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GROUND INVESTIGATION REPORT

FOR
73 NEW STREET, CHELTENHAM, GL50 3ND

Report No. 5254

Report Production Record		
Report No	5254	
Site Name	73 New Street, Cheltenham, GL50 3ND	
Client	Cape Homes Limited	
Report on	Ground Investigation	
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Checked & Approved by	David J Wilson BSc(Geol) CGeol FGS	[redacted]

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GROUND INVESTIGATION REPORT FOR 73 NEW STREET, CHELTENHAM, GL50 3ND
PREPARED FOR CAPE HOMES LIMITED

1 INTRODUCTION

1.1 A commercial vehicle tyre stockist and fitting shop is planned to be demolished and developed into seven residential properties with associated gardens. A ground investigation was requested to assess site suitability in respect of its contamination status and geotechnical conditions for appropriate foundation, ground floor slab and external pavement design.

1.2 The geotechnical investigation has been carried out in general accordance with Eurocode 7 'Geotechnical Design', in particular BS EN 1997-1:2004 and 1997-2:2007 and BS EN ISO 14688-1:2002 and 14688-2:2004. The proposed development is considered to fall into the Geotechnical Category 2 classification, thus routine field and laboratory testing methods have been adopted. Reference has also been made to BS5930:2015 Code of Practice for Ground Investigations, and National House Building Council (NHBC) Standards Chapter 4.2 – 'Building Near Trees'.

1.3 The Geo-environmental assessment comprising Phase 1 desk study followed by Phase 2 testing and quantitative contamination risk assessment has been carried out in accordance with BS10175:2011 "Code of Practice for the Investigation of Potentially Contaminated Sites" and EA document LCRM "Land Contamination Risk Management" (2020).

1.4 This report has been prepared in accordance with emailed instruction received 8th November 2023, in acceptance of quote Q23225 of 1st September 2023, from Mark Holland of Cape Homes Ltd to whom reliance on the report is presently restricted.

2 SITE LOCATION AND DESCRIPTION

2.1 Centred on National Grid Reference 394380, 222730 the 0.086 hectare site is located approximately 0.5km northwest of the town centre as shown on drawing 5254/1.

2.2 It comprises an irregular but broadly rectangular shaped commercial tyre fitting centre at the intersection of Station Road and New Street. Beyond the site boundaries are existing commercial units to the north, east and to the south beyond New Street and residential properties to the southwest and west.

2.3 Topographic elevation data provided by the client suggests a general elevation of 58m above Ordnance Datum, with a very slight fall in ground level to the southwest.

3 DESK STUDY RESEARCHES

Recorded Geology

3.1 The geology of the site is shown on the 1:50,000 scale British Geological Survey (BGS) Sheet 216, the 1:10,000 scale BGS Sheet SO92SW and online. Mapping indicates the site to be underlain by Charmouth Mudstone Group (ChM) which typically comprises silty bluish grey mudstone, overlain by superficial Cheltenham Sand and Gravel (CHSG) comprising sands and gravels. An area of made ground is mapped on the 1:10,000 sheet c.40m to the southwest to a base level of 1.1-1.5mbgl. No geological faulting shown either inside or within likely influencing distance of the site.

Hydrogeology

3.2 The MAGIC website confirms that the ChM is classified as a “Secondary Undifferentiated” aquifer, which means the EA has not been able to characterise the rock due to the variable characteristics of the rock type. This Practices experience of the ChM is that it mostly characterises as unproductive strata due to negligible permeability. The CHSG is recorded as a ‘Secondary A’ aquifer, meaning that it contains permeable materials capable of supporting water supplies at a local rather than a strategic level. The site does not lie inside or within 2km of a groundwater Source Protection Zone (SPZ) and there are no known groundwater abstractions within potentially influencing distance.

3.3 Based upon the above information the site is considered to lie within an area of low sensitivity in terms of groundwater resources.

Hydrology

3.4 The site itself contains no ponds or watercourses. The River Chelt is c215m to the southwest. The site surface currently comprises a tyre fitting garage and car parking with no areas of soft landscaping. This would indicate that rainwater infiltration can be expected to be negligible, subject to natural permeability.

3.5 Based upon the above information the site is considered to lie within an area of low sensitivity in terms of controlled surface waters.

Site History

3.6 The history of the site has been deduced by inspection of historical Ordnance Survey maps dating back to 1887 together with historical aerial imagery provided as part of the online Google Earth mapping service, and a selection of relevant extracts is presented on drawing 5254/3. On and off-site points of interest that may affect or be affected by the proposed development have been summarised within Table 1 below.

TABLE 1: SUMMARY OF SITE HISTORY

Date (Source Map Scale)	On-Site Features	Off-Site Features	Potential Contaminants with Potential To affect Site	Likelihood of Site Impact
1887 (1:2,500 and 1:10,560)	A row of terraced houses with associated gardens	0m W & N – Residential Estate 10m SW – Coal Depot 0mE - School	Toxic and phytotoxic metals, polyaromatic hydrocarbons (PAH)	Low
1923 (1:2,500 and 1:10,560)	No significant change	55m SE – Timber Yard 60m E – Stone Yard	As above	Low
1932 (1:2,500 and (1:10,560)	No significant change	No significant change	As above	Low
1954-55 (1:2,500)	Knapp Cottages remain at southern end but those across northern end cleared	38m NE – Engineering Works 55m SE – Timber Yard is now houses 60m E – Stone Yard is now a school	As above	Low

Date (Source Map Scale)	On-Site Features	Off-Site Features	Potential Contaminants with Potential To affect Site	Likelihood of Site Impact
1963-91 (1:2,500)	The northern end mapped as a warehouse with associated car parking to south	10mE Coal yard	As above plus possible asbestos containing materials used in construction of warehouse	Low
1974-82 (1:2,500)	No significant change	0m N – Works 10m SE – Coal Yard is now a builders' yard 10m S – Electrical Substation 95m SE – Electrical Sub Station 10m S- Coal depot is now mapped as a scrap metal yard	As above and possible PCBs from electrical substation but groundwater flow is away from the site	Low
1978 – 1988 (1:2,500)	No significant change	No significant change	As above	Low
1994 (1:2,500)	No significant change	No significant change	As above	Low
1999 (Google Earth/Aerial Photo Mapping)	No significant change	10m E – Fencing business 10mS – Car Park	As above	Low
Present day (Google Earth/Aerial Photo Mapping and site walkover)	No significant change	5m N – Vehicle Maintenance Garage	Possible hydrocarbon leaching if underground tanks present (none recorded)	Low

3.7 Please note that Ordnance Survey plans only represent periodic snapshots in time and do not provide a continuous record of previous site usage, thus there is a risk that the site may contain buried remnant foundations of former buildings or waste products associated with previous site usage, which may not be evident from the site walkover inspection and desk study researches.

Landfill Gas and Radon Gas

3.8 A historical landfill is mapped 115m to the southwest, recorded as St James Car Park which has been a large supermarket since c2006 and a car park prior to that since c1999. The southern area of the present day supermarket was likely filled after ceasing use as a commercial coal yard/scrap yard between 1982 and 1999. The age of this infill could be up to 40 years (which implies that such features ought to by now be no longer gassing).

3.9 According to Health Security Agency/BRE records the site lies in an area in which 3-5% of homes lie above the action level, suggesting that basic radon protection measures are required at this site.

Unexploded Ordnance Risk

3.10 An online review of regional unexploded bomb data on the Zetica website indicates that the Cheltenham area of Gloucestershire is considered to constitute a moderate risk (between 11 and 50 bombs per 1000 acres) and for which you may wish to consider acquiring a more detailed risk assessment.

Surrounding Land Use

3.11 There are no recorded significant pollution incidents inside or within potential influencing distance of the site and there is no evidence to suggest that the site has previously or currently contains any underground fuel storage tanks. Further research confirms that the site does not lie within or near any environmentally sensitive or designated areas such as a Special Area of Conservation, Site of Special Scientific Interest, Nature Reserve or Ramsar site. There is a Vehicle Maintenance Garage 5m to the north of the site however there are no underground tanks and the facility looks in good condition with intact/uncracked hardstanding.

Previous Investigations

3.12 This Practice has not previously investigated within the current site of interest, however an investigation has been undertaken circa 200m to the east. Those works encountered a ground profile consisting of a variable depth of made ground over orange-brown, fine-to medium grained quartzose sand, representing the recorded Cheltenham Sand (CHSG) to at least 1.2m depth.

4 PROPOSED DEVELOPMENT

4.1 It is proposed to develop the site with seven two-storey residential dwellings. External to the unit will be associated hardstand parking on the northern four plots and garden areas at all properties. The proposed development layout is shown on drawing 5254/2.

5 PRELIMINARY RISK ASSESSMENT AND CONCEPTUAL SITE MODEL

5.1 The site and its immediate surroundings have been assessed in terms of current and historical land use and the environmental, geological and hydrogeological setting; the methodology is described in Appendix 3. Given the proposed residential development the **critical receptor** is a female child (age class 6).

5.2 Historical mapping suggests the site was residential from earliest mapping in 1887 changing land use to a warehouse in 1963 onwards. The current operations of adjacent vehicle maintenance garage are not thought to pose a risk to the current site of interest considering there are no underground tanks or damaged hardstanding. The recorded historical landfill 110mS has been discounted as a potential source given that BGS borehole data shows that the made ground is brick fill.

5.3 In view of the foregoing the potential sources and the **principal contaminants of concern** are presented in Table 2 below.

TABLE 2: POTENTIAL SOURCES AND PRINCIPAL CONTAMINANTS OF CONCERN

	Potential Sources	Principal Contaminants of Concern
ON-SITE	Made Ground	Toxic and phytotoxic metals, petroleum & polyaromatic hydrocarbons (TPH/PAH), asbestos
OFF-SITE	None	N/A

5.4 The above information is converted into the preliminary Conceptual Site Model shown in Figure 1 below, and the **potential pollutant linkages** involving future site users, proposed services and local environmental receptors are discussed in Table 3, with appropriate risk levels:

FIGURE 1: PRELIMINARY CONCEPTUAL SITE MODEL (NTS)

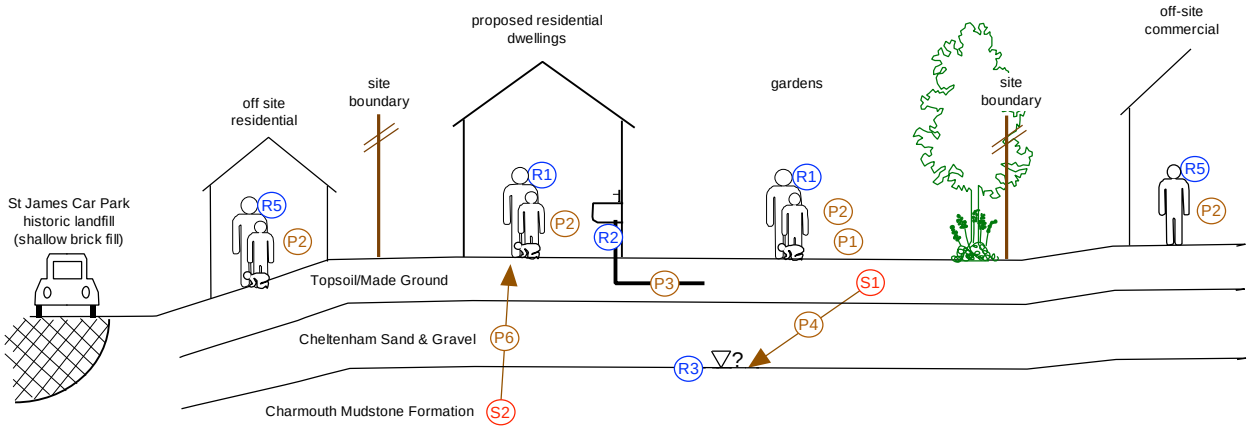


TABLE 3: SUMMARY OF PRELIMINARY POTENTIAL POLLUTANT LINKAGES

Potential Sources	Pathways	Receptors R1	R2	R3	R4	R5	Comments	Preliminary Risk Assessment
ON-SITE								
S1	P1	X					Site has been redeveloped from residential to commercial warehouse therefore shallow made ground is likely	Low
	P2	X						
	P3		X					
	P4			X				
	P5							
	P6							
S2	P1						The site lies in an area in which 3-5% of homes lie above the action level	Low/Medium
	P2							
	P3							
	P4							
	P5							
	P6	X						
OFF-SITE								
None							N/A	Negligible

SOURCES	**S1**	Localised made ground
	S2	Natural radon gas emissions from the bedrock
PATHWAYS	**P1**	Direct dermal contact or ingestion of soil

	P2	Inhalation of dust and vapours
	P3	Permeation into new water supply pipework
	P4	Vertical leaching of leachable contaminants in unsaturated zone and lateral migration in saturated zone
	P5	Landfill gas migration through unsaturated zone and accumulation within confined spaces
	P6	Radon gas migration through unsaturated zone and accumulation within confined spaces
RECEPTORS	R1	Future site users (critical receptor is residential female child age class 6)
	R2	Potable water supply
	R3	Groundwater (CHSG is a Secondary A aquifer, ChM is a Secondary Undifferentiated aquifer)
	R4	Surface waters (River Chelt is c215m to the southwest)
	R5	Adjacent site users (Residential/Commercial)

5.5 A routine 'due diligence' contamination assessment has been undertaken, the results of which are reported below. All contamination test results have been incorporated into an appropriate quantitative risk assessment to determine risk levels to the obvious receptors in the form of future site users and groundwater quality, as well as those less obvious such as the proposed buildings and infrastructure, such that any necessary remedial measures can be identified and recommended to ensure that the developed site will be "fit for purpose".

