contamination Risk to Human Health

Made ground ranged in depth from 0.30m (BH5) to 2.30m (BH6, though only recovered to 1.70m). The majority of the made ground comprised sandy gravelly clay fill with occasional gravel/rubble (primarily at the surface and at BH6).

No significant or visual evidence of potential contamination within the ground conditions on site. Also, no visual or olfactory evidence of potential contamination or contaminative materials, including visual evidence of Asbestos contamination such as roofing board, was noted in any of the soils encountered in the boreholes and trial pits.

As discussed earlier in the report, levels of determinands have been compared to the soil assessment criteria for residential end-use, as published by the Environment Agency, DEFRA and LQM/CIEH.

The results of the analyses of six (6) samples of soil recovered from the site from depths up to 0.50m returned concentrations of a range of substances falling for the most part below respective assessment criteria adopted from the sources named above with some exceptions discussed later. Further discussion is presented in the following sections. A summary of the returned soil concentrations together with the adopted assessment criteria is presented in Table 1 on the following page.

A mean Total Organic Carbon Content (TOC) of 5.60% and mean Soil Organic Matter Content (SOM) of 9.65% (estimated from the TOC) were returned from the soil analyses. Therefore, the LQM/CIEH GAC for PAHs and Hydrocarbons were chosen using the highest Soil Organic Matter (SOM) option of 6.0%.

Table 1: Chemical Determinands in Soils

	Range of Returned concentrations (mg/kg)	SGV (EA)* (mg/kg)	S4UL (LQM/CIEH)* (mg/kg)	C4SL (DEFRA)* (mg/kg)
Asbestos	None detected (all 3)	Any presence unacceptable		
Arsenic	5.9 - 57	32	37	37
Boron	<0.5 – 1.2		290	
Cadmium	<0.2 – 0.7	10	11	26
Chromium VI	<1	21	6	21
Chromium III	68 – 86		910	
Copper	7.4 – 138		2400	
Lead	14 - 258			200
Mercury (elemental)	<0.5	1	1.2	
Nickel	8.8 – 63		180	
Selenium	0.6 – 1.5	350	250	
Zinc	7.6 – 252		3700	
pH	6.7 – 9.7			
Water Soluble SO ₄	32 – 307			
Phenol	<0.5	420	1100	
Total PAH	<0.34 – 10.2			
PAH Naphthalene	<0.02 – 0.24		13	
PAH Acenaphthylene	<0.02		920	
PAH Acenaphthene	<0.02 – 0.03		1100	
PAH Fluorene	<0.02 – 0.14		860	
PAH Phenanthrene	<0.02 – 1.26		440	
PAH Anthracene	<0.02 – 0.23		11000	
PAH Fluoranthene	<0.02 – 1.94		890	
PAH Pyrene	<0.02 – 1.71		2000	
PAH Benzo[a]anthracene	<0.02 – 0.82		13	
PAH Chrysene	<0.03 – 0.97		27	
PAH Benzo(b)fluoranthene	<0.02 – 1.30		3.7	
PAH Benzo(k)fluoranthene	<0.03 – 0.48		100	
PAH Benzo(a)pyrene	<0.02 – 0.82		3.0	5
PAH Dibenzo(a,h)anthracene	<0.02 – 0.17		0.30	
PAH Indeno(123-cd)pyrene	<0.02 – 0.80		41	
PAH Benzo(ghi)perylene	<0.02 – 0.79		350	
TPH				
TPH Aromatic C5-C7	<0.01		300	
TPH Aromatic C7-C8	<0.01		660	
TPH Aromatic C8-C10	<0.01		190	
TPH Aromatic C10-C12	<1		380	
TPH Aromatic C12-C16	<1		660	
TPH Aromatic C16-C21	<1 – 6		930	
TPH Aromatic C21-C35	<1 – 5		1700	
TPH Aromatic C35-C44	<1		1700	
TPH Aliphatic C5-C6	<0.1		78	
TPH Aliphatic C6-C8	<0.1		230	
TPH Aliphatic C8-C10	<0.1		65	
TPH Aliphatic C10-C12	<4		330 (118)*	
TPH Aliphatic C12-C16	<4 – 8		2400 (59)*	
TPH Aliphatic C16-C35	10 – 86		92000 (21)*	
TPH Aliphatic C35-C44	<10 - 31		92000 (21)*	

*For residential use with no allowance for cultivation of fruit/veg and at 6% organic matter where relevant.

**Figures in parentheses represent estimated soil saturation limits above which there may be some potential for free phase contamination to exist.

As can be seen from the results in Table 1 and the detailed results presented in Chemtech Environmental Ltd. report 84152 (Appendix 3) the majority of the returned results are less than the adopted assessment criteria. However, there were a few exceptions which are listed below:

- An arsenic (As) concentration of 57mgkg⁻¹ in BH2 at 0.20m
- A lead (Pb) concentration of 258mgkg⁻¹ in the same sample.

No asbestos was detected in any of the samples inspected.

PCBs analysis was also undertaken on two samples due to the presence of a substation adjacent to the site, neither of these samples returned levels of any of the PCBs tested for at detectable levels.

5.2.2 Contamination Risk to Controlled Waters

Leachate was analysed from three (3) samples obtained from BH5, TPA and TPC. This screening returned generally negligible concentrations and concentrations below detectable limits and/or safe levels for domestic water supply or the protection of aquatic life levels as published by the Environment Agency which were used as the assessment criteria. The results of the testing and the assessment criteria are shown Table 2 below.

Table 2: Chemical Determinands in Leachate

	Returned Concentrations (µg/l)	UK Standard for Surface Waters intended for Drinking Water Abstraction* (DW) and/or protection of Aquatic Life in surface waters* (Aq) (µg/l)
<i>Inorganic Chemicals</i>		
Arsenic	1.62 – 2.41	50 (DW, range: 50-100) / 50 (Aq)
Boron	9 – 50	1000 (DW & Aq)
Cadmium	<0.07 – 0.08	5 (DW & Aq)
Chromium	0.4 – 8.4	50 (DW) / 5 (Aq, range: 5-250)
Copper	2 – 15	50 (DW) / 5 (Aq, range: 5-112)
Lead	<0.2 – 0.6	50 (DW) / 4 (Aq, range: 4-250)
Mercury (elemental Hg)	<0.008	1 (DW & Aq)
Nickel	0.7 – 3.2	20** (DW) / 50 (Aq, range: 50-200)
Selenium	0.16 – 0.72	10 (DW) (No Aq standard)
Zinc	5 – 68	3000 (DW, range: 3000-5000) / 30 (Aq, range: 30-2000)
pH	7.2 – 10.9	Range 5.5 to 10 (UK drinking water standards)
<i>Organic Chemicals</i>		
Cyanide	<20 (all 3)	50 (DW) / 5 (Aq)
Phenols	<10 (all 3)	50** (DW) / 300 (Aq)
PAHs (total)	<1.6***	0.2 (DW, range: 0.2-1.0) (No Aq standard)
No individual PAH species were present at detectable concentrations.		

*sourced from Environment Agency database at <http://evidence.environment-agency.gov.uk/ChemicalStandards/home.aspx>.

If more than one option is available (dependant on other water properties or environmental setting) the lowest value has been adopted.

**Standard for water supply as no standard available for surface water abstraction for drinking water.

***Sum of USEPA 16, each at Lower Limit of Detection of <0.1

As can be seen from Table 2 and the detailed results presented in Chemtech Environmental Ltd report 84152(1) (Appendix 3), soils at the site have been shown to not be leaching most potential contaminants at elevated levels and as such would not be considered to pose a potential risk to the local ground or surface water features through leaching.

- Chromium of 8.4µg/l in BH5 at 0.20m
- Copper of 15µg/l in BH5 at 0.20m
- Zinc of 48µg/l in TPA at 0.20m

It is noted however that three metals were present at very slightly elevated levels in one or other of two samples. Chromium (Cr) and copper (Cu) were present at 8.4µg/l and 15µg/l respectively in leachate from the sample from BH5 at 0.20m, and zinc (Zn) was present at 48µg/l in leachate from the sample from TPA at 0.20m. These lowest options relate to freshwater with very low calcium carbonate content (<50mg/l⁻¹) which is unlikely in water of pH 7.2 – 10.9 as measured for these leachates (low CaCO₃ content would be expected to be more likely in more acidic waters). Though no data has been collected regarding the calcium carbonate content of local waters and underlying groundwater, the low concentrations and consequently very minor nature of the exceedances suggests that these results do not represent any noteworthy risk to underground or surface waters.

Further to the low concentrations of potential contaminants leaching from soils at the site, the site is approximately 130m northeast from the nearest surface water feature (nearby unnamed pond/small reservoir), no water strikes or perched water tables were encountered during the drilling exercise to a maximum depth of 4.00m and the soils in question are low permeability due to clay being their dominant constituent and therefore would be expected to prevent any meaningful contaminant migration. As such these low results would not be considered to pose a significant risk to controlled waters.

In summary, the leachate testing returned negligible concentrations of potential contaminants which are not considered to pose a threat to surface or underground waters.

5.3 Review of Results

Soils

In general, all samples returned concentrations of all (tested) potential contaminants within acceptable limits save for those exceedances identified above in section 5.2.1. Importantly these exceedances are only a threat to the proposed new development if they have the ability to cause direct contact with the end-use receptors on site.

Only the sample from BH2 (0.20m) showed elevated levels of arsenic and lead at 57mgkg⁻¹ and 258mgkg⁻¹ respectively, compared with target values of 37mgkg⁻¹ (As) and 200mgkg⁻¹ (Pb).

The C4SL literature* considers 258mgkg⁻¹ Pb to be normal for an urban environment and that Pb level up to 820mgkg⁻¹ might be acceptable and even expected in that context, “A pragmatic approach for lead would be to recommend the use of the ‘normal’ background concentration [as the assessment criterion] when the land use and domain permit”. However, no such exceptions can be made for the returned concentration of As.

*SP1010: Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination – Policy Companion Document. DEFRA, March 2014

As such, it is likely that the contaminant levels returned for BH2 will necessitate some remedial works be undertaken at the site. However, this is not certain at this stage.

It may be that the arsenic concentration at BH2 is actually anomalous and not representative of soils generally at the site, and therefore not representative of a general risk in this part of the site, especially given that much of the made ground was similar in composition. As such with additional soil sampling and analysis, this result might be proven to be of negligible risk, and so a second phase of investigation might prove useful. The current data shows a mean As content of 17.15mgkg⁻¹ and a 95th percentile of

57.02mgkg⁻¹ (95% of data is expected to lie below the mean plus two standards deviations, with anything above that being considered anomalous and non-representative). As such, the As content at BH2 is extremely close to that 95th percentile limit and may actually be an anomalous result.

Additional testing would clarify:

1. If this result is in fact anomalous, and whether remedial works would be truly justifiable.
2. Whether any other areas or the area surrounding BH2 might be similarly affected.
3. The extent of the affected area around BH2 (if it is found to be generally contaminated), thus refining the requirements of any subsequent remedial works should the problem be found to be consistent/widespread.

The most likely form of remedial works would be the installation of a capping system, whereby the top 600mm of soils in proposed garden or soft landscaped areas are removed and replaced with proven uncontaminated soils. No remedial works will be required where hardstanding or buildings are proposed as there would be no pathway for human exposure to the soils in such areas.

However, the client may opt to remediate regardless, but this might comprise avoidable over excavation and removal/disposal of soils to landfill. The advantage would be an improvement of the growing medium in the proposed garden area(s) (i.e. a better quality and thicker topsoil horizon), but the existing sandy (sometimes slightly or very sandy) clay soils probably comprise a reasonable medium as they exist currently.

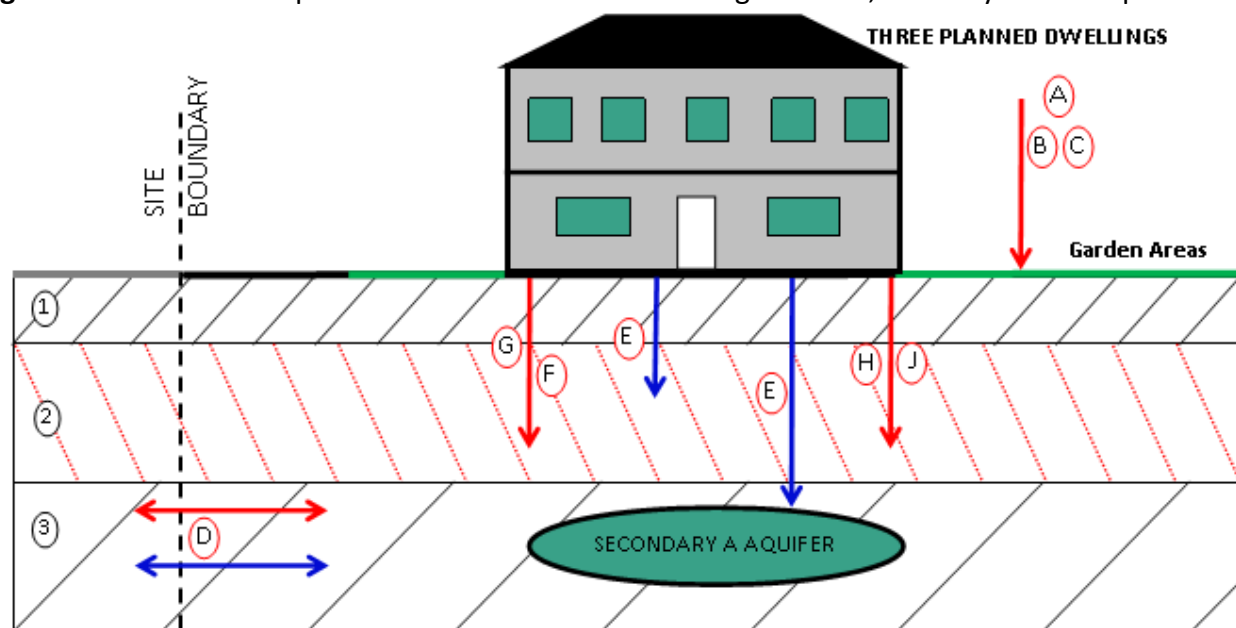
Another approach, which would remove any uncertainty, might be to redesign the proposed development to include only hardstanding in the south/front of the proposed development with no soft landscaped or garden areas other than the rear gardens. This would remove any potential pathway to human receptors and therefore any requirement for remedial works. This would however require the submission of revised plans to the local planning authority for approval.

Waters

Leachates from topsoil and made ground have been analysed and these contained no levels of potential contaminants that would be expected to pose any significant risk to ground and surface waters.

5.3.1 CGHM

The conceptual ground hazard model (CGHM) presented on the following page shows the potential hazards and pollutant linkages which have been considered at the site and those which may still be complete, or would be complete, if the site were to be developed as a residential unit in its current condition.

Figure 1: CGHM – Conceptual cross section of site including a Source, Pathway and Receptor Model

① MADE GROUND and TOPSOIL

② SUPERFICIAL GEOLOGY — GLACIAL DEPOSITS, DEVENSIAN (SAND AND GRAVEL)

③ BEDROCK GEOLOGY — PENNINE MIDDLE COAL MEASURE FORMATION (MUDSTONE, SILTSTONE AND SANDSTONE)

IDENTIFIED HAZARDS Including Potential CONTAMINATION SOURCES

- Made or infilled ground, associated with previous development and demolition on site.
- Adjacent electricity substation, old enough to have used PCB coolants before they were banned.
- Ground surface instability due potential shallow mine collapse or weak made ground.
- Potential hazardous gases sourced from possible shallow mining activity and/or made ground near to or within site.

IDENTIFIED RECEPTORS and ASSOCIATED PATHWAY

- A—** End Users through Direct Contact / Inhalation / Ingestion. Buildings and hard standing will encompass some of the site, removing any pathway to end users through direct contact in these areas
- B—** Plants and Trees through uptake
- C—** End Users through cultivation and consumption of vegetables / fruit. Possible given the intended end use of the site
Linkages A-C potentially complete in proposed development. Some potential contaminants discovered at concentrations above target values. Requires further investigation, remediation, or redesign of proposed development. See sections 5.3 and 7.1 for details.
- D—** Neighbouring Sites through lateral migration (in soil and water, including surface water run off)
- E—** Ground water through leaching of sub-soil
- F—** Buildings and services through direct contact.
Linkages D-F considered disproven by current analyses and risk assessment.
- G—** End users and buildings through ground gas migration
Gas monitoring exercise ongoing. Potential minor risk identified, see section 6 and 7.2 for details.
- H—** Ground surface instability due to potential shallow mine workings.
Linkage H considered disproven. No evidence of shallow coal or mining.
- J—** Ground surface instability due to weak made ground deposits.
Both poorly consolidated made ground and variably weak drift deposits discovered. Easily mitigated by correct foundation design. See section 7.3 for details.

6 Hazardous Gas

6.1 Gas Regime

Due to the potential for made ground to exist at the site and the potential for coal mine workings to exist at depth, ground gas monitoring was concluded to be required at the site prior to development for residential use. The presence of made ground up to 2.30m thick added credence to the conclusion that a ground gas monitoring exercise would be necessary to properly quantify this risk.

Gas monitoring wells were therefore installed in boreholes BH1, BH3 and BH6. The results of four (4) initial gas monitoring visits at the site are presented in Table 3 below. The completed monitoring spreadsheets for the four (4) visits are included in Appendix 4.

A further set of two additional measurements are required to complete the gas risk assessment at the site but no elevated results have been returned to date (see below).

Table 3 Summary of Gas Monitoring Data

Job Number	G19453
Client	Mr T Olumuyiwa
Site	Forker Kings Arms, Joseph Street, Manchester

	CH ₄ (%)	CO ₂ (%)	O ₂ (%)
Minimum	<0.1	<0.1	11.1
Maximum	0.1	5.5	20.1

Borehole	Number of Visits	CH ₄ (%)		CO ₂ (%)		O ₂ (%)		Flow Rate (l/hr)	Atmospheric Pressure (mb)
		Min.	Max.	Min.	Max.	Min.	Max.		
BH1	4	<0.1	<0.1	0.1	0.9	18.9	20.1	<0.1	991
BH3	4	<0.1	<0.1	3.3	5.5	11.1	18.0	<0.1	to
BH6	4	<0.1	0.1	<0.1	0.5	18.1	19.8	<0.1	1001

The two gas monitoring visits carried out to date at atmospheric pressures of 991mb and 1001mb returned:

- Near normal and occasionally slightly depleted levels of O₂ of between 11.1% and 20.1%.
- Levels of CH₄ recorded up to 0.1% but generally below detectable limits.
- Levels of CO₂ recorded levels between <0.1% and 5.5%.
- Negligible H₂S and CO below detectable limits (<1ppm) on all monitoring occasions.
- Consistently negligible flow rates below detectable limits (<0.1 l/hr) on all monitoring occasions.

6.2 Radon Gas

A brief review of the interactive map viewer at UKradon.org shows radon protection is not necessary for new buildings at the site.

7. Conclusions

7.1 Contamination

Analysis of the ground conditions at the site and an assessment of the potential pathways have confirmed that soils at the site are mostly uncontaminated and fit for purpose in the proposed residential end use of the site.

However, some elevated levels of contaminants were noted, as explained in section 5.2.1. A single sample of near-surface made ground recovered from BH2 returned elevated levels of arsenic (As) and lead (Pb), though the Pb concentration is not unacceptable in the context of the site's urban setting.

As such remediation works *may* be required in the adjacent area(s) of proposed soft landscaping close to BH2.

However, this is not certain. Four possible outcomes/options have been identified:

1. The single elevated As concentration may be anomalous. Additional soil sampling and analysis might be undertaken to determine whether remedial works are actually justifiable.
 - a) If similarly elevated results are returned by the additional works then remedial works would be required.
 - b) If consistently low As concentrations are returned by the additional works then the result at BH2 might be shown to be anomalous and not representative of significant risk at the site, and therefore no remedial works would be justifiable.
2. The developer may choose to replace these soils regardless to improve the final condition of the garden areas in terms of the soils suitability as a growing medium. This would comprise remedial works with regard to planning approval and reporting requirements (see below).
3. The developer may choose to remove all soft landscaping / garden areas from the front/south of the proposed development. If these areas are completely hardstanding then no exposure pathway would exist by which future residents might come into contact with the *potentially* contaminated soils. This would require submission and approval of a new development plan.

Any proposed remedial works would need to be approved in advance by the local planning authority. A Remediation and Validation Strategy would need to be approved prior to remedial works commencing, and a Validation Report would subsequently be required, confirming/evidencing their successful completion.

Further to the above, if hitherto unencountered contamination is discovered during development works, works should be halted and both Geoinvestigate and the Local Planning Authority should be notified.

7.2 Hazardous Gas

Gas monitoring is ongoing at the site with four (4) of a potential six monitoring visits having been undertaken to date. The monitoring undertaken to date has returned slightly elevated CO₂ in one borehole (BH3) and slightly low oxygen level in the same borehole.

If the continued monitoring returns comparable data the site is expected fall into Characteristic situation 2 (CS2) of the Modified Wilson and Card classification or "Amber 1" of the NHBC Traffic Light System for low rise housing with a ventilated under-floor void (min 150mm) (CIRIA C665). As such, gas protection measures according to those classifications will be required in the new structure(s).

No radon protection measures are required for the new development.

7.3 Historical Coal Mining

With reference to section 3.1.3.4 it is concluded that no voids or broken ground indicative of mine-workings at shallow depth below the site were encountered in any of the rotary boreholes, and therefore no mitigation measures, or special foundations are required with respect to the coal mining legacy at the site.

7.4 Foundation Recommendation

The made ground was encountered at varying depths across the site between 0.30m in BH5 and 2.30m in BH6. The made ground consisted of mostly sandy gravelly clay fill though some of the near surface <0.30m made ground comprised gravel or hardstanding predominantly of asphalt, and gravel/rubble fill was found to fill an assumed former cellar at BH6.

No moisture depletion was noted in any of the borehole and all samples tested returned clay of Low shrinkage meaning no mitigation is require in terms of vegetation shrinkage (see section 3.1.3).

The rotary open boreholes confirmed depths of between 20.8m and 21.6m to the sandstone bedrock. As concluded above, rotary drilling encountered no voided or broken ground or coal seams indicative of coal mining legacy beneath the site. It is considered that no shallow coal seams exist below the site and therefore no workings also.

Shear vane values are generally fairly low, with the natural clay being soft to firm with some boreholes showing bands of firm soils to ca. 1.50m (BH3-BH5) and most showing soft bands or strata below 2.00m.

No voids were noted in the open hole rotary boreholes but two voids were encountered within the shallow borehole investigation; BH2 noted a 200mm thick void at 2.60m, inferred to be a drain, and BH6 encountered a larger void from 1.70m to 2.30m, inferred be the old cellar of the previous building.

As such, given the variability of soil strengths and the variable depths of made ground, a short-bored pile foundation solution is probably appropriate. Advice regarding the depth and type of piles should be sought from a specialist piling contractor. It is possible that the cellar floor at BH6 may need to be broken and removed prior to piling.

The variable ground conditions and potential for hazardous gas also necessitate that a suspended block and beam floor be adopted.

7.5 Concrete Design

The results of chemical analyses of the fill returned Water Soluble Sulphate levels of between 32mg/l¹ and 307mg/l¹ and pH levels of between 6.7 and 9.7.

On this basis concrete in contact with the ground may be designed to ACEC Class DS-1 AC-1s (DC1) of "BRE Special Digest 1 – Concrete in aggressive ground".

END OF REPORT

The findings and contents of this (intrusive) Site Investigation Report pertain solely to the study area(s) outlined herein and are based solely on the findings of the excavations undertaken as part of the current exercise unless otherwise stated. The findings and/or recommendations of this report do not take into account any ground conditions that may be present but have hitherto not been encountered and as such further investigation and/or a reconsideration of the findings of this report should be undertaken if such conditions are subsequently encountered or an alternative development plan or land use is subsequently proposed.

This report considers various environmental and/or geological risks posed to the site and/or proposed development and offers advice accordingly as guidance only. The findings of this report will remain valid provided no change of ground or groundwater conditions, either natural or anthropogenic, take place and no warrantee is offered or implied.

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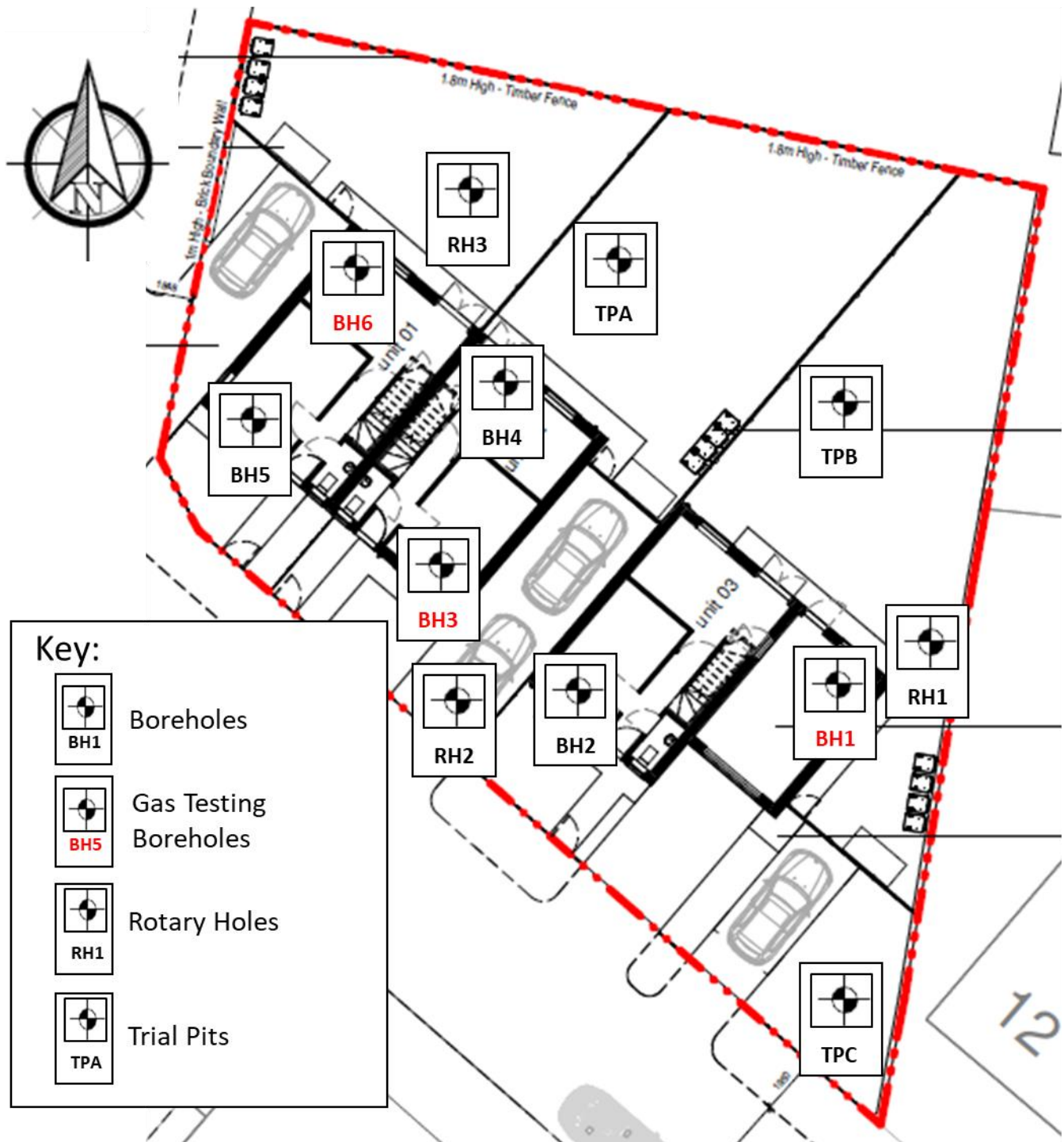
Tel. 01642 713779
Fax 01642713923

Email enquiries@geoinvestigate.co.uk

APPENDIX 1
Site Plan
and
Shallow Borehole, Trial Pit & Rotary Borehole Logs

GEOINVESTIGATE Ltd.

OUR REF: G19453	YOUR REF:	SITE PLAN (NOT TO SCALE)
DATE: 21/01/20	LOCATION: Former Kings Arms, Manchester M24 5SQ	



GEOINVESTIGATE Ltd.

Your Ref.

Our Ref.

G19453

BH No.1 Sheet No. 1 of 1

Location: Former Kings Arms, Joseph Street M24 5SQ

DATE: 21/01/20

Depth (m)	Description of Strata	Thickness	Legend	Gas Well	Sample	Test Type Result	SPT N Value (Depth)	Depth to Water	Depth (m)
0.10	MADE GROUND. Compact black fine to coarse gravel of asphalt and brick.	100			O	Cv kN/m ²	1.00m - 1.45m N=7 1,1,1,2,2,2		0.25
0.30	MADE GROUND. Soft to firm black and brown very sandy gravelly clay / clayey gravelly sand. Gravel is fine to coarse of asphalt, sandstone and brick	200							
1.20	MADE GROUND. Loose/soft yellow and brown mottled grey very sandy clay/clayey sand. Occasional fine to coarse gravel and cobbles of sandstone. Possible reworked natural soil.	900							
					O	16			0.50
					O S	31			0.75
					O	48			1.00
					O	51			1.25
					O S	51			1.50
					O	9			1.75
					O	20			2.00
					O	31			2.25
					O	35			2.50
					O	35			2.75
					O	35			3.00
					O	35			3.25
					O	35			3.50
					O	35			3.75
					O	35			4.00
					O	35			4.00

Remarks: Casing to 1.00m

Dynamic windowless sampling by Terrier Rig to 4.00m

Borehole remained dry on completion

Borehole closed below 3.50m

Gas well installed to 3.50m with gas bung and cover

Key:

Slotted Pipe

Plain Pipe

Bentonite

Gravel Filter

O Disturbed sample

Cv Shear vane

W Water sample

S Standard Penetration Test

BH1

GEOINVESTIGATE Ltd.