6 GROUND INVESTIGATION REPORT

Site Works

6.1 The Phase 2 intrusive investigation took place on 7th December 2023 by a combination of windowless sample borehole drilling and hand pitting. Borehole positions were selected by this Practice with targeted positions selected to acquire coverage around the proposed building footprint whilst hand pits were representative of garden locations. Positions were subsequently marked out on site (again by this Practice) and these are indicated on the proposed development layout drawing 5254/2. All available service plans were reviewed and as an added precaution a CAT electrical service scanner was deployed at surface. As agreed with the client on site, inspection pits were manually excavated prior to the intrusive drilling works. No services (recorded or unrecorded) were physically encountered during the intrusive works.

6.2 A total of three small diameter windowless sampling boreholes (WS1-3) were drilled to depths of 3.0-5.0m using an Archway Competitor Dart window-sampling rig. The

boreholes were logged on-site in accordance with Eurocode 7 (BS EN ISO 14688-1:2002 and 14688-2:2004) by a suitably qualified engineer from this Practice, and representative disturbed samples taken for geotechnical and contamination testing as appropriate. In-situ standard/cone penetration tests (SPT-C) were completed at 1.0m depth intervals in accordance with BS EN ISO 22476-3:2005 to assess the relative density of the material penetrated and these results are indicated on the respective logs in Appendix 2.

6.3 The above was supplemented with two hand pit excavations to between 1.05m to 1.20m depth in areas of proposed gardens. These were logged by a qualified engineer from this Practice and representative disturbed samples taken for contamination testing as appropriate.

Laboratory Testing - Geotechnical

6.4 A number of disturbed samples were taken for routine geotechnical classification testing, comprising moisture content, PSD grading of the CHSG sand and a single plasticity determination of the ChM clay at depth, along with classification to the Unified Soil Classification Scheme (USCS) and NHBC Standards, plus acidity and sulphate analysis to BRE Special Digest 1 requirements. Results are tabulated below.

TABLE 4: INDEX TEST RESULTS AND CLASSIFICATION

BH No	Depth (m)	Sample of	Moisture Content (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Plasticity / USCS	Consistency Index	<425µm (%)	Modified Plasticity Index (%)	Volume Change Potential (NHBC)
WS3	3.00	ChM	22	50	19	31	CM/CH	0.90	100	31	Medium

ChM = Charmouth Mudstone Group

TABLE 5: CHEMICAL TEST RESULTS AND CLASSIFICATION

BH No.	Depth (m)	Sample of	Total sulphate SO_4 (%)	Total sulphur (%)	Total potential sulphate SO_4 (%)	pH value in soil	Water soluble sulphate SO_4 (mg/l)	Design sulphate class	Aggressive chemical concrete class
WS1	1.0	ChSG	0.014	0.008	0.024	8.1	20.3	DS-1	AC-1
WS1	2.0	ChSG	0.019	0.01	0.03	8.6	24	DS-1	AC-1
WS2	0.5	ChSG	0.022	0.013	0.039	7.8	26.1	DS-1	AC-1
WS2	4.0	ChM	0.038	0.963	2.889	9.2	180	DS-4	AC-4

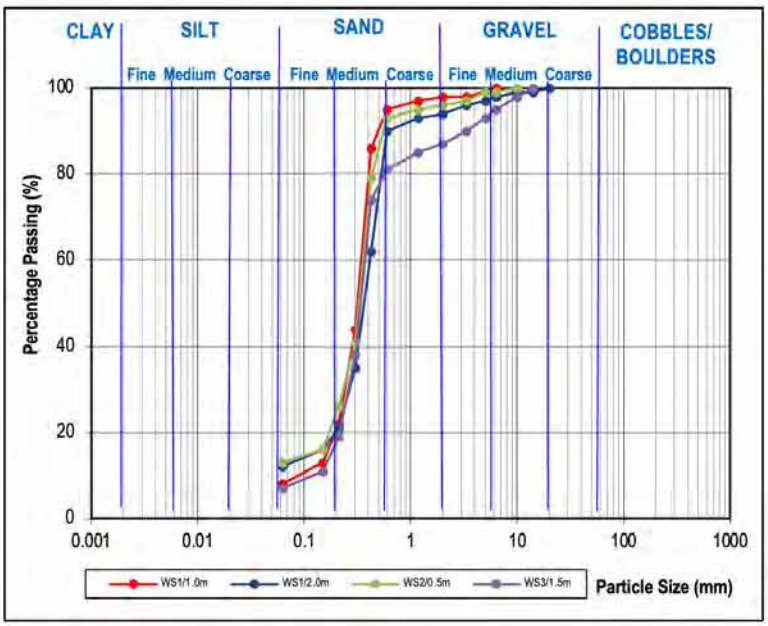
BH No.	Depth (m)	Sample of	Total sulphate SO_4 (%)	Total sulphur (%)	Total potential sulphate SO_4 (%)	pH value in soil	Water soluble sulphate SO_4 (mg/l)	Design sulphate class	Aggressive chemical concrete class
WS3	1.5	ChSG	0.03	0.017	0.051	9.0	15.5	DS-1	AC-1
WS3	3.0	ChM	0.116	1.23	3.69	8.5	186	DS-4	AC-4

ChSG = Cheltenham Sand & Gravel *ChM = Charmouth Mudstone Group*

TABLE 6: PARTICLE SIZE DISTRIBUTION ANALYSIS RESULTS

Sample Ref	Depth (m)	Sample Composition (%)			Classification (as per EN ISO 14688-2:2004)
		Gravel	Sand	Fines	
WS1	1.0	2	90	8	Slightly silty fine to coarse SAND
WS1	2.0	6	82	12	Slightly silty fine to coarse SAND
WS2	0.5	4	83	13	Slightly silty fine to coarse SAND
WS3	1.5	13	80	7	Slightly silty, gravelly fine to coarse SAND

FIGURE 2: PARTICLE SIZE DISTRIBUTION CURVES



Laboratory Testing - Contamination

6.5 The contamination sampling scheme was conducted in accordance with BS10175:2011. Three 'due diligence' samples were taken from the upper 1.2m of

extracted ground. Those soils to be scheduled for organic analysis were sealed within opaque amber glass jars to prevent loss of any volatiles during transit, whilst those for inorganic testing were placed in plastic tubs, all with chain of custody labelling. All soils were sent to UKAS accredited I2 laboratories under chain of custody labelling where analysis selectively comprised the following:

Toxic and phytotoxic metals

pH

Total petroleum hydrocarbons Banded C6-C40 (TPH)

Speciated polyaromatic hydrocarbons (PAH)

Soil organic matter content

Asbestos screen and identification

6.6 Additionally given that the CHSG is classed as a Secondary A Aquifer, leachate testing was undertaken to assess any potential risk from the made ground encountered.

6.7 The certified laboratory test results are presented as Appendix 3 and for convenience these have also been summarised to facilitate comparison against assessment criteria. All results and their implications upon the preliminary CSM are further discussed in Sections 8 and 9.

Discussion on Ground Conditions

6.8 Ground conditions appear to be commensurate with geological mapping and previous findings. Beneath a nominal surface mantle of topsoil/made ground and superficial Cheltenham Sand and Gravel, all boreholes encountered undisturbed clay to termination, representing the recorded Charmouth Mudstone Formation. A summary of the observed strata is presented in Table 7 below.

TABLE 7: SUMMARY OF OBSERVED STRATA

Stratum	Base Depth (m)	Notes
MADE GROUND: concrete/tarmac handstand layer	0.1 – 0.3	Encountered in all boreholes (concrete internally and tarmac externally) & trail pits
MADE GROUND: loose yellow brown gravel of subrounded to subangular fine to coarse oolitic limestone, quartzite and localised brick and concrete. Oolitic limestone cobbles at base.	0.3-0.65	Encountered in all boreholes/trial pits
SAND: loose to medium dense, mid brown becoming orange brown *(CHELTENHAM SAND & GRAVEL)*	2.9-4.65	Encountered in all boreholes/trial pits
MUDSTONE: extremely weak, bluish grey silty *(CHARMOUTH MUDSTONE FORMATION)*	>5.45	Encountered to terminal depth in WS1-WS3
Perched/Groundwater	WS1 – Groundwater encountered at 4.0m WS2 – Dry WS3 – 4.0m (strike) 2.9m (standing) HP1-2 - Dry	
Roots / Desiccation	No Live roots – No desiccation in any Borehole/Hand Pit	

6.9 Based upon on-site visual and olfactory examination of the subsoil there was nothing to suggest the presence of obviously significantly contaminated subsoil.

6.10 PSD classification confirms consistent granular non-cohesive sand deposits to >2.9mbgl across the site. The underlying ChM was identified as a cohesive deposit, classified by index testing as inorganic clay of medium/high plasticity and medium volume change potential in accordance with NHBC Standards. The Consistency index (CI) value of 0.90 suggests that the clay (at depth) is not desiccated.

6.11 Water was encountered in WS1 and WS3 only. It was struck at c4.0m and was monitored at a standing depth of 2.9m depth in WS3 (on top of the clay). The groundwater level is of course subject to seasonal fluctuation according to prevailing weather conditions, and the situation encountered and described above could potentially change in the future, especially in a period of seemingly ever-apparent but unpredictable climate change.

Soakaway Feasibility

6.12 Soakaway testing was not requested however given the thickness of sand and subject to the results of insitu testing a soakaway SuDS drainage system may potentially be suitable.

7 GEOTECHNICAL DESIGN REPORT

7.1 The investigation has proven ground conditions beneath the site to be in accordance with recorded mapping. Beneath a thin surface mantle of topsoil and made ground a variable thickness of dense superficial Cheltenham Sand and Gravel (varying with topography) was encountered over bedrock of the recorded Charmouth Mudstone Formation. On the assumption that standard strip footings are the preferred foundation, based on the ground conditions encountered and the assumed loading for a two-storey residential property as 45kN/m^2, the following foundation recommendations have been made.