Your Ref.

Our Ref.

G19453

BH No.2 Sheet No. 1 of 1

Location: Former Kings Arms, Joseph Street M24 5SQ

DATE: 21/01/20

Depth (m)	Description of Strata	Thick- ness	Legend	Gas Well			Sample	Test Type Result	SPT N Value (Depth)	Depth to Water	Depth (m)
0.10	MADE GROUND. Loose slighty clayey gravel. Gravel is fine to coarse of concrete, brick and sandstone	100					O	Cv kN/m ²			0.25
0.20		100									
	MADE GROUND. Medium dense black fine to coarse gravel of asphalt.	800					O	56			0.50
	MADE GROUND. Soft to firm slightly sandy very gravelly clay. Gravel is fine to coarse of asphalt, brick and coal										
	1.00										
	MADE GROUND. Soft orange and brown mottled grey slightly sandy gravelly clay. Gravel is fine to coarse of sandstone and coal. Possible reworked natural soils.	800					O	20			1.25
	1.80										
	Loose brown and light brown slightly silty SAND.	800					O	26			2.00
	2.60										
	VOID. Pot recovered. Possible drain.	200					O S	31	3.00m - 3.45m N=6 1,1,1,2,1,2		2.75
2.80											
	Soft to firm brown very sandy gravelly CLAY. Gravel is fine to coarse of coal and sandstone. Wet inclusion 3.0m to 3.20m	1200									
	4.00										
	Borehole terminated at 4.00m										4.00

Remarks:

Casing to 1.00m
Dynamic windowless sampling by Terrier Rig to 4.00m
Borehole remained open and dry on completion

Key:

Slotted Pipe
 Plain Pipe
 Bentonite
 Gravel Filter

O Disturbed sample
Cv Shear vane
W Water sample
S Standard Penetration Test

BH2

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Your Ref.

Our Ref.

G19453

BH No.3 Sheet No. 1 of 1

Location: Former Kings Arms, Joseph Street M24 5SQ

DATE: 21/01/20

Depth (m)	Description of Strata	Thickness	Legend	Gas Well	Sample	Test Type Result	SPT N Value (Depth)	Depth to Water	Depth (m)
0.30	MADE GROUND. Soft to firm dark brown and black very gravelly sandy clay. Gravel is fine to coarse of brick, concrete and coal.	300			O	Cv kN/m ²			0.25
0.50	MADE GROUND. Soft to firm brown and dark brown mottled orange slightly gravelly sandy clay. Gravel is fine to coarse of brick and coal.	200			O	31			0.50
1.90	Firm brown mottled orange and grey sandy gravelly CLAY. Gravel is fine to coarse of coal and sandstone.	1400			O	52			0.75
					O	62			1.00
					O	18			1.25
					O	16			1.50
					O	23			1.75
					O	20			2.00
	Soft brown slightly gravelly very sandy CLAY. Gravel is fine to coarse of coal and sandstone.								2.25
	Sand inclusion from 2.10m to 2.20m								2.50
									2.75
									3.00
	Sand inclusion from 3.20m to 3.50m								3.25
									3.50
									3.75
4.00					O	20			4.00
	Borehole terminated at 4.00m								

Remarks: Casing to 1.00m

Dynamic windowless sampling by Terrier Rig to 4.00m

Borehole remained dry on completion

Borehole closed below 3.30m

Gas well installed to 3.30m with gas bung and cover

Key:

Slotted Pipe
 Plain Pipe
 Bentonite
 Gravel Filter

O Disturbed sample

Cv Shear vane

W Water sample

S Standard Penetration Test

BH3

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Your Ref.

Our Ref.

G19453

BH No.4 Sheet No. 1 of 1

Location: Former Kings Arms, Joseph Street M24 5SQ

DATE: 21/01/20

Depth (m)	Description of Strata	Thickness	Legend	Gas Well	Sample	Test Type Result	SPT N Value (Depth)	Depth to Water	Depth (m)
0.10	TURF/TOPSOIL. Loose dark brown slightly sandy very gravelly clay. Gravel is fine to coarse of brick and concrete	100							
		300			O				0.25
0.40	MADE GROUND. Medium dense red and black fine to coarse gravel of brick				O	54			0.50
	MADE GROUND. Soft to firm orange and brown mottled grey slightly gravelly clay. Gravel is fine to coarse of coal, sandstone and brick.	600							0.75
					O	65			1.00
1.00									1.25
	Soft to firm dark brown mottled grey slightly sandy gravelly CLAY. Gravel is fine to coarse of sandstone and coal.								1.50
					O	66			1.75
									2.00
					O	27			2.25
									2.50
		3000			O	12			2.75
									3.00
					O	38			3.25
									3.50
					O				3.75
	Sand inclusion from 3.50m to 3.70m								
4.00					O	41			4.00
	Borehole terminated at 4.00m								

Remarks:

No Casing

Dynamic windowless sampling by Terrier Rig to 4.00m

Borehole remained open and dry on completion

Key:

Slotted Pipe

Plain Pipe

Bentonite

Gravel Filter

O Disturbed sample

Cv Shear vane

W Water sample

S Standard Penetration Test

BH4

GEOINVESTIGATE Ltd.

Your Ref.

Our Ref.

G19453

BH No.5 Sheet No. 1 of 1

Location: Former Kings Arms, Joseph Street M24 5SQ

DATE: 21/01/20

Depth (m)	Description of Strata	Thickness	Legend	Gas Well	Sample	Test Type Result	SPT N Value (Depth)	Depth to Water	Depth (m)
0.10	TOPSOIL/MADE GROUND. Soft black and brown very gravelly sandy clay. Gravel is fine to coarse of brick, pot and concrete.	100				Cv kN/m ²			
0.30		200			O				0.25
	MADE GROUND. Soft dark brown/black slightly gravelly sandy clay. Gravel is fine to coarse of brick and concrete.				O	39			0.50
	Soft to firm yellow and brown mottled grey slightly sandy gravelly CLAY. Gravel is fine to coarse of sandstone and coal.				O	57			0.75
		1700			O	76			1.00
									1.25
					O	20			1.50
2.00									1.75
	Soft brown very sandy gravelly CLAY. Gravel is fine to coarse of sandstone and coal.				O	31			2.00
									2.25
					O	39			2.50
									2.75
	Sand inclusion at 2.80m to 2.90m				O	22			3.00
		2000							3.25
					O	42			3.50
4.00									3.75
									4.00
	Borehole terminated at 4.00m								

Remarks:

Casing to 1.00m

Dynamic windowless sampling by Terrier Rig to 4.00m

Borehole remained open and dry on completion

Key:



Slotted Pipe



Plain Pipe



Bentonite



Gravel Filter

O Disturbed sample

Cv Shear vane

W Water sample

S Standard Penetration Test

BH5

GEOINVESTIGATE Ltd.

Your Ref.

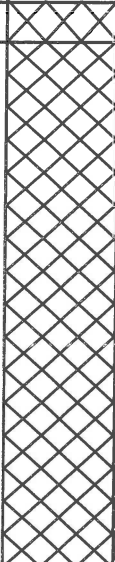
Our Ref.

G19453

BH No.6 Sheet No. 1 of 1

Location: Former Kings Arms, Joseph Street M24 5SQ

DATE: 21/01/20

Depth (m)	Description of Strata	Thick-ness	Legend	Gas Well	Sample	Test Type Result	SPT N Value (Depth)	Depth to Water	Depth (m)	
0.10	TURF / MADE GROUND. Loose brown and grey sandy gravel. Gravel is fine to coarse of sandstone comcrete and brick.	100			O	Cv kN/m ²			0.25	
	MADE GROUND. Loose red and grey gravel of brick, concrete and pot (Basement). Poor sample recovery 1.00m - 2.30m.	1600							O	0.50
									O	0.75
									O	1.00
									O	1.25
1.70					O				1.50	
	Void 1.70m - 2.30m.	600							1.75	
									2.00	
2.30	Probable concrete basement floor								2.30	
	Borehole Terminated at 2.30m									

Remarks: No casing

Gas monitoring well installed to 1.80m with bung and cover

Dynamic windowless sampling by Terrier Rig to 2.30m

Borehole remained dry on completion

Key:

 Slotted Pipe

 Plain Pipe

 Bentonite

 Gravel Filter

O Disturbed sample

Cv Shear vane

W Water sample

S Standard Penetration Test

BH6

GEOINVESTIGATE Ltd.

Your Ref.**Our Ref.**

G19453

TPA

Sheet No. 1 of 1

Location: Former Kings Arms, Joseph Street M24 5SQ

DATE: 21/01/20

Depth (m)	Description of Strata	Thick- ness	Legend	Gas Well			Sample	Test Type Result	SPT N Value (Depth)	Depth to Water	Depth (m)
0.10	MADE GROUND. Loose dark brown slightly sandy gravelly clay. Gravel is fine to coarse of brick and concrete.	100					O	Cv kN/m ²			0.25
	MADE GROUND. Loose red and black fine to coarse gravel of brick. Cobbles.	400									0.50
0.50	MADE GROUND. Soft to firm orange and brown mottled grey slightly sandy gravelly clay. Gravel is fine to coarse of sandstone and coal.	500									0.75
1.00	Trial pit terminated at 1.00m										1.00

Remarks:

Trial pit remained stable and dry on completion
Hand excavation to 1.00m

Key:

O Disturbed sample
Cv Shear vane
W Water sample

TPA

GEOINVESTIGATE Ltd.

Your Ref.**Our Ref.**

G19453

TPB

Sheet No. 1 of 1

Location: Former Kings Arms, Joseph Street M24 5SQ

DATE: 21/01/20

[illegible]

Remarks:

Trial pit remained stable and dry on completion
Hand excavation to 0.80m

Key:

O Disturbed sample
Cv Shear vane
W Water sample

TPB

GEOINVESTIGATE Ltd.

Your Ref.

Our Ref.

G19453

TPC

Sheet No. 1 of 1

Location: Former Kings Arms, Joseph Street M24 5SQ

DATE: 21/01/20

Depth (m)	Description of Strata	Thickness	Legend	Gas Well	Sample	Test Type Result	SPT N Value (Depth)	Depth to Water	Depth (m)
0.20	TURF / TOPSOIL. Soft dark brown sandy gravelly clay. Gravel is fine to coarse of brick, sandstone and coal.	200			O	Cv kN/m ²			0.25
0.50	MADE GROUND. Loose red and dark brown slightly clayey gravel. Gravel is fine to coarse of brick and concrete.	300			O				0.50
	Trial Pit terminated at 0.50m.								

Remarks:

Trial pit remained stable and dry on completion
Hand excavation to 0.50m

Key:

O Disturbed sample
Cv Shear vane
W Water sample

TPC

GEOINVESTIGATE Ltd.**Your Ref.****Our Ref.** G19453**RH No.1 Sheet No. 1 of 2****Location:** Former Kings Arms, Joseph Street, Manchester, M24 5SQ**Date** 21/01/20

Depth (m)	Description of Strata	Thickness	Legend	Gas Well	Sample	Test Type Result	Flush	Depth to Water	Depth (m)
0.10	TARMAC.	100							
	Dark Brown Drift. Becoming Orangish Brown from 1.40m.								2.50
	Becoming Brown from 4.10m								5.00
	Becoming Grey from 7.90m								7.50
		21200							10.00
									12.50
									15.00
									17.50
									20.00
21.3									
	Grey Silty Sandstone.								22.50
									25.00

Remarks: Casing to 2.00m

Microdrill rotary open hole borehole to 30.00m

No cores recovered from borehole

No gas detected from borehole on completion

Full flush Maintained No voids encountered.

Key:

Slotted Pipe

Plain Pipe

Bentonite

Gravel Filter

O Disturbed sample

Cv Shear vane

W Water sample

S Standard Penetration Test

C Cone Penetration Test

RH1

GEOINVESTIGATE Ltd.

Your Ref.

Our Ref. G19453

RH No.1 Sheet No. 2 of 2

Location: Former Kings Arms, Joseph Street, Manchester, M24 5SQ

Date

21/01/20

Depth (m)	Description of Strata	Thick- ness	Legend	Gas Well	Sample	Test Type Result	Flush	Depth to Water	Depth (m)
		8700							27.50
	Rotary Hole Terminated at 30.00m.								30.00

Remarks: Casing to 2.00m

Microdrill rotary open hole borehole to 30m

No cores recovered from borehole

No gas detected from borehole on completion

Full Flush maintained. No voids encountered.

Key:

 Slotted Pipe

 Plain Pipe

 Bentonite

 Gravel Filter

 Disturbed sample

 Shear vane

 Water sample

 Standard Penetration Test

 Cone Penetration Test
RH1

GEOINVESTIGATE Ltd.

Your Ref.

Our Ref. G19453

RH No.2 Sheet No. 1 of 2

Location: Former Kings Arms, Joseph Street, Manchester, M24 5SQ

Date

21/01/20

Depth (m)	Description of Strata	Thick- ness	Legend	Gas Well	Sample	Test Type Result	Flush	Depth to Water	Depth (m)
	TURF / Dark Brown Drift								
	Becoming Orangish Brown from 2.40m								2.50
									5.00
	Becoming Grey from 6.80m.								7.50
									10.00
		21600							12.50
									15.00
									17.50
									20.00
21.6									
	Grey and Light Grey Silty Sandstone.								22.50
		8400							
									25.00

Remarks: Casing to 2.00m

Microdrill rotary open hole borehole to 30.00m

No cores recovered from borehole

No gas detected from borehole on completion

Full flush maintained. No voids encountered.

Key:

 Slotted Pipe

 Plain Pipe

 Bentonite

 Gravel Filter

O Disturbed sample

Cv Shear vane

W Water sample

S Standard Penetration Test

C Cone Penetration Test

RH2

GEOINVESTIGATE Ltd.

Your Ref.

Our Ref. G19453

RH No.2 Sheet No. 2 of 2

Location: Former Kings Arms, Joseph Street, Manchester, M24 5SQ

Date

21/01/20

Depth (m)	Description of Strata	Thick -ness	Legend	Gas Well	Sample	Test Type Result	Flush	Depth to Water	Depth (m)
	Grey and Light Grey Silty Sandstone.	8400							27.50
	Rotary Hole Terminated at 30.00m								30.00

Remarks: Casing to 2.00m

Microdrill rotary open hole borehole to 30m

No cores recovered from borehole

No gas detected from borehole on completion

Full flush maintained. No voids encountered.

Key:

Slotted Pipe

Plain Pipe

Bentonite

Gravel Filter

Disturbed sample

Shear vane

Water sample

Standard Penetration Test

Cone Penetration Test

RH2

GEOINVESTIGATE Ltd.

Your Ref.

Our Ref. G19453

RH No.3 Sheet No. 1 of 2

Location: Former Kings Arms, Joseph Street, Manchester, M24 5SQ

Date 21/01/20

Depth (m)	Description of Strata	Thick-ness	Legend	Gas Well	Sample	Test Type Result	Flush	Depth to Water	Depth (m)
	TURF / Dark Brown Drift.								
	Becoming Orangish Brown from 1.80m.								2.50
	Becoming Brown from 3.70m.								5.00
	Becoming Grey from 7.40m.								7.50
		20800							10.00
									12.50
									15.00
									17.50
									20.00
20.8									
	Light Grey and Grey Silty Sandstone.	9200							22.50
									25.00

Remarks: Casing to 2.00m

Microdrill rotary open hole borehole to 30.00m

No cores recovered from borehole

No gas detected from borehole on completion

Full flush maintained. No voids encountered.

Key:

O Disturbed sample

Cv Shear vane

W Water sample

S Standard Penetration Test

C Cone Penetration Test

RH3

GEOINVESTIGATE Ltd.

Your Ref.

Our Ref. G19453

RH No.3 Sheet No. 2 of 2

Location: Former Kings Arms, Joseph Street, Manchester, M24 5SQ

Date

21/01/20

Depth (m)	Description of Strata	Thick -ness	Legend	Gas Well	Sample	Test Type Result	Flush	Depth to Water	Depth (m)
	Light Grey and Grey Silty Sandstone.	9200							27.50
	Rotary Hole Terminated at 30.00m								30.00

Remarks: Casing to 2.00m

Microdrill rotary open hole borehole to 30m

No cores recovered from borehole

No gas detected from borehole on completion

Full flush maintained.. No voids encountered.

Key:

Slotted Pipe

Plain Pipe

Bentonite

Gravel Filter

O Disturbed sample

Cv Shear vane

W Water sample

S Standard Penetration Test

C Cone Penetration Test

RH3

APPENDIX 2

Moisture Content and Atterberg Limit Test Results (Table 4) and Soil Moisture and Shear Strength Profiles

Atterberg Limit Test Results

Location: Former Kings Arms, Joseph Street M24 5SQ

TP / BH No.	Sample Depth (m)	Insitu Moisture Content (%)	% Passing BS 425 Micron Sieve	Corrected Moisture Content (%)	Plastic Limit (%)	Liquid Limit (%)	Plasticity Index (%)	Soil Classification BS5930 [1999]
1	0.20	9.2	87.2	19.5	19.5	28.8	9.3	CL
	0.50	25.3						
	1.00	19.4						
	1.50	17.0						
	2.00	14.5						
	2.50	17.8						
	3.00	15.1						
	3.50	14.1						
	4.00	12.3						
2	0.20	22.8	91.7	17.4	15.5	24.0	8.5	CL
	0.50	18.7						
	1.00	16.0						
	1.50	24.6						
	2.00	16.3						
	2.50	15.0						
	3.00	15.1						
	3.50	12.7						
	4.00	12.8						

Atterberg Limit Test Results

Table 4 cont.

Location: Former Kings Arms, Joseph Street M24 5SQ

TP / BH No.	Sample Depth (m)	Insitu Moisture Content (%)	% Passing BS 425 Micron Sieve	Corrected Moisture Content (%)	Plastic Limit (%)	Liquid Limit (%)	Plasticity Index (%)	Soil Classification BS5930 [1999]
3	0.20	23.3	93.6	19.7	19.3	29.0	9.7	CL
	0.50	21.9						
	1.00	18.4						
	1.50	16.7						
	2.00	15.7						
	2.50	17.7						
	3.00	15.3						
	3.50	21.9						
	4.00	15.4						
4	0.20	22.7						
	0.50	19.5						
	1.00	18.2						
	1.50	18.8						
	2.00	15.5						
	2.50	16.3						
	3.00	13.7						
	3.50	13.2						
	4.00	13.4						

Atterberg Limit Test Results

Your ref.

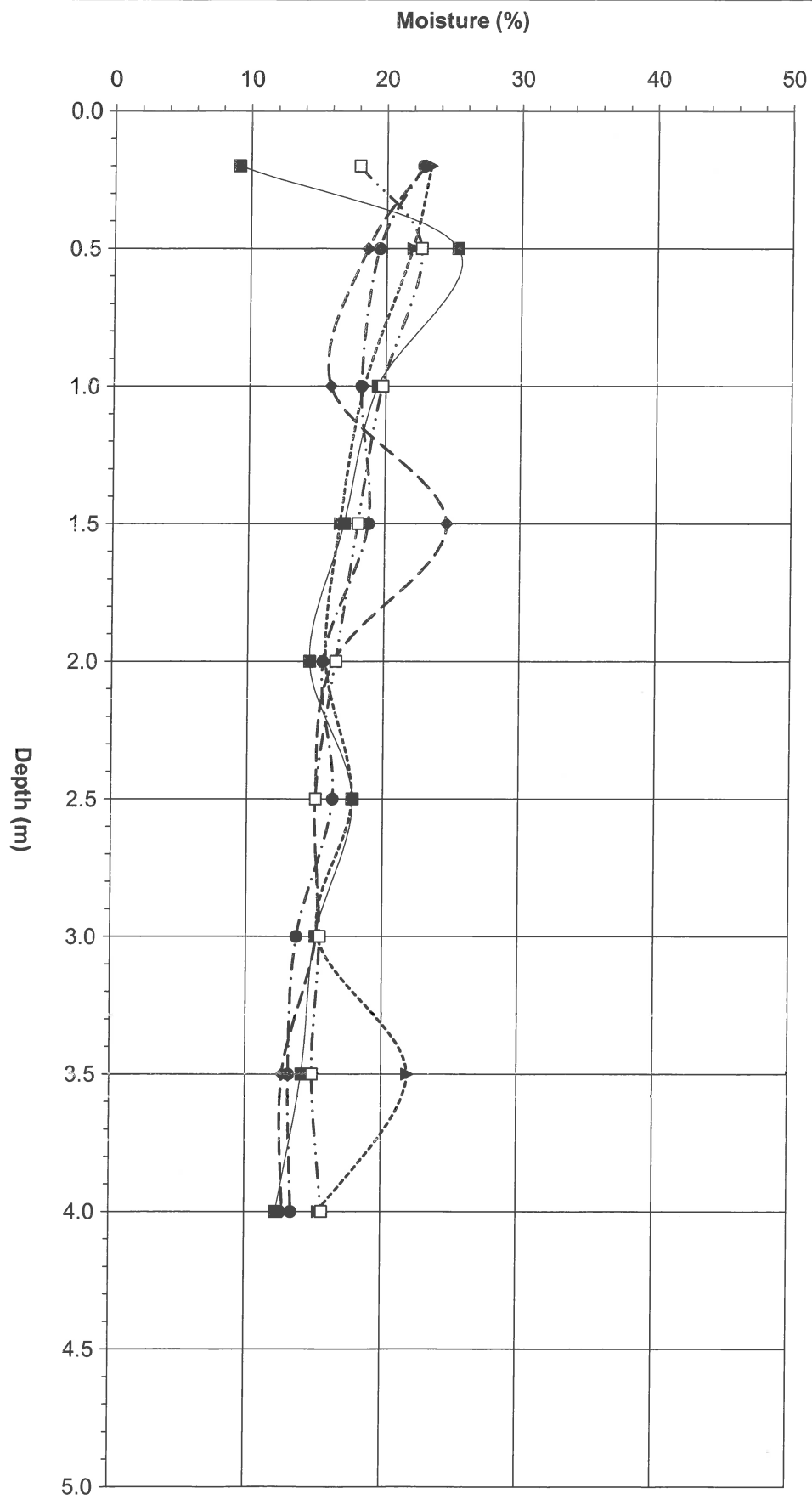
Table 4 cont.

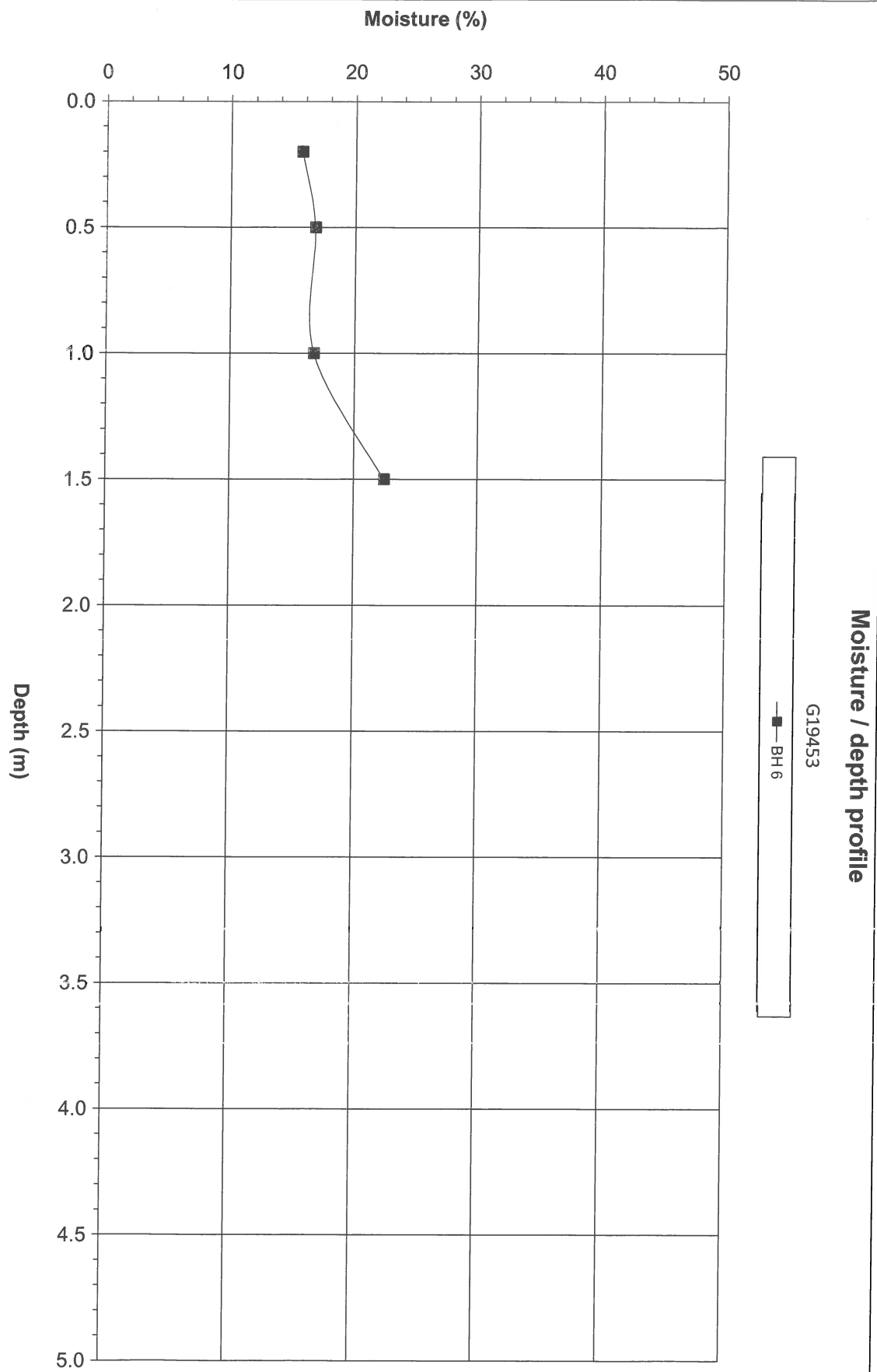
Location: Former Kings Arms, Joseph Street M24 5SQ

TP / BH No.	Sample Depth (m)	Insitu Moisture Content (%)	% Passing BS 425 Micron Sieve	Corrected Moisture Content (%)	Plastic Limit (%)	Liquid Limit (%)	Plasticity Index (%)	Soil Classification BS5930 [1999]
5	0.20	18.0	91.5	19.7	20.8	30.7	9.9	CL
	0.50	22.6						
	1.00	19.8						
	1.50	18.0						
	2.00	16.5						
	2.50	15.0						
	3.00	15.4						
	3.50	14.9						
	4.00	15.6						
	6	0.20						
0.50		16.8						
1.00		16.7						
1.50		22.5						

Moisture / depth profile

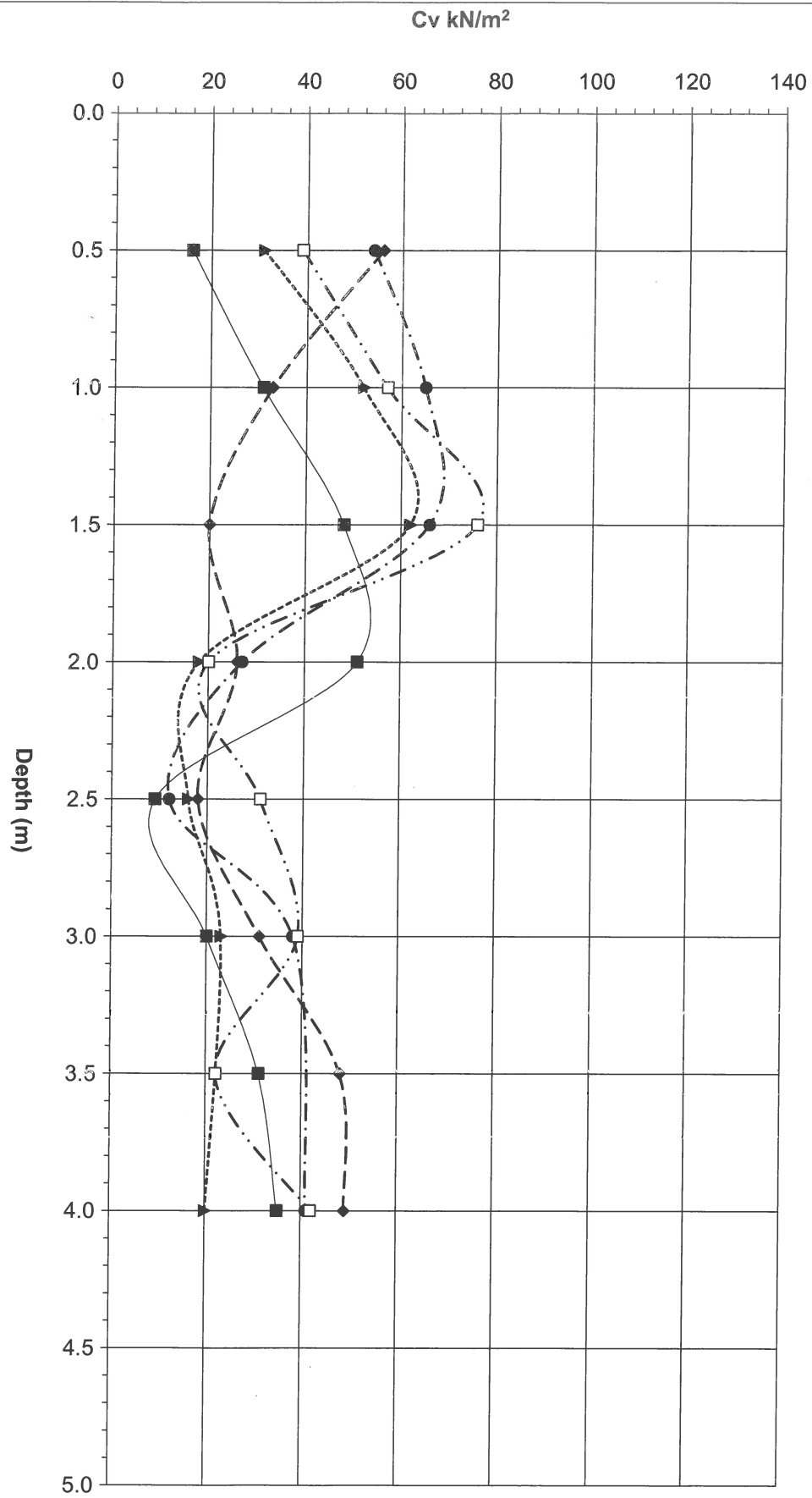
G19453





Shear strength / depth profile

G19453



APPENDIX 3

Chemtech Analytical Test Reports



ANALYTICAL TEST REPORT

Contract no: 84152(1)
Contract name: Proposed Development, Former Kings Arms, Joseph Street, Manchester, M24 5SQ
Client reference: G19453
Clients name: Geo Investigate
Clients address: Units 3a & 4 Terry Dicken Industrial Estate
Ellerbeck Way, Stokesley
North Yorkshire
TS9 7AE
Samples received: 05 February 2020
Analysis started: 05 February 2020
Analysis completed: 16 March 2020
Report issued: 16 March 2020

This is a supplementary report to report number 84152 issued 12 February 2020.