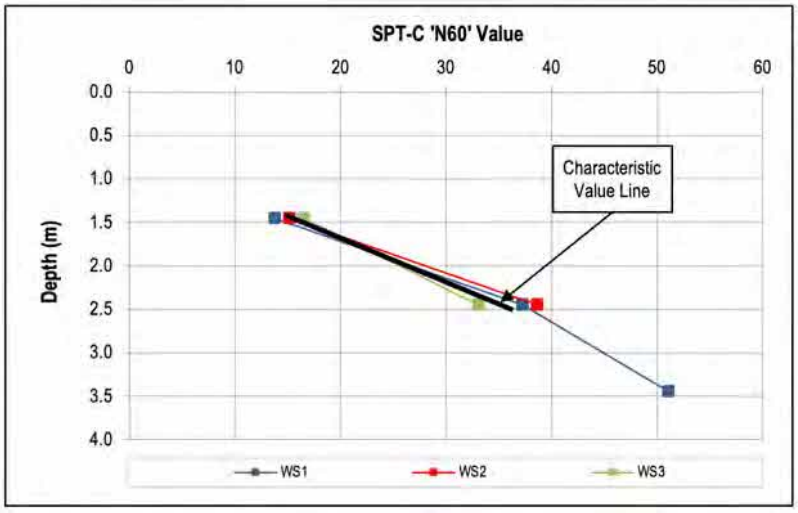
Foundation Design

7.2 Corrected SPT-C N_{60} data has been plotted in Fig. 2. The granular soils of the CHSG from 1.45mbgl are considered a suitable material to found on. Given the SPT data using a characteristic value at 1.45mbgl a bearing resistance of 160kN/m^2 compared to a (presumed) design load of 60kN/m^2 should be more than sufficient. Although in-situ SPT testing only commenced below 1.0m the sand is logged as medium dense from 0.7mbgl, and which depth an approximate bearing resistance of 155kN/m^2 compared to a design load of 53kN/m^2 should also be sufficient for traditional 450mm or 600m strip/trench fill.

7.3 No further deepening in respect to trees is required due to the non-cohesive nature of the founding strata.

7.4 Given the granular nature of the shallow soils heave protection ought not to be necessary. Ground bearing floor slabs may be suitable provided that once existing made ground is removed the replacement compacted selected granular fill is <0.6m thick, otherwise suspended slabs are advised.

FIGURE 3: SPT-C 'N60' VALUES -v- DEPTH



7.5 Based on the results of acidity and sulphate testing presented in Table 4 it is recommended that buried concrete associated with foundations penetrating into the CHSG be designed to Design Sulphate Class DS-1 and Aggressive Chemical Environment for Concrete Class ACEC-1, i.e. no special sulphate protection measures required in accordance with BRE Special Digest 1 (2005). This is sufficient as long as they don't come into contact with ChM arisings from depth (DS4, AC-4).

7.6 Groundwater has been identified below the site at c2.9mbgl, which given the above should be at sufficient depth to not be considered an issue for the foundation excavations. As always it is recommended that any excavations are not left open and unsupported for any longer than necessary and if encountered water should not be permitted to sit on the foundation base to avoid potential softening. As always groundwater levels may vary seasonally, and water may therefore be encountered at levels in variance to those recorded by this investigation.

Pavement Design

7.7 Based on empirical data for medium dense granular strata a preliminary CBR value of approximately 20% might be achievable. It is recommended that insitu CBR testing is undertaken closer to the time of construction to obtain a more accurate bearing ratio and it should be noted that CBR value can vary seasonally. The subsoil is not considered to be frost-susceptible, however the Local Authority should be able to advise based upon their previous experience in the area.

Recommendations for Monitoring of Ground Conditions During Construction

7.8 In view of the importance of founding on natural ground, a careful watch must be maintained during all foundation excavations to ensure that this requirement has been satisfied.

7.9 In the event of any doubt in the above matters, this Practice would be pleased to attend site as instructed.

8 CONTAMINATION RISK ASSESSMENT

Human Health

8.1 The contamination risk assessment has been carried out in general accordance with the methodology described within Appendix 3. Testing has included samples of the near-surface topsoil, made ground and natural soil to assess their suitability for retention within a proposed development. Tier 1 risk modelling has adopted the **'Residential with plant uptake'** land use scenario and for which the 'critical receptor' is taken as a female child of age class 6. Basic desk study researches suggested that the site poses a low risk to a proposed residential development, however, the garden areas were specifically targeted with two hand pit locations along with a spread of sampling across the rest of the site.

8.2 Disturbed samples were taken for laboratory contamination testing as previously detailed in Section 6.5. Whilst these results are presented in full in Appendix 3, for ease of reference Table 8 below provides a summary of the maximum measured concentration of each determinant against respective Tier 1 GAC.

TABLE 8: COMPARISON OF SOIL CHEMICAL TEST RESULTS WITH GUIDELINE VALUES

Determinand	Maximum Measured Concentration (mg/kg)	LQM/CIEH S4UL Residential land without home grown produce (mg/kg) $	Tests Undertaken (No.)	Exceedances (No.)	Notes
Arsenic	30	37	6	0	
Cadmium	1.5	11	6	0	
Chromium III	17	910	6	0	

Determinand	Maximum Measured Concentration (mg/kg)	LQM/CIEH S4UL Residential land without home grown produce (mg/kg) $	Tests Undertaken (No.)	Exceedances (No.)	Notes
Chromium VI	<1.2	6	6	0	
Lead	220	200*	6	1/6	**HP2 – 0.40-0.65 only**
Mercury	1.5	40	6	0	
Selenium	<1.0	250	6	0	
Nickel	22	130	6	0	
Copper	74	2400	6	0	
Zinc	410	3700	6	0	
All speciated PAH determinands	All below <LOD or <<S4UL	Various	6	0/3	
All BTEX compounds	All below <LOD or <<S4UL	Various	1	0/1	
All other TPH bands	All below <LOD or <<S4UL	Various	6	0/6	
Asbestos	0.004%	0.001%	4	1/4	**HP1 0.40-0.50 only**
Notes:					
* C4SL used in absence of S4UL					
$ based on soil organic matter = 1%					
ND = None Detected					

8.3 The findings presented in Table 7 indicate that there was a single elevation of lead in HP2, and a single record of asbestos identified in HP1 (0.004%). There are no other exceedances recorded. Since both exceedances are located in the shallow made ground of the proposed garden areas, this is considered a significant risk to the health of future site users. While the asbestos identification could represent a localised hot spot this cannot be confirmed without further investigation.

Water Supply Pipework

8.4 In addition to the above, consideration has been given to the potential effects of recorded concentrations on new water utility pipework. Given the negligible perceived risk from volatile organic contaminants there ought to be no requirement for upgraded barrier pipework. As always it is recommended that advice be sought from the local regulatory authority prior to ordering pipework, since it is possible that their specific in-house thresholds may differ markedly from those within the most recent guidance by UK Water Industry Research (UKWIR) report “Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites” (2010).

Landfill Gas and Radon Gas

8.5 There is no requirement for landfill gas protection measures, however basic radon protection measures are required in the new development at this site.

Controlled Waters

8.6 Given that the groundwater was monitored at a standing depth of 2.9m, it is not thought that any shallow Made Ground is in hydraulic conductivity with the underlying aquifer. Additionally, leachable contaminants in the Made Ground are limited to a slight arsenic elevation in respect to WFD (Groundwater) acceptance criteria. On this basis it is considered that the site does not pose a significant risk to controlled waters or groundwater resources and pre-construction remedial action is not currently considered necessary.

Waste Classification for Off-site Disposal of Arisings

8.7 In accordance with current legislation all soil arisings generated for disposal as part of this development site are by definition a “commercial waste” and will be classified as both a directive and controlled waste. In view of the proposed construction and hence likely derivative of excavated arisings for off-site disposal, then as per the European Waste Catalogue (EWC) such material will be coded 1705, that is “soil (including excavated soil from contaminated sites), stones and dredging spoil”.

8.8 A WAC test was not undertaken as part of the investigation. If one is required to advise the disposal of made ground/shallow natural soils then this practice would be happy to carry out further sampling to give to the landfill operator.

Caveats

8.9 In line with best industry practice the scope of contamination testing has been based upon the site history, current land usage and actual findings, with reference where necessary to DoE Industry Profiles and DEFRA/EA guidance. To the best of our knowledge information concerning the land quality assessment is accurate at the date of issue, however subsurface conditions including ground contamination may vary spatially and with time. There may be conditions pertaining to the site not disclosed by the above sources of information, which might have a bearing upon the

recommendations made, were such conditions known. We have however used our professional judgement in order to limit this during the investigation.

8.10 The conclusions and recommendations made in respect of land quality do not address any potential risks to site operatives or ground workers during the construction stage. These issues should be addressed by the Principal Contractor in accordance with the relevant statutory procedures and regulations (CDM Regulations 2015).

8.11 It is important that these limitations be clearly recognised when the findings and recommendations of this report are being interpreted. Additional assessment may be necessary should a significant delay occur between report date and implementation of the proposed scheme to which it relates.

9 REFINED CONCEPTUAL SITE MODEL

9.1 In view of the above discussions the preliminary conceptual site model has been refined as shown in Figure 4 and Table 9 below.

FIGURE 4: REFINED CONCEPTUAL SITE MODEL (NTS)

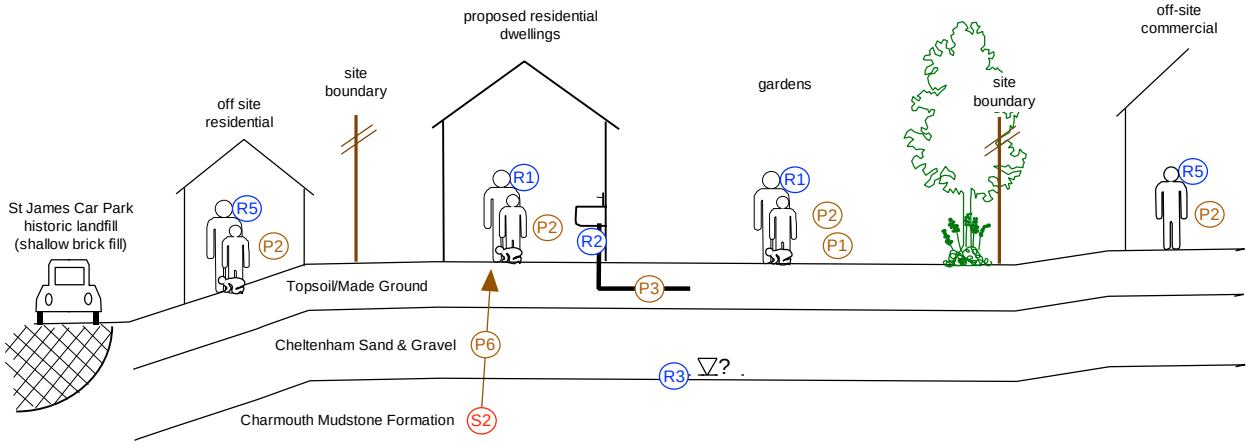


TABLE 9: SUMMARY OF POTENTIAL / IDENTIFIED POLLUTANT LINKAGES

Potential Sources	Pathways	Receptors R1	R2	R3	R4	R5	Comments	Refined Risk Rating	Remedial/Mitigation Requirements
ON-SITE									
S1	P1	X					Localised elevations of **asbestos** and **lead** were identified in the proposed garden areas	High	The shallow made ground in the garden areas to 0.65mbgl should be removed and replaced with clean subsoil and top soil.
	P2	X							
	P3		X						
	P4			X					
	P5								
	P6								
S2	P1						The site lies in an area in which 3-5% of homes lie above the action level	Low/Medium	Basic Radon Protection Required
	P2								
	P3								
	P4								
	P5								
	P6	X							
OFF-SITE									
None							N/A	Negligible	None

SOURCES	S1	Localised made ground
	S2	Natural radon gas emissions from the bedrock
PATHWAYS	P1	Direct dermal contact or ingestion of soil
	P2	Inhalation of dust and vapours
	P3	Permeation into new water supply pipework
	P4	Vertical leaching of leachable contaminants in unsaturated zone and lateral migration in saturated zone
	P5	Landfill gas migration through unsaturated zone and accumulation within confined spaces
	P6	Radon gas migration through unsaturated zone and accumulation within confined spaces
RECEPTORS	R1	Future site users (critical receptor is residential female child age class 6)
	R2	Potable water supply
	R3	Groundwater (CHSG is a Secondary A aquifer, ChM is a Secondary Undifferentiated aquifer)
	R4	Surface waters (River Chelt is c215m to the southwest)
	R5	Adjacent site users (Residential/Commercial)

10 CONCLUSIONS AND RECOMMENDATIONS

10.1 The foregoing discussions and recommendations are based upon the findings of a desk study followed by intrusive ground investigation comprising boreholes and hand pits plus laboratory geotechnical and contamination testing. The boreholes/hand pits appear to present a relatively consistent pattern of subsoil conditions concordant with recorded geological mapping. The soils comprised a generally nominal surface mantle hardstand/made ground (but locally to 0.65mbgl under the tyre warehouse concrete slab) was recorded a substantial sand layer representing the superficial Cheltenham Sand and Gravel (to 2.9-4.65mbgl). Plastic clay of the Charmouth Mudstone Formation was encountered at depth in all boreholes. As always however a careful watch should be maintained for any anomalous conditions during site stripping and excavation, which should be reported back to this Practice for further investigation and assessment.