Notes: Opinions and interpretations expressed herein are outside the UKAS accreditation scope.
Unless otherwise stated, Chemtech Environmental Ltd was not responsible for sampling.
All testing carried out at Unit 6 Parkhead, Stanley, DH9 7YB, except for subcontracted testing.
Methods, procedures and performance data are available on request.
Results reported herein relate only to the material supplied to the laboratory.
This report shall not be reproduced except in full, without prior written approval.
Samples will be disposed of 6 weeks from initial receipt unless otherwise instructed.

Key: U UKAS accredited test
M MCERTS & UKAS accredited test
\$ Test carried out by an approved subcontractor
I/S Insufficient sample to carry out test
N/S Sample not suitable for testing
NAD No Asbestos Detected

Approved by:

Dave Bowerbank
Customer Support Hero

Chemtech Environmental Limited

SAMPLE INFORMATION

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.

All results are reported on a dry basis. Samples dried at no more than 30°C in a drying cabinet.

Analytical results are inclusive of stones.

Lab ref	Sample id	Depth (m)	Sample description	Material removed	% Removed	% Moisture
84152-1	BH2	0.20	Clayey Sand with Gravel	-	-	22.8
84152-2	BH4	0.50	Sandy Clay with Gravel	-	-	16.5
84152-3	BH5	0.20	Sandy Clay with Gravel & Roots	-	-	20.0
84152-4	TPA	0.20	Clayey Sand with Gravel	-	-	15.0
84152-5	TPB	0.50	Sandy Clay with Gravel	-	-	24.6
84152-6	TPC	0.20	Clayey Sand with Gravel & Roots	-	-	18.1

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SOILS

Lab number			84152-1	84152-2	84152-3	84152-4	84152-5	84152-6
Sample id			BH2	BH4	BH5	TPA	TPB	TPC
Depth (m)			0.20	0.50	0.20	0.20	0.50	0.20
Date sampled			21/01/2020	21/01/2020	21/01/2020	21/01/2020	21/01/2020	21/01/2020
Test	Method	Units						
Arsenic (total)	CE127 ^M	mg/kg As	57	9.1	6.9	7.0	5.9	17
Boron (water soluble)	CE063 ^M	mg/kg B	1.2	0.5	<0.5	1.2	<0.5	0.6
Cadmium (total)	CE127 ^M	mg/kg Cd	0.7	<0.2	<0.2	0.3	<0.2	0.3
Chromium (total)	CE127 ^M	mg/kg Cr	72	74	82	68	86	84
Chromium (III)	CE208	mg/kg CrIII	72	74	82	68	86	84
Chromium (VI)	CE146	mg/kg CrVI	<1	<1	<1	<1	<1	<1
Copper (total)	CE127 ^M	mg/kg Cu	138	21	7.4	16	11	44
Lead (total)	CE127 ^M	mg/kg Pb	258	24	17	14	17	177
Mercury (total)	CE127 ^M	mg/kg Hg	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Nickel (total)	CE127 ^M	mg/kg Ni	63	18	8.8	12	6.5	21
Selenium (total)	CE127 ^M	mg/kg Se	1.5	0.7	0.9	0.6	1.0	0.9
Zinc (total)	CE127 ^M	mg/kg Zn	252	31	7.6	40	20	94
pH	CE004 ^M	units	7.5	7.0	7.5	9.7	6.7	8.0
Sulphate (2:1 water soluble)	CE061 ^M	mg/l SO ₄	57	32	95	307	44	45
Sulphide	CE079	mg/kg S ²⁻	<10	<10	<10	<10	<10	<10
Cyanide (free)	CE077	mg/kg CN	<1	<1	<1	<1	<1	<1
Cyanide (total)	CE077	mg/kg CN	<1	<1	<1	<1	<1	<1
Thiocyanate	CE145 ^M	mg/kg SCN	<1	<1	<1	<1	2.9	<1
Phenols (total)	CE078	mg/kg PhOH	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Total Organic Carbon (TOC)	CE072 ^M	% w/w C	22.2	0.9	0.9	2.5	2.0	5.1
Estimate of OMC (calculated from TOC)	CE072 ^M	% w/w	38.3	1.5	1.6	4.3	3.5	8.7
PAH								
Acenaphthene	CE087 ^M	mg/kg	0.03	<0.02	<0.02	<0.02	<0.02	0.23
Acenaphthylene	CE087 ^M	mg/kg	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Anthracene	CE087 ^U	mg/kg	0.16	<0.02	<0.02	0.04	<0.02	0.23
Benzo(a)anthracene	CE087 ^U	mg/kg	0.77	<0.02	0.02	0.06	<0.02	0.82
Benzo(a)pyrene	CE087 ^U	mg/kg	0.82	<0.02	<0.02	0.05	<0.02	0.62
Benzo(b)fluoranthene	CE087 ^M	mg/kg	1.30	<0.02	<0.02	0.07	<0.02	0.87
Benzo(ghi)perylene	CE087 ^M	mg/kg	0.79	<0.02	<0.02	0.04	<0.02	0.38
Benzo(k)fluoranthene	CE087 ^M	mg/kg	0.48	<0.03	<0.03	0.03	<0.03	0.30
Chrysene	CE087 ^M	mg/kg	0.96	<0.03	<0.03	0.07	<0.03	0.97
Dibenz(ah)anthracene	CE087 ^M	mg/kg	0.17	<0.02	<0.02	<0.02	<0.02	0.09
Fluoranthene	CE087 ^M	mg/kg	1.55	<0.02	<0.02	0.10	<0.02	1.94
Fluorene	CE087 ^U	mg/kg	0.05	<0.02	<0.02	<0.02	<0.02	0.14
Indeno(123cd)pyrene	CE087 ^M	mg/kg	0.80	<0.02	<0.02	0.04	<0.02	0.39
Naphthalene	CE087 ^M	mg/kg	0.21	<0.02	<0.02	0.24	<0.02	0.39
Phenanthrene	CE087 ^M	mg/kg	0.76	<0.02	<0.02	0.20	<0.02	1.26
Pyrene	CE087 ^M	mg/kg	1.41	<0.02	<0.02	0.10	<0.02	1.71
PAH (total of USEPA 16)	CE087	mg/kg	10.2	<0.34	<0.34	1.04	<0.34	10.3

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SOILS

Lab number			84152-1	84152-2	84152-3	84152-4	84152-5	84152-6
Sample id			BH2	BH4	BH5	TPA	TPB	TPC
Depth (m)			0.20	0.50	0.20	0.20	0.50	0.20
Date sampled			21/01/2020	21/01/2020	21/01/2020	21/01/2020	21/01/2020	21/01/2020
Test	Method	Units						
TPH								
VPH Aromatic (>EC5-EC7)	CE067	mg/kg	-	-	-	<0.01	<0.01	<0.01
VPH Aromatic (>EC7-EC8)	CE067	mg/kg	-	-	-	<0.01	<0.01	<0.01
VPH Aromatic (>EC8-EC10)	CE067	mg/kg	-	-	-	<0.01	<0.01	<0.01
EPH Aromatic (>EC10-EC12)	CE068	mg/kg	-	-	-	<1	<1	<1
EPH Aromatic (>EC12-EC16)	CE068	mg/kg	-	-	-	<1	<1	<1
EPH Aromatic (>EC16-EC21)	CE068	mg/kg	-	-	-	<1	<1	6
EPH Aromatic (>EC21-EC35)	CE068	mg/kg	-	-	-	<1	<1	5
EPH Aromatic (>EC35-EC44)	CE068	mg/kg	-	-	-	<1	<1	<1
VPH Aliphatic (>C5-C6)	CE067	mg/kg	-	-	-	<0.1	<0.1	<0.1
VPH Aliphatic (>C6-C8)	CE067	mg/kg	-	-	-	<0.1	<0.1	<0.1
VPH Aliphatic (>C8-C10)	CE067	mg/kg	-	-	-	<0.1	<0.1	<0.1
EPH Aliphatic (>C10-C12)	CE068	mg/kg	-	-	-	<4	<4	<4
EPH Aliphatic (>C12-C16)	CE068	mg/kg	-	-	-	8	<4	7
EPH Aliphatic (>C16-C35)	CE068	mg/kg	-	-	-	86	10	111
EPH Aliphatic (>C35-C44)	CE068	mg/kg	-	-	-	31	<10	23
PCB								
PCB Congener 28	CE137 ^M	mg/kg	-	-	-	<0.004	<0.004	-
PCB Congener 52	CE137 ^M	mg/kg	-	-	-	<0.004	<0.004	-
PCB Congener 101	CE137 ^M	mg/kg	-	-	-	<0.008	<0.008	-
PCB Congener 118	CE137 ^M	mg/kg	-	-	-	<0.006	<0.006	-
PCB Congener 138	CE137 ^M	mg/kg	-	-	-	<0.006	<0.006	-
PCB Congener 153	CE137 ^M	mg/kg	-	-	-	<0.009	<0.009	-
PCB Congener 180	CE137 ^M	mg/kg	-	-	-	<0.008	<0.008	-
PCB (total of ICES 7)	CE137 ^M	mg/kg	-	-	-	<0.045	<0.045	-
Subcontracted analysis								
Asbestos (qualitative)	\$	-	-	-	NAD	NAD	-	NAD

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PREPARED LEACHATES

Lab number Sample id Depth (m)			84152-3L BH5 0.20	84152-4L TPA 0.20	84152-6L TPC 0.20
Test	Method	Units			
Arsenic (dissolved)	CE128 ^U	µg/l As	1.62	2.41	1.85
Boron (dissolved)	CE128 ^U	µg/l B	50	9	26
Cadmium (dissolved)	CE128 ^U	µg/l Cd	<0.07	0.08	<0.07
Chromium (dissolved)	CE128 ^U	µg/l Cr	8.4	1.1	0.4
Copper (dissolved)	CE128 ^U	µg/l Cu	15.0	3.0	2.0
Lead (dissolved)	CE128 ^U	µg/l Pb	<0.2	0.6	<0.2
Mercury (dissolved)	CE128 ^U	µg/l Hg	<0.008	<0.008	<0.008
Nickel (dissolved)	CE128 ^U	µg/l Ni	2.1	3.2	0.7
Selenium (dissolved)	CE128 ^U	µg/l Se	0.72	0.16	0.18
Zinc (dissolved)	CE128 ^U	µg/l Zn	5	48	6
pH	CE213 ^U	units	7.2	10.9	8.0
Sulphate	CE049 ^U	mg/l SO ₄	6.8	24	6.7
Sulphur (dissolved)	CE128 ^U	mg/l S	2.3	7.9	2.3
Sulphide	CE079	µg/l S ²⁻	<100	<100	<100
Cyanide (free)	CE147	µg/l CN	<20	<20	<20
Cyanide (total)	CE147	µg/l CN	<20	<20	<20
Thiocyanate	CE014	µg/l SCN	<200	<200	<200
Phenols (total)	CE148	µg/l PhOH	<10	<10	<10
PAH					
Acenaphthene	CE051	µg/l	<0.1	<0.1	<0.1
Acenaphthylene	CE051	µg/l	<0.1	<0.1	<0.1
Anthracene	CE051	µg/l	<0.1	<0.1	<0.1
Benzo(a)anthracene	CE051	µg/l	<0.1	<0.1	<0.1
Benzo(a)pyrene	CE051	µg/l	<0.1	<0.1	<0.1
Benzo(b)fluoranthene	CE051	µg/l	<0.1	<0.1	<0.1
Benzo(ghi)perylene	CE051	µg/l	<0.1	<0.1	<0.1
Benzo(k)fluoranthene	CE051	µg/l	<0.1	<0.1	<0.1
Chrysene	CE051	µg/l	<0.1	<0.1	<0.1
Dibenz(ah)anthracene	CE051	µg/l	<0.1	<0.1	<0.1
Fluoranthene	CE051	µg/l	<0.1	<0.1	<0.1
Fluorene	CE051	µg/l	<0.1	<0.1	<0.1
Indeno(123cd)pyrene	CE051	µg/l	<0.1	<0.1	<0.1
Naphthalene	CE051	µg/l	<0.1	<0.1	<0.1
Phenanthrene	CE051	µg/l	<0.1	<0.1	<0.1
Pyrene	CE051	µg/l	<0.1	<0.1	<0.1
PAH (total of USEPA 16)	CE051	µg/l	<1.6	<1.6	<1.6

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METHOD DETAILS

METHOD	SOILS	METHOD SUMMARY	SAMPLE	STATUS	LOD	UNITS
CE127	Arsenic (total)	Aqua regia digest, ICP-MS	Dry	M	1	mg/kg As
CE063	Boron (water soluble)	Hot water extract, ICP-OES	Dry	M	0.5	mg/kg B
CE127	Cadmium (total)	Aqua regia digest, ICP-MS	Dry	M	0.2	mg/kg Cd
CE127	Chromium (total)	Aqua regia digest, ICP-MS	Dry	M	1	mg/kg Cr
CE208	Chromium (III)	Calculation: Cr (total) - Cr (VI)	Dry		1	mg/kg CrIII
CE146	Chromium (VI)	Acid extraction, Colorimetry	Dry		1	mg/kg CrVI
CE127	Copper (total)	Aqua regia digest, ICP-MS	Dry	M	1	mg/kg Cu
CE127	Lead (total)	Aqua regia digest, ICP-MS	Dry	M	1	mg/kg Pb
CE127	Mercury (total)	Aqua regia digest, ICP-MS	Dry	M	0.5	mg/kg Hg
CE127	Nickel (total)	Aqua regia digest, ICP-MS	Dry	M	1	mg/kg Ni
CE127	Selenium (total)	Aqua regia digest, ICP-MS	Dry	M	0.3	mg/kg Se
CE127	Zinc (total)	Aqua regia digest, ICP-MS	Dry	M	5	mg/kg Zn
CE004	pH	Based on BS 1377, pH Meter	As received	M	-	units
CE061	Sulphate (2:1 water soluble)	Aqueous extraction, ICP-OES	Dry	M	10	mg/l SO ₄
CE079	Sulphide	Extraction, Continuous Flow Colorimetry	As received		10	mg/kg S ²⁻
CE077	Cyanide (free)	Extraction, Continuous Flow Colorimetry	As received		1	mg/kg CN
CE077	Cyanide (total)	Extraction, Continuous Flow Colorimetry	As received		1	mg/kg CN
CE145	Thiocyanate	Weak acid extraction, Colorimetry	Dry	M	1	mg/kg SCN
CE078	Phenols (total)	Extraction, Continuous Flow Colorimetry	As received		0.5	mg/kg PhOH
CE072	Total Organic Carbon (TOC)	Removal of IC by acidification, Carbon Analyser	Dry	M	0.1	% w/w C
CE072	Estimate of OMC (calculated from TOC)	Calculation from Total Organic Carbon	Dry	M	0.1	% w/w
CE087	Acenaphthene	Solvent extraction, GC-MS	As received	M	0.02	mg/kg
CE087	Acenaphthylene	Solvent extraction, GC-MS	As received	M	0.02	mg/kg
CE087	Anthracene	Solvent extraction, GC-MS	As received	U	0.02	mg/kg
CE087	Benzo(a)anthracene	Solvent extraction, GC-MS	As received	U	0.02	mg/kg
CE087	Benzo(a)pyrene	Solvent extraction, GC-MS	As received	U	0.02	mg/kg
CE087	Benzo(b)fluoranthene	Solvent extraction, GC-MS	As received	M	0.02	mg/kg
CE087	Benzo(ghi)perylene	Solvent extraction, GC-MS	As received	M	0.02	mg/kg
CE087	Benzo(k)fluoranthene	Solvent extraction, GC-MS	As received	M	0.03	mg/kg
CE087	Chrysene	Solvent extraction, GC-MS	As received	M	0.03	mg/kg
CE087	Dibenz(ah)anthracene	Solvent extraction, GC-MS	As received	M	0.02	mg/kg
CE087	Fluoranthene	Solvent extraction, GC-MS	As received	M	0.02	mg/kg
CE087	Fluorene	Solvent extraction, GC-MS	As received	U	0.02	mg/kg
CE087	Indeno(123cd)pyrene	Solvent extraction, GC-MS	As received	M	0.02	mg/kg
CE087	Naphthalene	Solvent extraction, GC-MS	As received	M	0.02	mg/kg
CE087	Phenanthrene	Solvent extraction, GC-MS	As received	M	0.02	mg/kg
CE087	Pyrene	Solvent extraction, GC-MS	As received	M	0.02	mg/kg
CE087	PAH (total of USEPA 16)	Solvent extraction, GC-MS	As received		0.34	mg/kg
CE067	VPH Aromatic (>EC5-EC7)	Headspace GC-FID	As received		0.01	mg/kg
CE067	VPH Aromatic (>EC7-EC8)	Headspace GC-FID	As received		0.01	mg/kg
CE067	VPH Aromatic (>EC8-EC10)	Headspace GC-FID	As received		0.01	mg/kg
CE068	EPH Aromatic (>EC10-EC12)	Solvent extraction, GC-FID	As received		1	mg/kg
CE068	EPH Aromatic (>EC12-EC16)	Solvent extraction, GC-FID	As received		1	mg/kg
CE068	EPH Aromatic (>EC16-EC21)	Solvent extraction, GC-FID	As received		1	mg/kg

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METHOD DETAILS

METHOD	SOILS	METHOD SUMMARY	SAMPLE	STATUS	LOD	UNITS
CE068	EPH Aromatic (>EC21-EC35)	Solvent extraction, GC-FID	As received		1	mg/kg
CE068	EPH Aromatic (>EC35-EC44)	Solvent extraction, GC-FID	As received		1	mg/kg
CE067	VPH Aliphatic (>C5-C6)	Headspace GC-FID	As received		0.1	mg/kg
CE067	VPH Aliphatic (>C6-C8)	Headspace GC-FID	As received		0.1	mg/kg
CE067	VPH Aliphatic (>C8-C10)	Headspace GC-FID	As received		0.1	mg/kg
CE068	EPH Aliphatic (>C10-C12)	Solvent extraction, GC-FID	As received		4	mg/kg
CE068	EPH Aliphatic (>C12-C16)	Solvent extraction, GC-FID	As received		4	mg/kg
CE068	EPH Aliphatic (>C16-C35)	Solvent extraction, GC-FID	As received		4	mg/kg
CE068	EPH Aliphatic (>C35-C44)	Solvent extraction, GC-FID	As received		10	mg/kg
CE137	PCB Congener 28	Solvent extraction, GC-MS	As received	M	0.004	mg/kg
CE137	PCB Congener 52	Solvent extraction, GC-MS	As received	M	0.004	mg/kg
CE137	PCB Congener 101	Solvent extraction, GC-MS	As received	M	0.008	mg/kg
CE137	PCB Congener 118	Solvent extraction, GC-MS	As received	M	0.006	mg/kg
CE137	PCB Congener 138	Solvent extraction, GC-MS	As received	M	0.006	mg/kg
CE137	PCB Congener 153	Solvent extraction, GC-MS	As received	M	0.009	mg/kg
CE137	PCB Congener 180	Solvent extraction, GC-MS	As received	M	0.008	mg/kg
CE137	PCB (total of ICES 7)	Solvent extraction, GC-MS	As received	M	0.045	mg/kg
\$	Asbestos (qualitative)	HSG 248, Microscopy	Dry	U	-	-

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METHOD DETAILS

METHOD	PREPARED LEACHATES	METHOD SUMMARY	STATUS	LOD	UNITS
CE002	Leachate preparation (EA)	L:S 10:1		-	-
CE128	Arsenic (dissolved)	ICP-MS	U	0.06	µg/l As
CE128	Boron (dissolved)	ICP-MS	U	8	µg/l B
CE128	Cadmium (dissolved)	ICP-MS	U	0.07	µg/l Cd
CE128	Chromium (dissolved)	ICP-MS	U	0.2	µg/l Cr
CE128	Copper (dissolved)	ICP-MS	U	0.4	µg/l Cu
CE128	Lead (dissolved)	ICP-MS	U	0.2	µg/l Pb
CE128	Mercury (dissolved)	ICP-MS	U	0.008	µg/l Hg
CE128	Nickel (dissolved)	ICP-MS	U	0.5	µg/l Ni
CE128	Selenium (dissolved)	ICP-MS	U	0.07	µg/l Se
CE128	Zinc (dissolved)	ICP-MS	U	1	µg/l Zn
CE213	pH	Based on BS 1377, pH Meter	U	-	units
CE049	Sulphate	Ion Chromatography	U	1.7	mg/l SO ₄
CE128	Sulphur (dissolved)	ICP-MS	U	0.2	mg/l S
CE079	Sulphide	Continuous Flow Colorimetry		100	µg/l S ²⁻
CE147	Cyanide (free)	Continuous Flow Colorimetry		20	µg/l CN
CE147	Cyanide (total)	Continuous Flow Colorimetry		20	µg/l CN
CE014	Thiocyanate	Colorimetry		200	µg/l SCN
CE148	Phenols (total)	Continuous Flow Colorimetry		10	µg/l PhOH
CE051	Acenaphthene	Solvent extraction, GC-MS		0.1	µg/l
CE051	Acenaphthylene	Solvent extraction, GC-MS		0.1	µg/l
CE051	Anthracene	Solvent extraction, GC-MS		0.1	µg/l
CE051	Benzo(a)anthracene	Solvent extraction, GC-MS		0.1	µg/l
CE051	Benzo(a)pyrene	Solvent extraction, GC-MS		0.1	µg/l
CE051	Benzo(b)fluoranthene	Solvent extraction, GC-MS		0.1	µg/l
CE051	Benzo(ghi)perylene	Solvent extraction, GC-MS		0.1	µg/l
CE051	Benzo(k)fluoranthene	Solvent extraction, GC-MS		0.1	µg/l
CE051	Chrysene	Solvent extraction, GC-MS		0.1	µg/l
CE051	Dibenz(ah)anthracene	Solvent extraction, GC-MS		0.1	µg/l
CE051	Fluoranthene	Solvent extraction, GC-MS		0.1	µg/l
CE051	Fluorene	Solvent extraction, GC-MS		0.1	µg/l
CE051	Indeno(123cd)pyrene	Solvent extraction, GC-MS		0.1	µg/l
CE051	Naphthalene	Solvent extraction, GC-MS		0.1	µg/l
CE051	Phenanthrene	Solvent extraction, GC-MS		0.1	µg/l
CE051	Pyrene	Solvent extraction, GC-MS		0.1	µg/l
CE051	PAH (total of USEPA 16)	Solvent extraction, GC-MS		1.6	µg/l

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DEVIATING SAMPLE INFORMATION

Comments

Sample deviation is determined in accordance with the UKAS note "Guidance on Deviating Samples" and based on reference standards and laboratory trials.

For samples identified as deviating, test result(s) may be compromised and may not be representative of the sample at the time of sampling.

Chemtech Environmental Ltd cannot be held responsible for the integrity of sample(s) received if Chemtech Environmental Ltd did not undertake the sampling. Such samples may be deviating.

Key

N	No (not deviating sample)
Y	Yes (deviating sample)
NSD	Sampling date not provided
NST	Sampling time not provided (waters only)
EHT	Sample exceeded holding time(s)
IC	Sample not received in appropriate containers
HP	Headspace present in sample container
NCF	Sample not chemically fixed (where appropriate)
OR	Other (specify)

Lab ref	Sample id	Depth (m)	Deviating	Tests (Reason for deviation)
84152-1	BH2	0.20	N	
84152-2	BH4	0.50	N	
84152-3	BH5	0.20	N	
84152-4	TPA	0.20	Y	PCB (EHT)
84152-5	TPB	0.50	Y	PCB (EHT)
84152-6	TPC	0.20	N	

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TEST REPORT REVISIONS

The table below identifies ammendments that have been made to this test report for each revision.

Test Report Reference	Details of amendments to test report	Issue Date
84152	Original report issued	12 February 2020
84152(1)	PCB added for 84152-4 & 84152-5	16 March 2020

APPENDIX 4

Gas Monitoring Results

Job Number	G19453
Client	Mr T Olumuyiwa
Site	Forker Kings Arms, Joseph Street, Manchester
Instrument	GFM 406 + 410

Key	Water Logged
WL	Below Detectable Levels
BDL	No Bung
NB	Well destroyed / inaccessible
WD/I	

Monitoring Personal		PG	Date		14/02/2020	Weather		windy	Temperature		6	Starting Pressure		991	Carbon Monoxide	
Monitoring Point	Well condition		Flow range (l/hr)		Atmospheric Pressure (mb)	Methane % (v/v)			Carbon dioxide % (v/v)		Oxygen % (v/v)	Water Level (mbgl)	Depth of Well (m)	Volume of gas in well (m ³)	Hydrogen Sulphide (ppm)	Carbon Monoxide (ppm)
BH1			<0.1		991	0.0		0	0.5		20.1				0	0
BH3			<0.1		991	0.0		0	3.8		17.4				0	0
BH6			<0.1		991	0.1		2	0.5		18.5				0	0

Monitoring Personal		JP	Date		21/02/2020	Weather		raining	Temperature		17	Starting Pressure		994	Carbon Monoxide	
Monitoring Point	Well condition		Flow range (l/hr)		Atmospheric Pressure (mb)	Methane % (v/v)			Carbon dioxide % (v/v)		Oxygen % (v/v)	Water Level (mbgl)	Depth of Well (m)	Volume of gas in well (m ³)	Hydrogen Sulphide (ppm)	Carbon Monoxide (ppm)
BH1			<0.1		994	0.0		0	0.4		20.0				0	0
BH3			<0.1		994	0.0		0	3.3		18.0				0	0
BH6			<0.1		994	0.0		0	0.4		18.1				0	0

Monitoring Personal		A	Date		27/02/2020	Weather		sunny	Temperature		4	Starting Pressure		1001	Carbon Monoxide	
Monitoring Point	Well condition		Flow range (l/hr)		Atmospheric Pressure (mb)	Methane % (v/v)			Carbon dioxide % (v/v)		Oxygen % (v/v)	Water Level (mbgl)	Depth of Well (m)	Volume of gas in well (m ³)	Hydrogen Sulphide (ppm)	Carbon Monoxide (ppm)
BH1			<0.1		1001	0.0		0	0.1		19.0				0	0
BH3			<0.1		1001	0.0		0	5.4		13.4				0	0
BH6			<0.1		1001	0.0		0	0.5		19.8				0	0

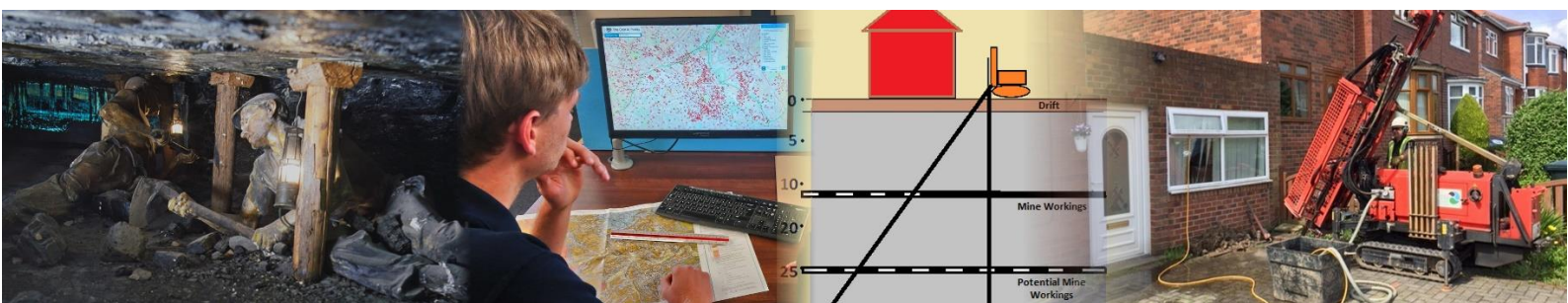
Monitoring Personal		PG	Date		11/09/2019	Weather		sunny/cloudy	Temperature			Starting Pressure			Carbon Monoxide	
Monitoring Point	Well condition		Flow range (l/hr)		Atmospheric Pressure (mb)	Methane % (v/v)			Carbon dioxide % (v/v)		Oxygen % (v/v)	Water Level (mbgl)	Depth of Well (m)	Volume of gas in well (m ³)	Hydrogen Sulphide (ppm)	Carbon Monoxide (ppm)
BH1			<0.1		1002	0.0		0	0.9		18.9				0	0
BH3			<0.1		1002	0.0		0	5.5		11.1				0	0
BH6			<0.1		1002	0.0		0	0.0		19.1				0	0

APPENDIX 5

Coal Mining Risk Assessment Report



GEOLOGICAL
GEOTECHNICAL
GEOENVIRONMENTAL
CONSULTANCY
DRILLING & DATA ACQUISITION



GEOINVESTIGATE LIMITED

Coal Mining Risk Assessment (CMRA)

LOCATION	Former Kings Arms, Joseph Street, Middleton, Rochdale M24 5SQ
ISSUE DATE	18 th October 2019
FOR	Tobi Olumuyiwa
CLIENT REF.	
OUR REF.	G19387

Prepared by

Matthew Walker BSc(Hons)
Asst. Geo-environmental Engineer

Checked by

Ross Nicolson BSc(Hons) MSc(Eng) CEng MIMMM
Principal Geotechnical Engineer

SUMMARY FINDINGS

OUTCOME (MITIGATION REQUIRED)

Exploratory drilling is required to investigate possible underground coal/fireclay mine workings within shallow depth beneath this site. Additionally, a **shallow geo-environmental site investigation (SI)** may be required to establish whether ground contamination is present from previous historical land use activity within the property and gas risk from nearby infilled reservoirs.