10.2 Some instability of the superficial sand was found at depth (below water table). Boreholes generally remained stable during the works. The short-term stability of side walls within open excavations for foundations and services is unlikely to be an issue during construction. As always perched and groundwater levels do vary seasonally and care should be taken if development is proposed during traditionally wetter winter months, as a high-water table may then result in an adverse effect upon short-term side wall stability.

10.3 Traditional strip/trench fill foundations will need to penetrate near surface disturbed and soft ground to found within normally hydrated soil of the undisturbed CHSG at a minimum depth of 0.7mbgl. As the subsoil is granular and non-shrinkable heave protection ought not to be necessary (subject to confirmation by the Building Control Officer at the time of construction). Ground bearing floor slabs might be suitable if the compacted selected granular fill (once existing made ground has been removed) is <0.6m thick, otherwise suspended slabs are advised.

10.4 Buried concrete for foundations penetrating into the CHSG will need to be designed to DS-1/AC-1. This will be sufficient unless the concrete is in contact with the clay of the ChM in which case DS/AC-4 design specification should be used.

10.5 In terms of proposed external pavement design, near surface sand is medium-dense granular material present at/below the presumed 0.5m formation level and basic empirical observations suggests that initial design could be based on a CBR value of

20%. This soil is unlikely to be frost susceptible. As always we recommend that in-situ tests be undertaken closer to the time of construction once the final development layout is confirmed, since CBR can vary seasonably.

10.6 The CHSG is a granular deposit and considered to be of sufficient thickness across the majority of the site to be considered suitable for water attenuation. This practice could help with soakaway testing if required.

10.7 A detailed contamination risk assessment has identified two localised exceedances within Made Ground beneath the concrete slab presumably related to the demo waste used as a base layer for the slab. Considering that the gardens are of relatively small area, it would seem prudent to remove the entirety of the made ground in this vicinity and export it off site rather than recommend more sampling to delimit the asbestos hot spot. The made ground at this location would not be suitable to remain on site. Assuming current ground levels are being retained, it would be recommended that remediation of the Made Ground be focused to the areas where a future pathway exists i.e. in the proposed garden and areas of soft landscaping. It would be recommended that the garden areas would be excavated to <0.65mbgl i.e. onto the undisturbed natural CHSG sand and replaced with clean sub-soil and topsoil. This Practice would be happy to assist with appropriate validation works, however given the wording of Condition 5 within planning consent a formal Remediation Strategy will first be needed for submission to and approval by the LPA.

10.8 There is no requirement for landfill gas protection measures however basic radon protection measures are required in the new development at this site.

10.9 Waste Acceptance Criteria (WAC) testing was not requested as part of the investigation but we would be happy to carry out WAC testing to aid disposal of arisings.

10.10 Given the age of the present building, a full pre-demolition survey would be recommended to identify any asbestos containing materials to aid their removal prior to demolition.

10.11 Should planning consent be subject to certain conditions, this report and attachments should be lodged with the local planning authority, such that they can update their records.

10.12 The above recommendations must not be used in respect of any development differing in any way from the proposals described in this report, without reference back to this Practice or to another geotechnical/geo-environmental specialist. This report is subject to our standard terms and conditions.

11 REFERENCES

Geotechnical

BS EN 1997-1:2004 'Geotechnical Design - *General Rules'*

BS EN 1997-2:2007 'Geotechnical Design - *Ground Investigation and Testing'*

British Standards Institute, BS5930:2015 '*Code of Practice for Ground Investigations*'

National House Building Council (NHBC) Standards: Chapter 4.2 '*Building Near Trees*'

BS EN 14688: *'Geotechnical Investigation and Testing - Identification and Classification of Soil Part 1 Identification and Description*' (2002)

BS EN 14688: *'Geotechnical Investigation and Testing - Identification and Classification of Soil Part 2 Principles for a Classification'* (2004)

BS EN 14689: *'Geotechnical Investigation and Testing - Identification and Classification of Rock Part 1 Identification and Description*' (2003)

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CIRIA C735:2014 *'Good Practice on the Testing and Verification of Protection Systems for Buildings Against Hazardous Ground Gases'*

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UK Health Secuity Agency (HPA-RPD-033): Indicative atlas of radon in England and Wales (2007)

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The Water Supply (Water Quality) Regulations 2000 (Amendment) Regulations (2007)

UK Water Industry Research Limited (UKWIR). *'Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites' (2010)*

Technical Guidance Waste Management 3 (TGWM3, EA Version 1.2, October 2021)

Building Research Establishment (BRE)- *'Cover Systems for Land Regeneration'* (2004)

Landmark Historical Plans (ref 25753181_1_1, dated July 2008)

MAGIC (www.magic-defra.co.uk)

Zetica (www.zetica.com)

Google Earth (current and historical aerial mapping plus street view)

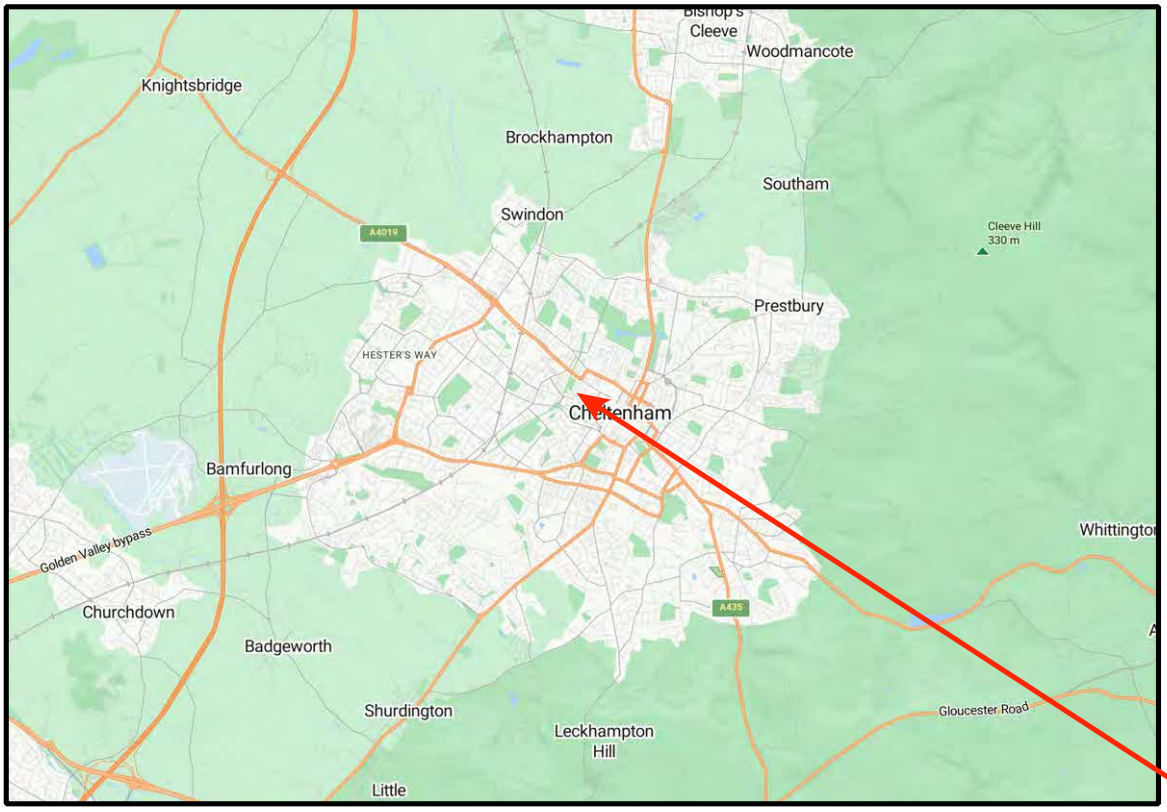
UK Grid Reference Finder (www.gridreferencefinder.com)

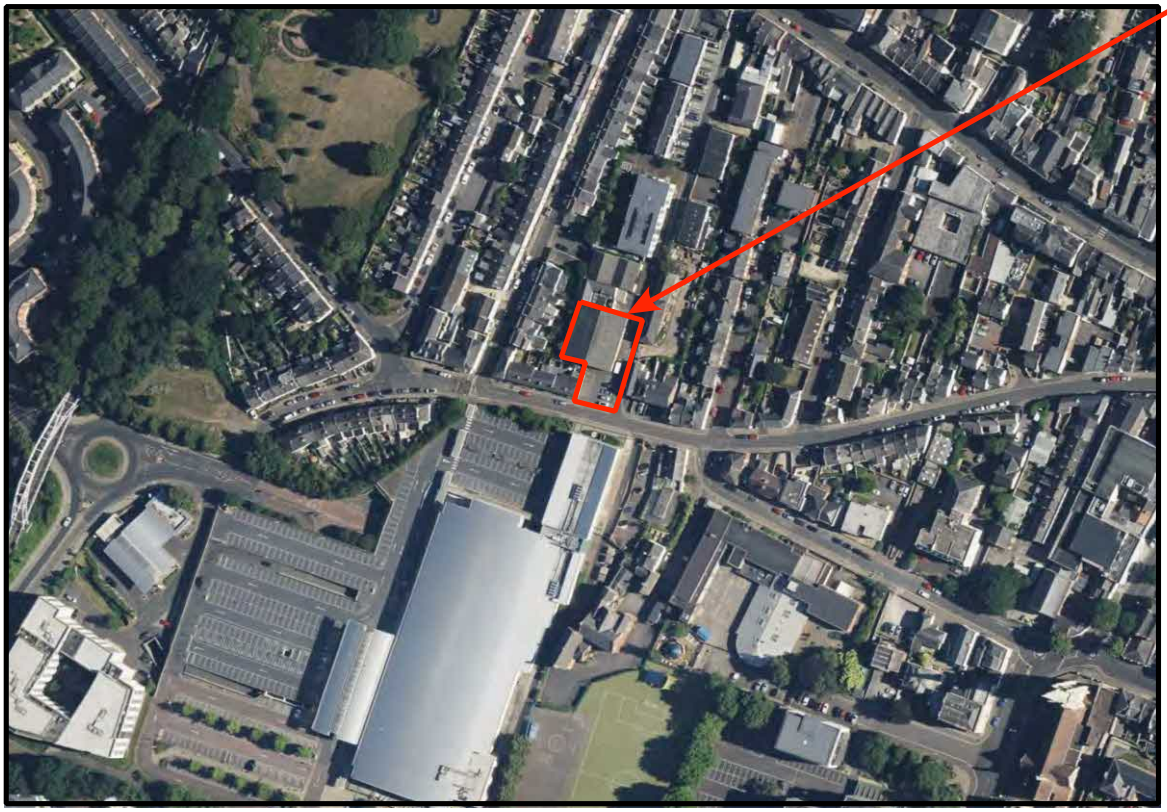
HazWaste Online (www.hazwasteonline.com)

73 NEW STREET, CHELTENHAM GL50 3ND!

SITE LOCATION (based on Microsoft Bing Mapping)

Job No.	Drawing No.	Scale:	Date:
5254	5254/1	NTS	14-11-23





P1 Number and direction of photograph (Appendix 1)

73 NEW STREET, CHELTENHAM, GLOS GL50 3ND!
!
!
!
EXISTING DEVELOPMENT LAYOUT (based upon MIDLAND SURVEY LTD drg S2495 - 1, dated January 2022) SHOWING INVESTIGATION LOCATIONS and WALKOVER PHOTOGRAPHS

Wilson Associates
Consulting Engineering Geologists & Geo-Environmental Engineers

Job No.	Drawing No.	Scale:	Date:
5254	5254/2	1:200@A3	14-12-23

73 NEW STREET, CHELTENHAM, GLOS GL50 3ND!

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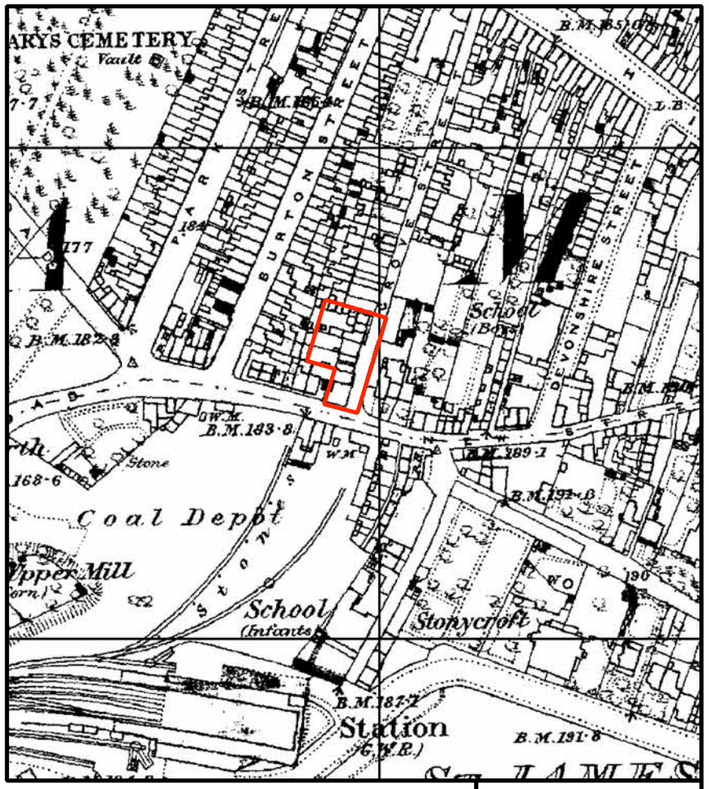
!

PROPOSED DEVELOPMENT LAYOUT (based upon Brodie Planning Associates drg 3025-150, dated January 2022) SHOWING INVESTIGATION LOCATIONS

Job No.	Drawing No.	Scale:	Date:
5254	5254/3	1:200@A3	14-12-23



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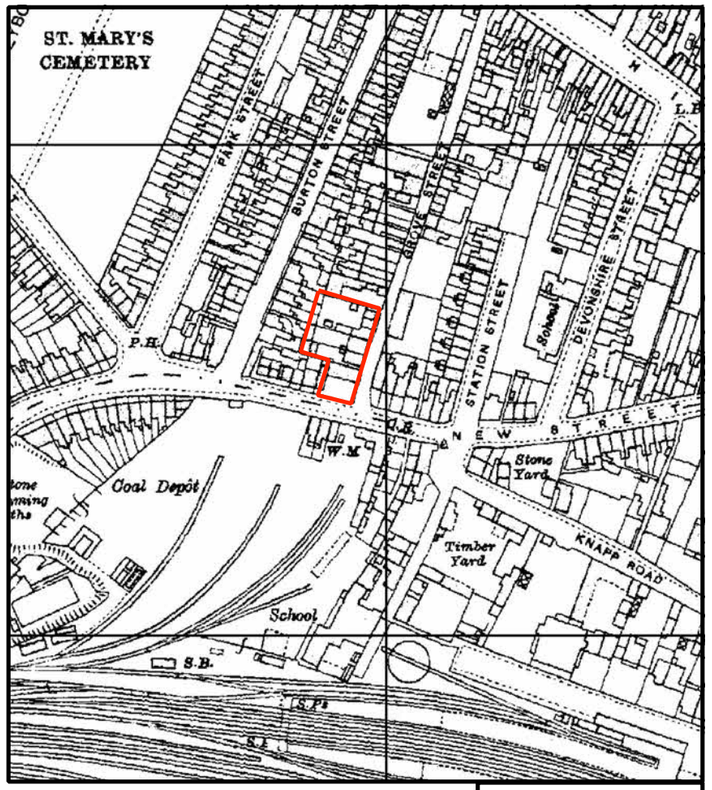
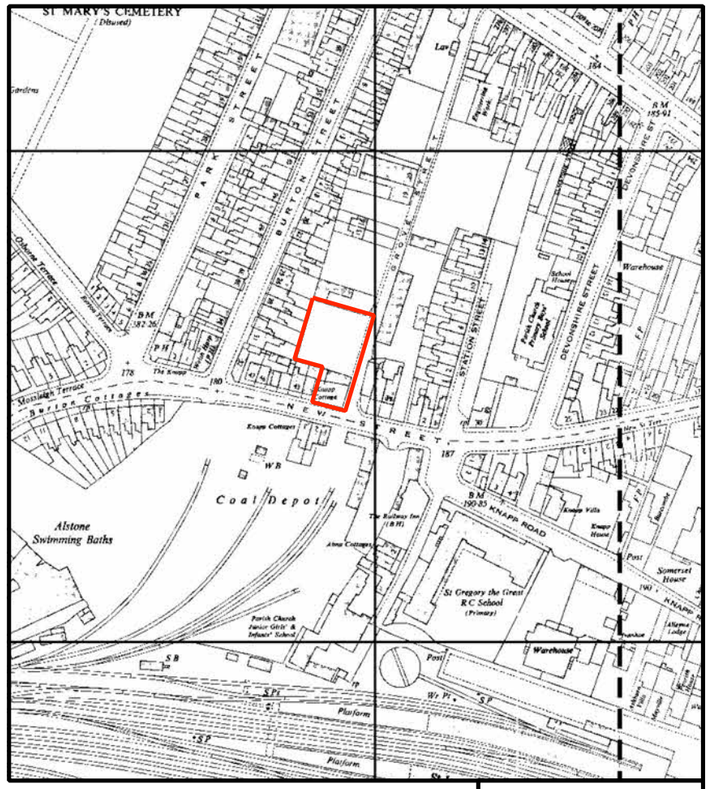
(scale 1:2500)

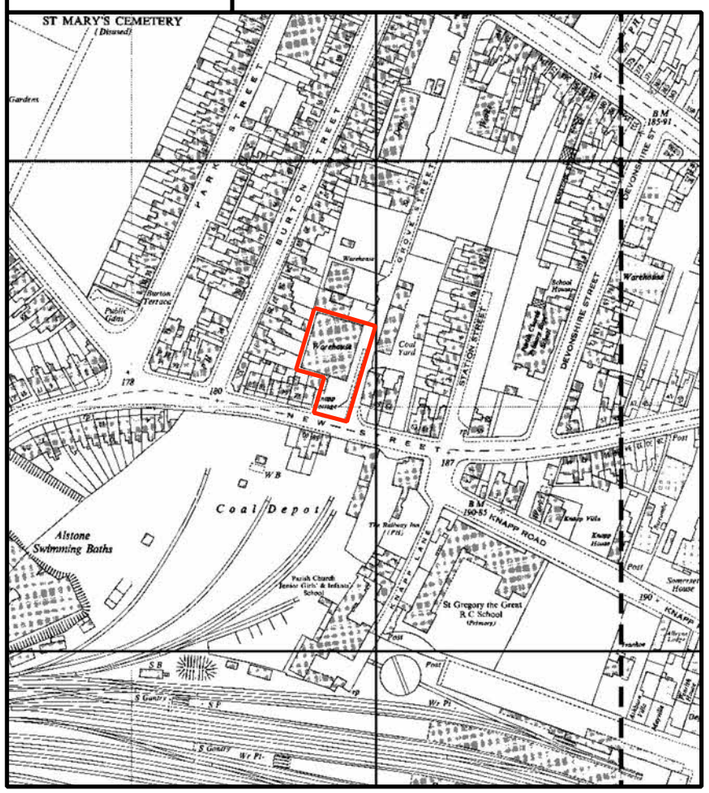


1923 !
(scale 1:2500)



1954-55 !
(scale 1:2500)

1963-91 !
(scale 1:2500)



1974-82 !
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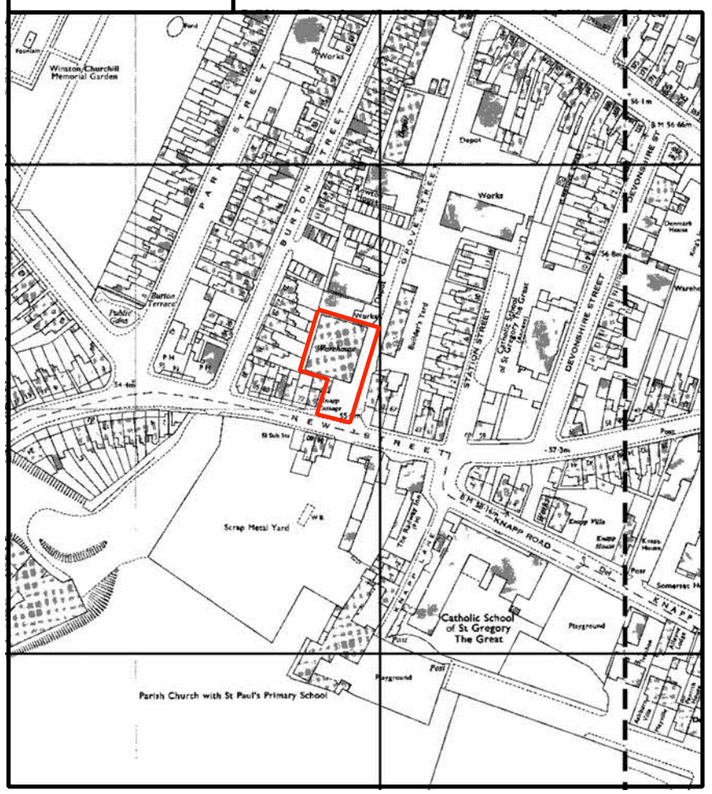

2022 !
(Google Earth NTS)

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73 NEW STREET, CHELTENHAM, GLOS GL50 3ND!