WHAT TO DO NEXT

Obtain quotes for the intrusive site investigation works. The cost of the SI works should be a **"lump sum" fixed price**. Geoinvestigate can provide advice and assistance with helping you find suitable site investigation & drilling contractors. Call us on 01642 713779 or email enquiries@geoinvestigate.co.uk.

1. CMRA INTRODUCTION

1.1 SITE LOCATION AND DESCRIPTION

The approximate centre of this site is at National Grid Reference E 386588, N 406302 with an elevation of about 1502m AOD. The boundary shown RED on the Coal Authority (CA) report provided in Appendix A corresponds with the planning application area. Google Satellite and Street View imagery shows the site located in an established housing estate comprising of newer terrace housing and bungalows. The development area is currently a small unoccupied parcel of land - the former site of the Kings Arms pub. The plot fronts onto Josephs Street and is bounded by a retaining wall on the eastern and northern perimeters. The surface of the site is flat, gently sloping to the north and falling to the south. Hardstanding tarmac and gravel occupies the eastern half of the plot and rough grass / bushes occupy the western portion of the site. A second square plot of land is present adjacent to the rear of the development area comprising overgrown trees, bushes and an electricity substation. Site images are presented in Appendix B.

The OS map record dating back to 1848 shows the site comprising a road and dwelling. Two large reservoirs are recorded some 30m west and northeast of the development area. Six terrace houses and the Kings Arms pub were erected within the western half and eastern portion of the site respectively circa 1891. The two nearby reservoirs were perhaps infilled circa 1955 and the terrace houses demolished by 1979. The Kings Arms pub was demolished sometime after 1983. Google Satellite and Street View imagery shows the infilled reservoir to the west of the site is now occupied by a park.

Description & Layout of Proposed Development: It is proposed to erect three (3) dwellings on the site with vehicle parking and rear garden space. The proposed development plan is included in Appendix C.

Risk Methodology Applied: This document and the risk assessment methodology adopted herein is based on CA publication RISK BASED APPROACH TO DEVELOPMENT MANAGEMENT - GUIDANCE FOR DEVELOPERS Version 3, 2014 and Version 4 - 2017. The template contained therein is adopted with amendments made by Geoinvestigate Limited.

2. ASSESSMENT OF SITE-SPECIFIC COAL MINING ISSUES

The table below summarises the potential risks associated with coal mining legacy for the proposed development site identified from the CA report in Appendix A:

Coal Mining Issues	Yes	No	Risk Assessment/Remarks
Past underground coal mining		No	
Probable unrecorded shallow workings		No	2.1.1 (refer below)
Spine roadways at shallow depth		No	
Mine entries		No	
Outcrop		No	2.1.1
Geological faults, fissures and breaklines		No	
Opencast Mines		No	
Site Investigation		No	
Coal Mining Subsidence		No	
Mine Gas		No	

Note: For those coal mining issues above identified as "Yes" or highlighted "YELLOW" a more detailed discussion and assessment are made of the risks to the application site and the proposed development. Additional coal mine issues have also been discussed where appropriate.

2.1 DETAILED DISCUSSION & ASSESSMENT RESPONSE

2.1.1 Coal Outcrop & Probable Unrecorded Shallow Workings

The location of the site is shown on the extract of BGS geology map included in Appendix D. The tentative elevation of the site relative to the vertical geology column is shown below the map. According to the BGS geology map the site is underlain by the Pennine Lower Coal Measures Formation comprising Interbedded grey mudstone, siltstone, pale grey sandstone and commonly with mudstones containing marine fossils in the lower part, and more numerous and thicker coal seams in the upper part. The strata within the site and in the surrounding area is expected to dip southwest.

The BGS geology map records outcrop of the Arley Coal seam (A) some 500m northwest of the site and the Lower Bent (LBt) and Higher Bent (HBt) coal seams outcrop some 550m south of the site. The 'UK Coal Resource for New Exploitation Technologies Final Report' CR/04/015N in Appendix E shows the Arley Coal seam (A) to have a workable thickness of 0.4m to 1.7m.

According to the BGS vertical geology column five (5) coal seams may outcrop between the Arley Coal seam (A) and Lower Bent Coal seam (LBt). Depending on the elevation of the site in relation to geological stratigraphic succession the site could be underlain by perhaps the Half Yard coal seam (HY) and any working at perhaps shallow depth. Therefore, given the forgoing the uncertainty, even though the site is not located within an area of probable unrecorded shallow mine workings the possibility of such cannot be discounted without further intrusive investigation.

2.1.2 Expected Drift/Bedrock Depth

The BGS drift geology map suggests the site is underlain by Hummocky Glacial Deposits comprising sand and gravel. There is no readily available historical borehole information in the close vicinity of the site which might establish drift depth and coal mining geology beneath the new development. Distant BGS borehole log SD80NE/7/11/12/12/14 & /21 some 350m south and southeast of the site record drift to depth between 39.01m and 17.06m, continuing into generally mudstone bedrock. Workable coal and fireclay are recorded at 23.77m depth in BGS borehole SD80NE/11. While this coal seam may not be wholly pertinent to this development, workable coal/fireclay at shallow depth in the surrounding area raises concern in regard to potential shallow coal mine working beneath the site. The logs of SD80NE/7/11/12/12/14 & /21 are not included in this report.

In our opinion, given the forgoing uncertainty and the important bearing drift depth has on coal mining legacy further intrusive investigation may be required to establish drift/bedrock within the site area.

3. SUMMARY AND OUTCOME

This CMRA has indicated the development may be underlain shallow coal/fireclay mine working. In our opinion the possible occurrence of shallow mine workings beneath the site could pose a significant risk to surface ground stability within the development area.

Therefore, given the forgoing outcome it is our opinion that drilling is required to reliably establish drift/bedrock depth and the presence, depth and nature of mine workings (if any) beneath this site.

Additionally, a shallow geo-environmental site investigation (SI) may be required to establish whether ground contamination is present from previous historical land use activity within the property and gas risk from nearby infilled reservoirs.

While the mine gas risk is expected to be LOW given the presence of possible shallow mine workings beneath the site, and the very serious nature of mine gas it is our opinion that this risk is raised to **MODERATE** to perhaps HIGH **until proven otherwise by drilling and gas monitoring.**

4. MITIGATION STRATEGY PROPOSED AND CONCLUSION

To properly determine the coal mining risk at this site it is proposed to drill 2 or 3 boreholes to target depths up to 30m (but not necessarily reaching 30m) to locate possible coal seams below the new development as well as drift and bedrock depth.

Risks for Different Drilling Scenarios					
Air flush	Mist flush	Foam flush	Water flush	Mud flush	Additional controls
HIGH	HIGH / MED'M	HIGH / MED'M	LOW	LOW	- Monitoring at rig and other open holes. - Seal boreholes

A Coal Authority Permit needs to be obtained (ahead of) further intrusive exploratory drilling. Water Drill Flush to be used when drilling. Permit application must state **WATER ONLY DRILL FLUSH** for the safety of the public and drill crew.

On the basis of the CMRA work to date, we are of the opinion that the mining stability and mine gas risks posed by the strata beneath this site from coal mining legacy can be mitigated by routinely adopted measures and should not preclude the planning permission being registered.

In conclusion we see no reason why Planning Permission should not be granted in the interim and that these works form a condition on the planning approval.

Appendices:

- A. CA dated 11 October 2019 ref 51002184490001
- B. Site images
- C. Proposed development plan
- D. Extracts of BGS Geology Map, Sheet 85 – Manchester at 1:50000 scale
- E. Extract of the 'UK Coal Resource for New Exploitation Technologies Final Report' CR/04/015N stratigraphic succession in the South Lancashire Coalfield.

Other sources of information include historic Ordnance Survey maps and BGS boreholes nearby the site.

APPENDIX A
COAL AUTHORITY REPORT



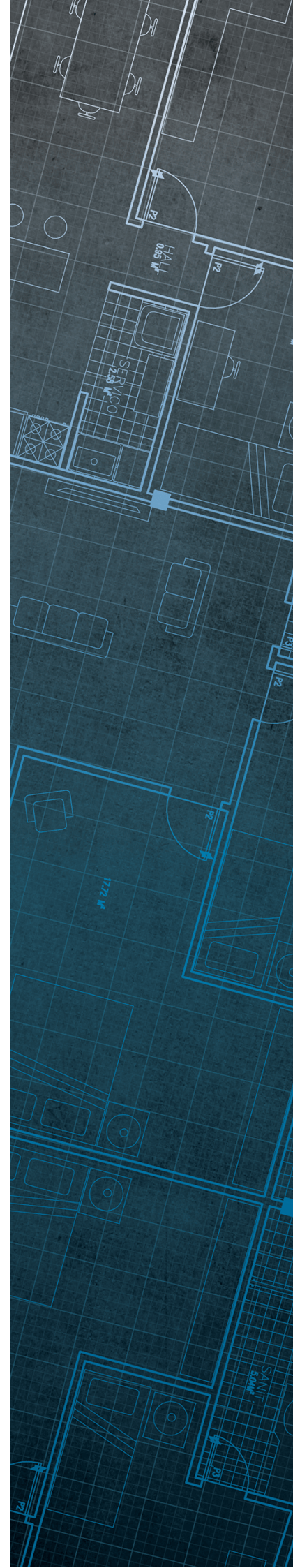
The Coal
Authority

Consultants Coal Mining Report

Former Kings Arms
Joseph Street
Middleton
Rochdale
M24 5SQ

Date of enquiry:	11 October 2019
Date enquiry received:	11 October 2019
Issue date:	11 October 2019

Our reference:	51002184490001
Your reference:	G19387



Consultants

Coal Mining Report

This report is based on and limited to the records held by the Coal Authority at the time the report was produced.

Client name

GEOINVESTIGATE

Enquiry address

Former Kings Arms
Joseph Street
Middleton
Rochdale
M24 5SQ

How to contact us

0345 762 6848 (UK)
+44 (0)1623 637 000 (International)

200 Lichfield Lane
Mansfield
Nottinghamshire
NG18 4RG

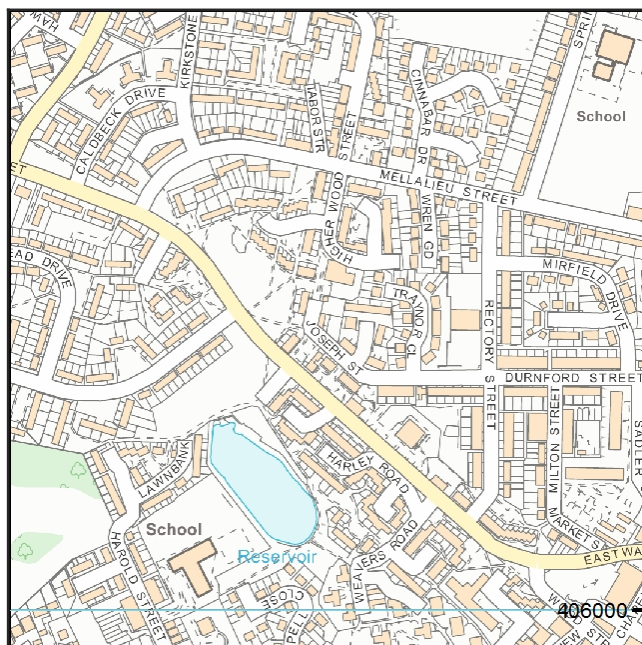
www.groundstability.com

 @coalauthority

 /company/the-coal-authority

 /thecoalauthority

 /thecoalauthority



Approximate position of property



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Section 1 – Mining activity and geology

Past underground mining

No past mining recorded.

Probable unrecorded shallow workings

None.

Spine roadways at shallow depth

No spine roadway recorded at shallow depth.

Mine entries

None recorded within 100 metres of the enquiry boundary.

Abandoned mine plan catalogue numbers

The following abandoned mine plan catalogue numbers intersect with some, or all, of the enquiry boundary:

16820		
-------	--	--

Please contact us on 0345 762 6848 to determine the exact abandoned mine plans you require based on your needs.

Outcrops

No outcrops recorded.

Geological faults, fissures and breaklines

No faults, fissures or breaklines recorded.

Opencast mines

None recorded within 500 metres of the enquiry boundary.

Coal Authority managed tips

None recorded within 500 metres of the enquiry boundary.

Section 2 – Investigative or remedial activity

Please refer to the 'Summary of findings' map (on separate sheet) for details of any activity within the area of the site boundary.

Site investigations

None recorded within 50 metres of the enquiry boundary.

Remediated sites

None recorded within 50 metres of the enquiry boundary.

Coal mining subsidence

The Coal Authority has not received a damage notice or claim for the subject property, or any property within 50 metres of the enquiry boundary, since 31 October 1994.

There is no current Stop Notice delaying the start of remedial works or repairs to the property.

The Coal Authority is not aware of any request having been made to carry out preventive works before coal is worked under section 33 of the Coal Mining Subsidence Act 1991.

Mine gas

None recorded within 500 metres of the enquiry boundary.

Mine water treatment schemes

None recorded within 500 metres of the enquiry boundary.

Section 3 – Licensing and future mining activity

Future underground mining

None recorded.

Coal mining licensing

None recorded within 200 metres of the enquiry boundary.

Court orders

None recorded.

Section 46 notices

No notices have been given, under section 46 of the Coal Mining Subsidence Act 1991, stating that the land is at risk of subsidence.

Withdrawal of support notices

The property is not in an area where a notice to withdraw support has been given.

The property is not in an area where a notice has been given under section 41 of the Coal Industry Act 1994, cancelling the entitlement to withdraw support.

Payments to owners of former copyhold land

The property is not in an area where a relevant notice has been published under the Coal Industry Act 1975/Coal Industry Act 1994.

Section 4 – Further information

Based on the responses in this report, no further information has been highlighted.

Section 5 – Data definitions

The datasets used in this report have limitations and assumptions within their results. For more guidance on the data and the results specific to the enquiry boundary, please **call us on 0345 762 6848** or **email us at groundstability@coal.gov.uk**.