EXTRACTS OF ORDNANCE SURVEY PLANS TO SHOW SITE HISTORY

Job No.	Drawing No.	Scale:	Date:
5254	5254/4	as shown	15-11-23

N

APPENDIX 1

SITE PHOTOGRAPHS

Photograph **P1**

Photograph **P2**

Photograph **P3**

Photograph **P4**

Photograph **P5**

APPENDIX 2

INVESTIGATION LOGS WITH PHOTOGRAPHS

Wilson Associates
Consulting Engineering Geologists & Geo-Environmental Engineers

KEY TO BOREHOLE LOG SYMBOLS

Symbol	Explanation
D or J	Small Disturbed Sample (tub or jar sample)
B	Large Disturbed Sample
U	Undisturbed Sample
W	Water Sample
U70	Undisturbed Sample

Undrained Shear Strength Test (HSV)

90	Hand vane - direct reading in kN/m^2

Standard Penetration Test (SPT)

15	SPT 'N' Value (BS EN ISO 22476-3:2005)
125/50	Where full test drive not completed, penetration (125mm) and blow count (50) recorded
NR	No effective penetration

Water

	Water struck
	Water standing

Test/Core Range

TCR	Total Core Recovery - as percentage of core run. Where value significantly exceeds 100%, a note is given on remarks on log
SCR	Solid Core Recovery - as percentage of core run. Note: assessment of solid core is based on full diameter
RQD	Rock Quality Designation - the amount of solid core greater than 100mm expressed as percentage of core run
	Where SPT has been carried out at beginning of core run, disturbed section of core excluded from SCR and RQD assessment

Instrumentation

	Bentonite Seal
	Solid / Perforated Standpipe
	Granular Response Zone

BOREHOLE LOG

Project				BOREHOLE No
73 NEW STREET, CHELTENHAM, GLOS GL50 3ND				**WS1**
Job No	Date	Ground Level (c.m,AOD)	Co-Ordinates (c.)	
5254	07-12-23 07-12-23	58.00	E 394,396 N 222,732	
Contractor				Sheet
Cook Ground Investigation Limited				1 of 1

SAMPLES & TESTS			STRATA							
Depth	Type No	Test Result	Water	Undrained Shear Strength	Legend	Depth (Thick-ness)	DESCRIPTION		Geology	Instrument/ Backfill
0.10	ES					0.10	MADE GROUND: Tarmacadam			
0.30	ES					0.30	MADE GROUND: loose yellowish brown gravel of sub-angular to sub-rounded, fine to coarse oolitic limestone/quartzite			
						0.55				
					×	0.70	MADE GROUND: Oolitic limestone cobbles		CHSG	
							SAND: loose mid brown silty SAND			
1.00	D						SAND: medium dense to dense, orangish brown, gravelly, fine to medium SAND. Gravel is sub-angular fine to coarse quartzite/limestone (oolitic)			
1.45		N10								
2.00	D									
2.00-2.45	SPT									
2.45		N27				(3.95)			CHSG	
3.00-3.45	SPT									
3.45		N37								
4.00-4.45	SPT		1							
4.45		N38				4.65				
5.00-5.45	SPT					(0.80)	CLAY: stiff, bluish grey, silty CLAY		ChM	
5.45		N30				5.45	Core Recovery: 0.0 - 1.2m: hand-dug starter pit 1.2 - 2.0m: 100% 2.0 - 3.0m: 100% 3.0 - 4.0m: 100% 4.0 - 5.0m: 100% Hand dug starter pit: 0.0-1.2m. Dynamic sampling using 101mm sample barrels: 1.20-5.45m. No casing used. Groundwater encountered at 4.0m. Borehole collapsed from 4.0m. Borehole backfilled with arisings			

Boring Progress and Water Observations					
Date	Hole Dia. mm	Depth	Casing Depth	Casing Dia. mm	Water Dpt
07/11/2023	101	5.45			4.00

Chiselling			Water Added	
From	To	Hours	From	To

GENERAL REMARKS

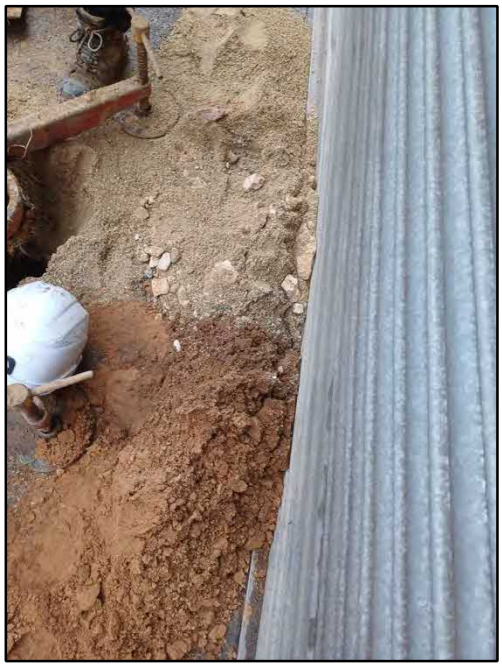
Borehole position scanned using Cable Avoidance Tool (CAT)

ChSG = Cheltenham Sand & Gravel
ChM = Charmouth Mudstone

All dimensions in metres Scale 1:50	Client CAPE HOMES LIMITED	Method/ Plant Used Archway Competitor Dart	Logged By

BOREHOLE PHOTOGRAPHS

Project 73 NEW STREET, CHELTENHAM, GLOS GL50 3ND	Borehole No. **WS1**
Job No. 5254 **Date**: 07/12/2023	



Starter pit arisings: 0.0-1.2m

Borehole Core: 1.2-5.0m

Client	Method/Plant Used	Logged By
CAPE HOMES LIMITED	Window Sampling / Archway Competitor Dart	DB

BOREHOLE LOG

Project				BOREHOLE No
73 NEW STREET, CHELTENHAM, GLOS GL50 3ND				**WS2**
Job No	Date	Ground Level (c.m,AOD)	Co-Ordinates (c.)	
5254	07-12-23 07-12-23	57.00	E 394,387 N 222,710	
Contractor				Sheet
Cook Ground Investigation Limited				1 of 1

SAMPLES & TESTS			STRATA						
Depth	Type No	Test Result	Water	Undrained Shear Strength	Legend	Depth (Thick-ness)	DESCRIPTION	Geology	Instrument/ Backfill
						0.10	MADE GROUND: Tarmacadam		
						0.30	MADE GROUND: loose yellowish brown, sandy, sub-rounded to sub-angular, fine to coarse gravel of oolitic limestone/ quartzite		
0.50	D					0.40		CHSG	
						0.65	MADE GROUND: oolitic limestone cobbles		
							SAND: loose mid brown, silty SAND with occasional coarse gravel of oolitic limestone		
1.00-1.20 1.00-1.45	ES SPT						SAND: medium dense to dense, orangish brown, gravelly fine to medium gravelly SAND. Gravel is sub-angular to sub-rounded oolitic limestone/quartzite		
1.45		N11							
2.00-2.45	SPT								
						(3.30)		CHSG	
2.45		N28							
3.00-3.45	SPT								
3.45		N34							
						3.95	3.70 very gravelly, sub-angular fine to coarse oolitic limestone		
4.00 4.00-4.45	D SPT						CLAY: stiff, bluish grey, silty plastic CLAY		
4.45		N28				(1.05)		ChM	
						5.00			
							Core Recovery: 0.0 - 1.2m: hand-dug starter pit 1.2 - 2.0m: 100% 2.0 - 3.0m: 100% 3.0 - 4.0m: 100% 4.0 - 5.0m: 60% Hand dug starter pit: 0.0-1.2m. Dynamic sampling using 101mm sample barrels: 1.20-5.00m. No casing used. No groundwater encountered. Borehole backfilled with arisings		

Boring Progress and Water Observations					
Date	Hole Dia. mm	Depth	Casing Depth	Casing Dia. mm	Water Dpt
07/12/2023	101	5			DRY

Chiselling			Water Added	
From	To	Hours	From	To

GENERAL REMARKS

Borehole position scanned using Cable Avoidance Tool (CAT)

ChSG = Cheltenham Sand & Gravel
ChM = Charmouth Mudstone

All dimensions in metres Scale 1:50	Client CAPE HOMES LIMITED	Method/ Plant Used Archway Competitor Dart	Logged By

BOREHOLE PHOTOGRAPHS

Project 73 NEW STREET, CHELTENHAM, GLOS GL50 3ND	Borehole No. WS2
Job No. 5254 **Date**: 07/12/2023	

Starter pit arisings: 0.0-1.2m

Borehole Core: 1.2-5.0m

Client	Method/Plant Used	Logged By
CAPE HOMES LIMITED	Window Sampling / Archway Competitor Dart	DB

BOREHOLE LOG

Project				BOREHOLE No
73 NEW STREET, CHELTENHAM, GLOS GL50 3ND				**WS3**
Job No	Date	Ground Level (c.m,AOD)	Co-Ordinates (c.)	
5254	07-12-23 07-12-23	57.00	E 394,378 N 222,700	
Contractor				Sheet
Cook Ground Investigation Limited				1 of 1

SAMPLES & TESTS			STRATA							
Depth	Type No	Test Result	Water	Undrained Shear Strength	Legend	Depth (Thick-ness)	DESCRIPTION	Geology	Instrument/ Backfill
						0.12	MADE GROUND: Tarmacadam		
0.20-0.40	ES					0.30	MADE GROUND: loose, yellowish brown sandy, sub-rounded to sub-angular, fine to coarse GRAVEL of oolitic limestone/quartzite		
						0.60	SAND: loose, mid brown, silty SAND	CHSG	
1.00-1.45	SPT						SAND: med dense orangish brown gravelly, fine to medium grained SAND. Gravel is sub-rounded, fine to medium, oolitic limestone and quartzite		
1.45		N12				(2.30)		CHSG	
2.00-2.45	SPT								
2.45		N24	1			2.90			
3.00	D			88			CLAY: stiff, bluish grey, silty plastic CLAY with occasional shells		
3.00	H								
3.00-3.45	SPT			48					
3.30	H			68					
3.45		N26				(1.55)		ChM	
3.50	H		1	72					
3.80	H			43					
4.00	H								
4.00-4.45	SPT					4.45			
4.45		N16					Core Recovery: 0.0 - 1.2m: hand-dug starter pit 1.2 - 2.0m: 100% 2.0 - 3.0m: 100% 3.0 - 4.0m: 100% Hand dug starter pit: 0.0-1.2m. Dynamic sampling using 101mm sample barrels: 1.20-4.45m. No casing used. Groundwater encountered at 4.0m standing at 2.9m after 20 minute monitoring period. Borehole backfilled with arisings		

Boring Progress and Water Observations						Chiselling			Water Added	
Date	Hole Dia. mm	Depth	Casing Depth	Casing Dia. mm	Water Dpt	From	To	Hours	From	To
07/12/2023	101	4.45			4.0					

GENERAL REMARKS

Borehole position scanned using Cable Avoidance Tool (CAT)

ChSG = Cheltenham Sand & Gravel
ChM = Charmouth Mudstone

All dimensions in metres Scale 1:50	Client CAPE HOMES LIMITED	Method/ Plant Used Archway Competitor Dart	Logged By

BOREHOLE PHOTOGRAPHS

Project 73 NEW STREET, CHELTENHAM, GLOS GL50 3ND	Borehole No. WS1
Job No. 5254 **Date**: 07/12/2023	

Starter pit arisings: 0.0-1.2m

Borehole Core: 1.2-5.0m

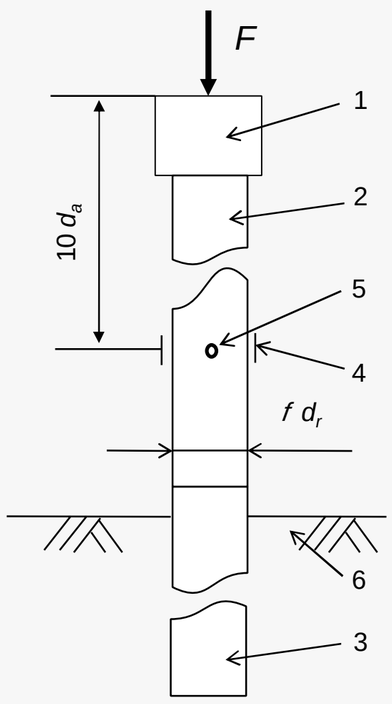
Client	Method/Plant Used	Logged By
CAPE HOMES LIMITED	Window Sampling / Archway Competitor Dart	DB

SPT Calibration Report

Hammer Energy Measurement Report

Type of Hammer		Dart
Test No		EQU2023_124
Client		Cook Ground Investigation
Test Depth (m)		9.70
Mass of hamme	m =	63.5kg
Falling height	h =	0.76m
E_{theor} =	$m \times g \times h$ =	473J

Characteristics of the instrumented rod



Key

1 Anvil
2 Part of instrumented rod
3 Drive Rod
4 Strain Gauge
5 Accelerometer
6 Ground

F Force
d_r Diameter of rod

Fig. B.1 and B.2
BS EN ISO 22476-3 : 2005 + A1 : 2011

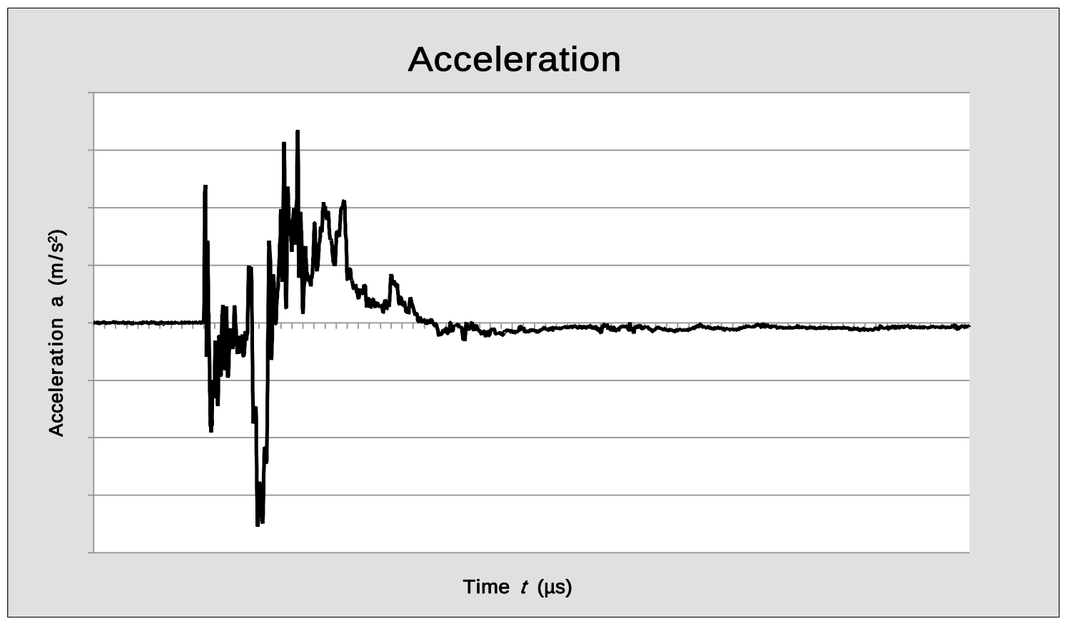
Diameter	d_r =	0.052 m
Length of instrumented rod		0.558 m
Area	A =	11.61 cm^2
Modulus	E_a =	206843 MPa

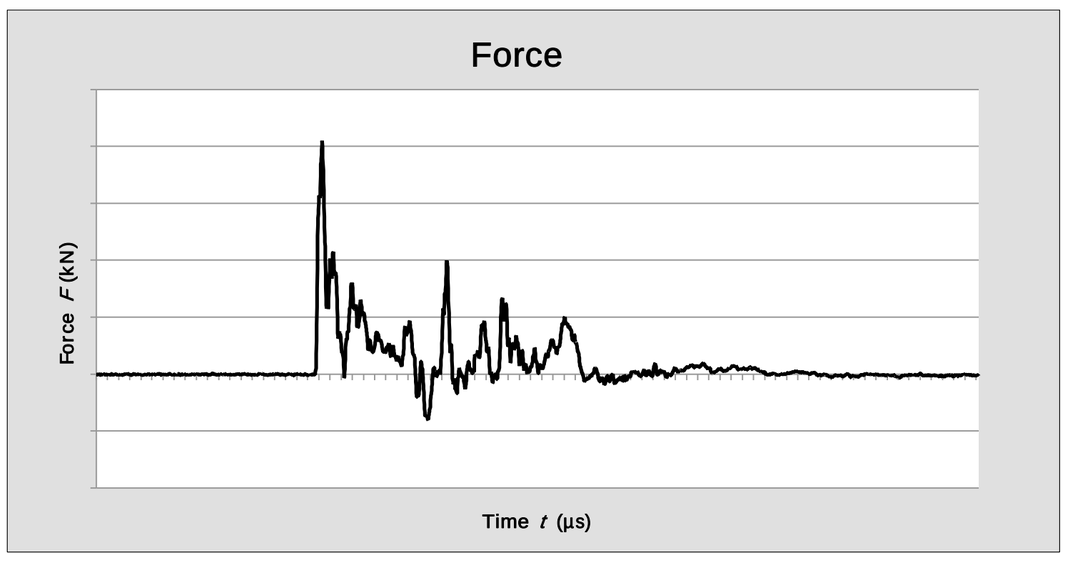
DATE OF TEST	VALID UNTIL	HAMMER ID
18/07/2023	17/07/2024	

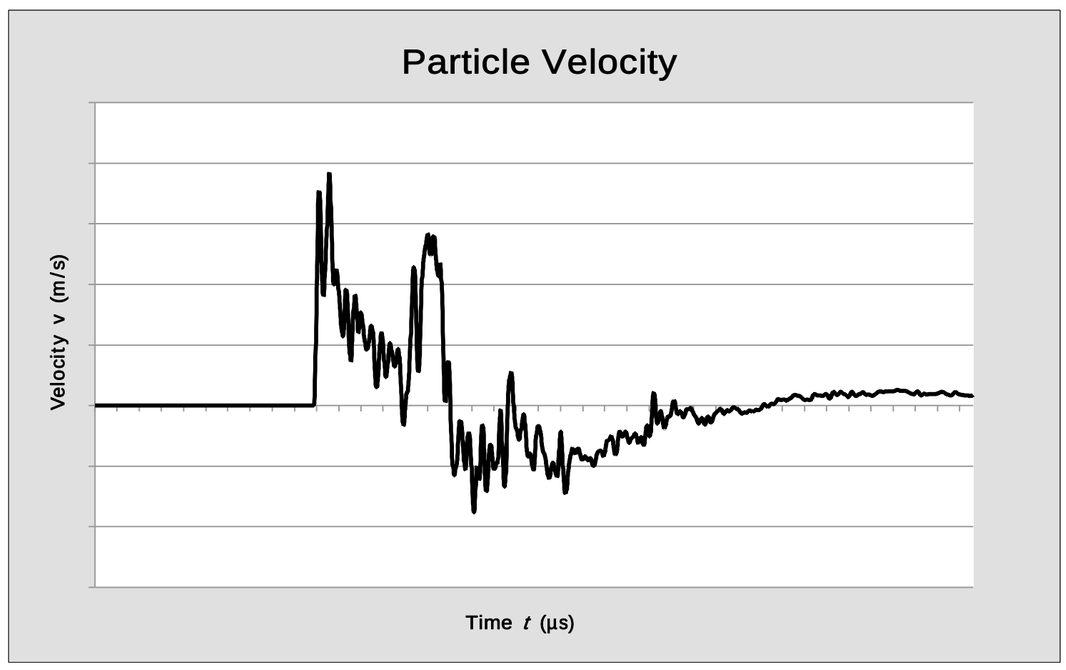
E_{meas} = 0.392 kN-m

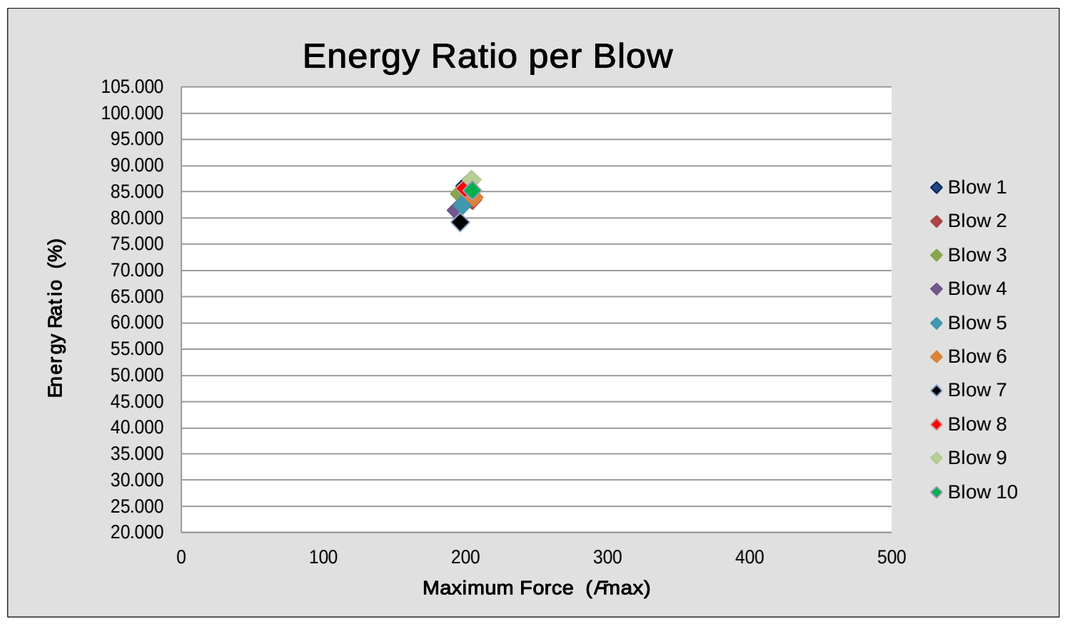
E_{theor} = 0.473 kN-m

Comments









Energy Ratio (Er) = $\frac{E_{meas}}{E_{theor}}$	82.88%

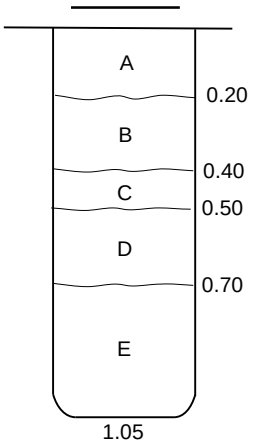
Equipe SPT Analyzer Operator	Certificate prepared b	Certificate checked by	Certificate date
KS	27/07/2023	27/07/2023	27/07/2023

 Equipe Group, The Paddocks, Home Farm Offices, The Upton Estate, Banbury, Oxfordshire, OX15 6HU
Tel: +44 (0)1295 670990 Fax: +44 (0)1295 678232 Email: info@equipegroup.com

Wilson Associates
Consulting Engineering Geologists & Geo-Environmental Engineers

36 Brunswick Road, Gloucester GL1 1JJ!
Tel: 01452 422843!
Email: info@wilsonac.co.uk

Site: 73 NEW STREET, CHELTENHAM, GLOS GL50 3ND				TRIAL PIT No.
Job No. 5254	**Date** 12-12-23	**Ground Level (c.m, AOD)** 58m	**Co-Ordinates (c.)** E 394,377 N: 222732	**HP1**



DETAILS OF SUBSOIL!

!
A! CONCRETE SLAB: 6mm rebar at 110mm !
! !
B! MADE GROUND: loose yellowish brown, sandy!
! gravel of sub-rounded to sub-angular, fine to coarse!
! brick/concrete/oolitic limestone!
!
C! MADE GROUND: loose black/dark brown!
! sandy gravel of sub-angular, fine to coarse!
! brick/oolitic limestone!
!
D! SAND: loose, mid brown, silty SAND!
! *(CHELTENHAM SAND & GRAVEL)!*
!
E! SAND: medium dense, orangey brown, fine!
! grained SAND!
! *(CHELTENHAM SAND & GRAVEL)!*
!
!
!

NOTES!

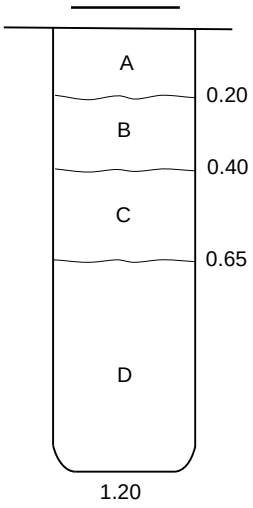
!
1! Pit logged from surface!
!
2! Pit dry and stable !
!
3! No roots encountered!
!
4! Soil samples taken at 0.4-0.5m and 0.7-0.8m depth!
!