Past underground coal mining

Details of all recorded underground mining relative to the enquiry boundary. Only past underground workings where the enquiry boundary is within 0.7 times the depth of the workings (zone of likely physical influence) allowing for seam inclination, will be included.

Probable unrecorded shallow workings

Areas where the Coal Authority believes there to be unrecorded coal workings that exist at or close to the surface (less than 30 metres deep).

Spine roadways at shallow depth

Connecting roadways either, working to working, or, surface to working, both in-seam and cross measures that exist at or close to the surface (less than 30 metres deep), either within or within 10 metres of the enquiry boundary.

Mine entries

Details of any shaft or adit either within, or within 100 metres of the enquiry boundary including approximate location, brief treatment details where known, the mineral worked from the mine entry and conveyance details where the mine entry has previously been sold by the Authority or its predecessors British Coal or the National Coal Board.

Abandoned mine plan catalogue numbers

Plan numbers extracted from the abandoned mines catalogue containing details of coal and other mineral abandonment plans deposited via the Mines Inspectorate in accordance with the Coal Mines Regulation Act and Metalliferous Mines Regulation Act 1872. A maximum of 9 plan extents that intersect with the enquiry boundary will be included. This does not infer that the workings and/or mine entries shown on the abandonment plan will be relevant to the site/property boundary.

Outcrops

Details of seam outcrops will be included where the enquiry boundary intersects with a conjectured or actual seam outcrop location (derived by either the British Geological Survey or the Coal Authority) or intersects with a defined 50 metres buffer on the coal (dip) side of the outcrop. An indication of whether the Coal Authority believes the seam to be of sufficient thickness and/or quality to have been worked will also be included.

Geological faults, fissures and breaklines

Geological disturbances or fractures in the bedrock. Surface fault lines (British Geological Survey derived data) and fissures and breaklines (Coal Authority derived data) intersecting with the enquiry boundary will be included. In some circumstances faults, fissures or breaklines have been known to contribute to surface subsidence damage as a consequence of underground coal mining.

Opencast mines

Opencast coal sites from which coal has been removed in the past by opencast (surface) methods and where the enquiry boundary is within 500 metres of either the licence area, site boundary, excavation area (high wall) or coaling area.

Coal Authority managed tips

Locations of disused colliery tip sites owned and managed by the Coal Authority, located within 500 metres of the enquiry boundary.

Site investigations

Details of site investigations within 50 metres of the enquiry boundary where the Coal Authority has received information relating to coal mining risk investigation and/or remediation by third parties.

Remediated sites

Sites where the Coal Authority has undertaken remedial works either within or within 50 metres of the enquiry boundary following report of a hazard relating to coal mining under the Coal Authority's Emergency Surface Hazard Call Out procedures.

Coal mining subsidence

Details of alleged coal mining subsidence claims made since 31 October 1994 either within or within 50 metres of the enquiry boundary. Where the claim relates to the enquiry boundary confirmation of whether the claim was accepted, rejected or whether liability is still being determined will be given. Where the claim has been discharged, whether this was by repair, payment of compensation or a combination of both, the value of the claim, where known, will also be given.

Details of any current 'Stop Notice' deferring remedial works or repairs affecting the property/site, and if so the date of the notice.

Details of any request made to execute preventative works before coal is worked under section 33 of the Coal Mining Subsidence Act 1991. If yes, whether any person withheld consent or failed to comply with any request to execute preventative works.

Mine gas

Reports of alleged mine gas emissions received by the Coal Authority, either within or within 500 metres of the enquiry boundary that subsequently required investigation and action by the Coal Authority to mitigate the effects of the mine gas emission.

Mine water treatment schemes

Locations where the Coal Authority has constructed or operates assets that remove pollutants from mine water prior to the treated mine water being discharged into the receiving water body.

These schemes are part of the UK's strategy to meet the requirements of the Water Framework Directive. Schemes fall into 2 basic categories: Remedial – mitigating the impact of existing pollution or Preventative – preventing a future pollution incident.

Mine water treatment schemes generally consist of one or more primary settlement lagoons and one or more reed beds for secondary treatment. A small number are more specialised process treatment plants.

Future underground mining

Details of all planned underground mining relative to the enquiry boundary. Only those future workings where the enquiry boundary is within 0.7 times the depth of the workings (zone of likely physical influence) allowing for seam inclination will be included.

Coal mining licensing

Details of all licenses issued by the Coal Authority either within or within 200 metres of the enquiry boundary in relation to the under taking of surface coal mining, underground coal mining or underground coal gasification.

Court orders

Orders in respect of the working of coal under the Mines (Working Facilities and Support) Acts of 1923 and 1966 or any statutory modification or amendment thereof.

Section 46 notices

Notice of proposals relating to underground coal mining operations that have been given under section 46 of the Coal Mining Subsidence Act 1991.

Withdrawal of support notices

Published notices of entitlement to withdraw support and the date of the notice. Details of any revocation notice withdrawing the entitlement to withdraw support given under Section 41 of the Coal Industry Act 1994.

Payment to owners of former copyhold land

Relevant notices which may affect the property and any subsequent notice of retained interests in coal and coal mines, acceptance or rejection notices and whether any compensation has been paid to a claimant.

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VAT receipt

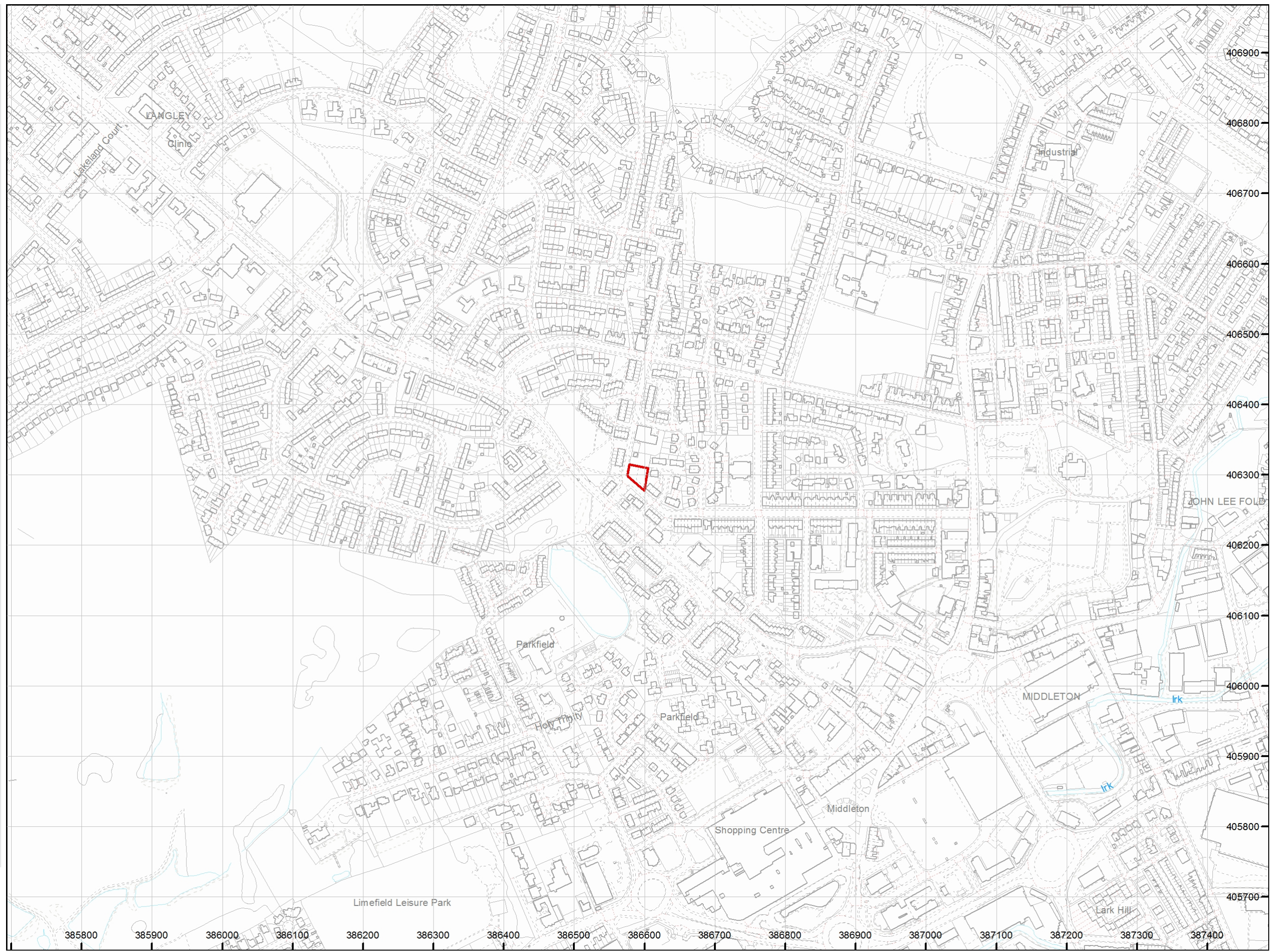
Issued by	The Coal Authority 200 Lichfield Lane Mansfield Nottinghamshire NG18 4RG
Tax point date	11 October 2019
Issued to	GEOINVESTIGATE TERRY DICKEN INDUSTRIAL ESTATE TERRY DICKEN INDUSTRIAL ESTATE, ELLERBECK WAY STOKESLEY NORTH YORKSHIRE TS9 7AE
Property search for	FORMER KINGS ARMS JOSEPH STREET MIDDLETON ROCHDALE M24 5SQ
Reference number	51002184490001
Date of issue	11 October 2019
Cost	£112.13
VAT @ 20%	£22.43
Total received	£134.56
VAT registration	598 5850 68

The map highlights any specific surface or subsurface features within or near to the boundary of the site.

Key

Approximate position of the enquiry boundary shown 

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+44 (0)1623 637 000 (International)
www.groundstability.com



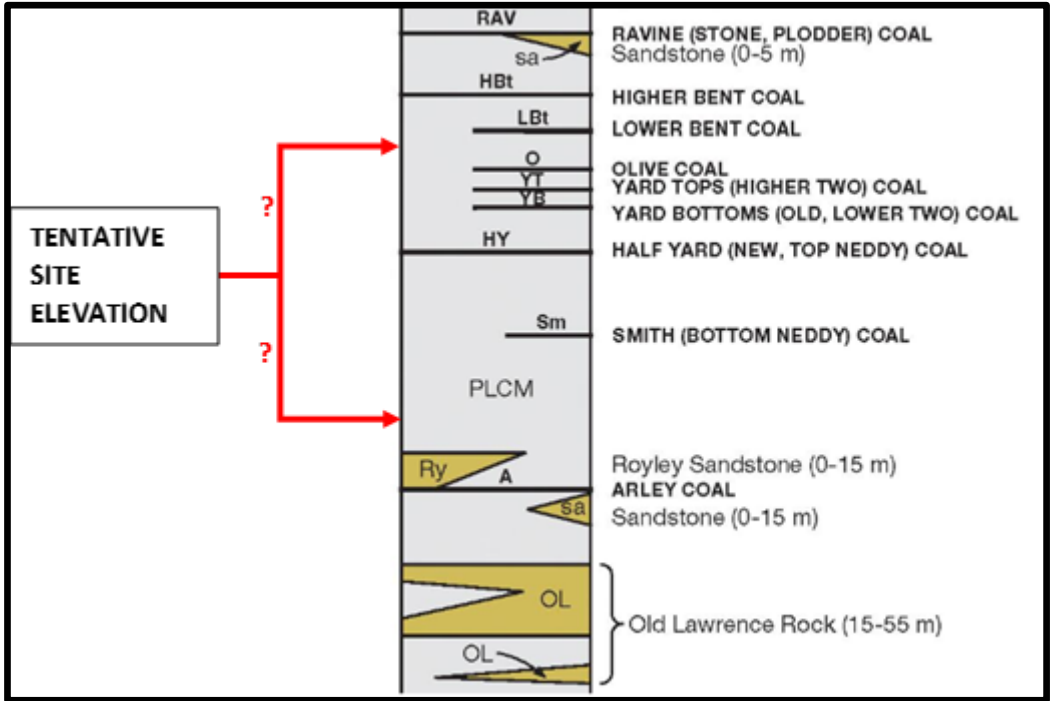
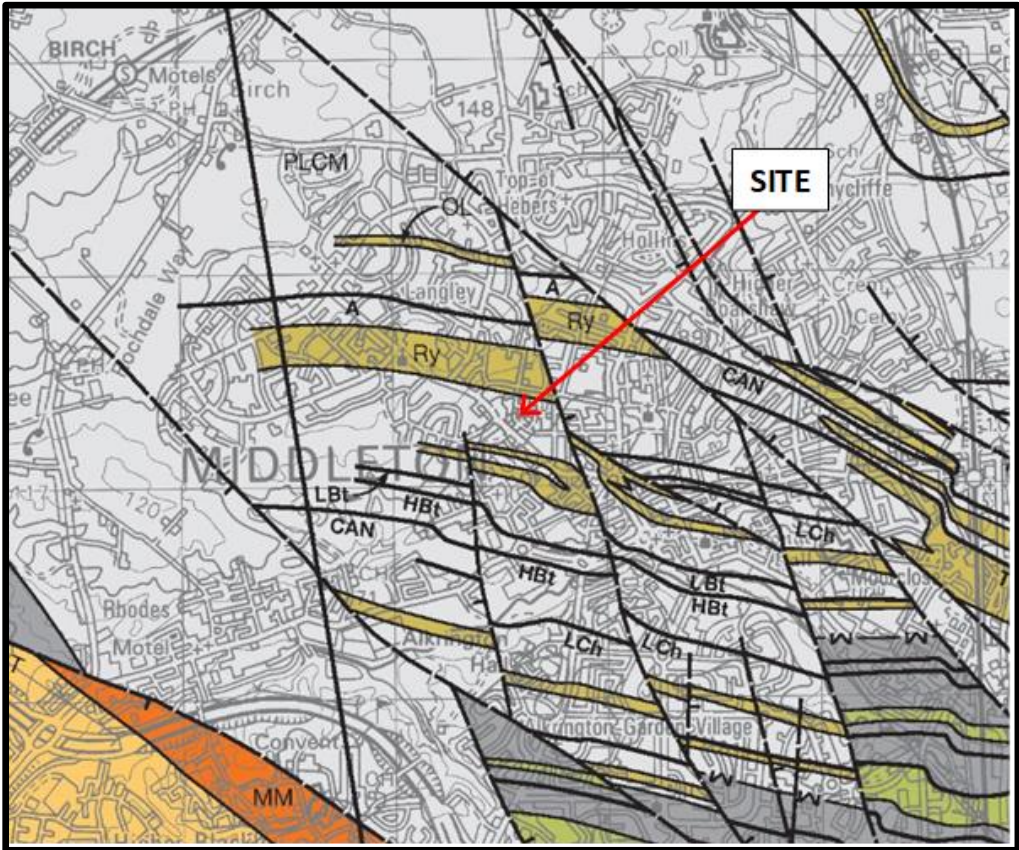
APPENDIX B SITE IMAGES





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APPENDIX D
EXTRACTS OF BGS GEOLOGY MAP



APPENDIX E

COAL GEOLOGY