Scale: 1:20	Client Cape Homes Limited	Logged By: DB

Wilson Associates
Consulting Engineering Geologists & Geo-Environmental Engineers

36 Brunswick Road, Gloucester GL1 1JJ!
Tel: 01452 422843!
Email: info@wilsonac.co.uk

Site: 73 NEW STREET, CHELTENHAM, GLOS GL50 3ND				TRIAL PIT No.
Job No. 5254	**Date** 12-12-23	**Ground Level (c.m, AOD)** 58m	**Co-Ordinates (c.)** E 394,377 N: 222723	**HP2**



DETAILS OF SUBSOIL!

!

A! CONCRETE SLAB: 4mm rebar at base !

! !

B! MADE GROUND: yellowish brown, sandy!

! GRAVEL of brick/concrete/oolitic limestone cobbles!

!

C! MADE GROUND: loose mid brown/black gravelly!

! SAND. Gravel is sub-angular, fine to coarse!

! brick/concrete/oolitic limestone!

!

D! SAND: medium dense, orangey brown, fine!

! grained SAND!

! *(CHELTENHAM SAND & GRAVEL)!*

!

!

!

NOTES!

!

1! Pit logged from surface!

!

2! Pit dry and stable !

!

3! No roots encountered!

!

4! Soil samples taken at 0.4-0.65m depth!

!

Scale: 1:20	Client Cape Homes Limited	Logged By: DB

APPENDIX 3

CONTAMINATION
STATUTORY FRAMEWORK / METHODOLOGY
AND
CERTIFIED CONTAMINATION TEST RESULTS

A3 CONTAMINATION RISK ASSESSMENT

Statutory Framework

A3.1 Part 2A of the Environmental Protection Act 1990 (inserted by Section 57 of the Environment Act 1995) provides a regime for the control of specific threats to health or the environment from existing land contamination. In accordance with the Act and the statutory guidance document on the Contaminated Land (England) Regulations 2000, the definition of contaminated land is intended to embody the concept of risk assessment. Within the meaning of the Act, land is only 'contaminated land' where it appears to the regulatory authority to be in such a condition, by reason of substances within or under the land, that:

harm is being caused or has significant possibility of significant harm to be caused to human health, or

pollution is being caused or has significant possibility of significant pollution to be caused to controlled waters.

A3.2 In 2012 revised Statutory Guidance for Part 2A of the Environmental Protection Act (1990) came into force for England and Wales. This introduced a new four category approach for classifying land affected by contamination to assist decisions by regulators in cases of Significant Possibility of Significant Harm (SPOSH) to specified receptors, including humans, and significant pollution of controlled waters.

Category 1 describes land which is clearly problematic e.g. because similar sites are known to have caused a significant problem in the past. The legal definition is where "there is an unacceptably high probability, supported by robust science-based evidence, that significant harm would occur if no action is taken to stop it".

Categories 2 and 3 cover land where detailed consideration is needed before deciding whether it may be contaminated land. Category 2 is defined as land where "there is a strong case for considering that the risks from the land are of sufficient concern that the land poses a significant possibility of significant harm". Category 3 is defined as land where there is not the strong case described in the test for Category 2, and may include "land where the risks are not low, but nonetheless the authority considers that regulatory intervention under Part 2A is not warranted". The decision basis is initially related to human health risks, and if this is not conclusive due to uncertainty over risks, wider socio-economic factors (e.g. cost, local perception etc).

Category 4 describes land that is clearly not contaminated land, where there is no risk or the level or risk posed is low.

A3.3 This same 4 category system has also been introduced to assist in identifying whether there is a significant possibility of significant pollution of controlled waters. Part 2A states that normal levels of contaminants in soil should not be considered to cause land to qualify as contaminated land, unless there is a particular reason to consider otherwise.

A3.4 Once land has been determined as contaminated land, the enforcing authority must consider how it should be remediated and, where appropriate, it must issue a remediation notice to require such remediation. The enforcing authority for the purposes of remediation may be the local authority which determined the land, or the Environment Agency which takes on responsibility once land has been determined if the land is deemed to be a "special site". The rules on what land is to be regarded as special sites, and various rules on the issuing of remediation notices, are set out in the Contaminated Land (England) Regulations 2006.

A3.5 The UK guidance on the assessment of land contamination has developed as a direct result of the introduction of the above two Acts. The current technical guidance supporting the legislation has been summarised in the document Land Contamination Risk Management (LCRM), originally published in October 2020 by the Environment Agency (EA).

Contamination Assessment Methodology

A3.6 LCRM guidance proposes a three-stage risk based assessment process for identifying if a hazard exists within a site.

Stage 1: Risk assessment

Stage 2: Options appraisal

Stage 3: Remediation and verification

A3.7 Stage 1 is to collect detailed information about the site, firstly to establish the likelihood of a hazard being present, and if a potential hazard is identified, to assess (through the source-pathway-receptor potential pollutant linkage concept) whether it has the

potential to pose an unacceptable risk. That unacceptable risk is subsequently estimated and /or evaluated.

A3.8 Stage 1 can be achieved through a preliminary desk-based risk assessment and if considered appropriate, by progression to a generic or detailed quantitative risk assessment using appropriate intrusive investigation methods supported by UKAS accredited laboratory testing.

A3.9 Quantitative assessment of human health risk posed by ground contamination is achieved by comparison of soil concentrations with Tier 1 Suitable for Use Levels (S4UL) as published by LQM/CIEH (2015) or (in the case of the toxic metal Lead only) with a Category Four Screening Level (C4SL) published by DEFRA (2014). The official Soil Guideline Values utilise a soil organic matter content of 6% which is considered to be higher than typical UK soils, however three sets of S4UL's have been developed for organic matter contents of 1%, 2.5% and 6%, thus the most appropriate set is selected based upon proven site conditions.

A3.10 Contaminant concentrations below the threshold screening values are considered not to warrant further risk assessment. Concentrations of contaminants above these screening values require further consideration of potential pollutant linkages and may indicate potentially unacceptable risks to site users that warrants either further detailed quantitative risk assessment or progression to Stage 2. It should be noted that S4UL/C4SL's are not absolute thresholds and an exceedance does not necessarily indicate that a potential pollutant linkage is automatically established.

A3.11 In order to assess any risk to controlled waters posed by contaminants within the underlying soils and groundwater, laboratory results are screened against Level 1 Environmental Quality Standard (EQS) values derived from the Water Framework Directive (Standards & Classification) Directions (England & Wales) 2015 and the current UK Drinking Water Supply (Water Quality) Regulations (DWS), dependent upon the most vulnerable receptor. The EQS is usually an upper concentration set for the receiving watercourse and not the discharge itself. The DWS is established for compliance at the point of use or abstraction and not the source area.

A3.12 Stage 2 follows on from the risk assessment completed in Stage 1 by firstly identifying all feasible remediation options, then through consideration of additional factors including but not limited to; sustainability, limitations, timescales and budgets and regulatory controls, narrow the list of remediation options down to a favoured

remediation/mitigation approach. Note that this approach is not restrictive and may include the adoption of as many remediation options as necessary in order to achieve the remediation objective(s).

A3.13 Stage 3 takes the chosen remediation/mitigation approach from Stage 2 and from which a remediation strategy 'that can be implemented in practice' is developed and agreed with the regulatory authority. Once agreed the approved remediation works can take place as per the strategy, whilst still being mindful of whether the chosen remedial strategy is working as anticipated and also for the presence of unexpected contamination. Subject to findings, the agreed remedial strategy may require adjustment in order to ensure that the remediation objectives(s) can be met.

A3.14 Upon completion of the remedial works a verification plan is produced detailing the works undertaken and demonstrating that the risk has been reduced, that the remediation objective(s) and criteria have been met and that the site no longer presents a risk to human health and/or controlled waters, and therefore can be considered 'suitable for use'.

Waste Classification

A3.15 In terms of controlled off-site disposal to landfill of site arisings, if/where intended, waste classification is carried out in line with European Waste Catalogue (EWC) and Technical Guidance Waste Management 3 (TGWM3, EA Version 1.2, October 2021) using contamination test results obtained for that material. The assessment utilises the 'HazWasteOnline' software to establish a 'Hazardous' (170503*) / 'Non-hazardous' (170504) classification. Where required, the foregoing may be supplemented by Waste Acceptance Criteria (WAC) analysis, in order that the waste can further be designated as 'Hazardous' / 'Stable non-reactive' / 'Inert', for use by the receiving landfill operator. It should be noted that WAC is only required for disposal of wastes at certain classes of landfill; if arisings are not intended for removal to landfill, then WAC testing is not applicable.

SUMMARY OF CONTAMINATION TEST RESULTS

		SOILS						TIER 1: GENERIC ASSESSMENT CRITERIA					
Sample Ref		WS1	WS2	WS3	HP1	HP1	HP2	S4UL (Residential with plant uptake)	S4UL (Residential without plant uptake)	S4UL (Allotments)	S4UL (Commercial)	S4UL (Public Open Space - Residential)	S4UL (Public Open Space - Park)
Sample Depth (m)		0.10-0.30	1.00-1.20	0.20-0.40	0.40-0.50	0.70-0.80	0.40-0.65						
Sample of		MADE GROUND	GRAVELLY SAND	MADE GROUND/NATURAL /SAND	MADE GROUND	SAND	MADE GROUND						
DETERMINAND (mg/kg)													
	pH	8.4	8.2	8.2	8.6	8	9.1						
TOXIC METALS	Arsenic	12	9.2	9.9	30	7.4	26	**37**	40	**43**	**640**	**79**	**170**
	Cadmium	< 0.2	< 0.2	0.5	< 0.2	< 0.2	1.5	11	85	1.9	190	120	532
	Chromium VI	< 1.2	< 1.2	< 1.2	< 1.2	< 1.2	< 1.2	6	6	1.8	33	8	220
	Chromium	11	12	10	17	7.1	16	910	910	18,000	8,600	1,500	33,000
	Lead	5.4	5.8	47	170	15	220	200 ♠	310 ♠	80 ♠	2330 ♠	630 ♠	1300 ♠
	Mercury	< 0.3	< 0.3	0.4	1	< 0.3	1.5	40	56	19	1100	120	240
	Nickel	10	12	11	22	7.5	22	180	180	230	980	230	800
	Selenium	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	250	430	88	12000	1100	1800
PHYTOTOXIC METALS	Copper	5.2	12	19	74	11	63	2,400	7,100	520	68,000	12,000	44,000
	Zinc	37	30	110	230	39	410	3,700	40,000	620	730,000	81,000	170,000
	Moisture Content (%)	5.9	6.2	14	12	3.4	11						
	Stone Content (%)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1						
	Soil Organic Matter (%)	-	-	-	3.6	0.6	-						
ASBESTOS	Screen/Identification	-	-	-	Chrysotile-Asbestos Cement	-	-						
	In Soil	Not-detected	-	Not-detected	Detected	-	Not-detected						
	Quantification (Stage 2)		0.004										
	Quantification (total)				0.004								
SPECIATED POLYAROMATIC HYDROCARBONS (PAH)	Total PAH	< 0.80	< 0.80	< 0.80	9.54	< 0.80	18.1						
	Naphthalene	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.1	5.6	5.6	10	460 (183)s	4,900	1,900 (183)s
	Acenaphthylene	< 0.05	< 0.05	< 0.05	0.07	< 0.05	0.12	420	4,600 (212)s	69	97,000 (212)s	15,000	30,000
	Acenaphthene	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	510	4,700 (141)s	85	97,000 (141)s	15,000	30,000
	Fluorene	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.05	400	3,800 (76.5)s	67	68,000	9,900	20,000
	Phenanthrene	0.07	< 0.05	< 0.05	0.59	< 0.05	1.1	220	1,500	38	22,000	3,100	6,200
	Anthracene	< 0.05	< 0.05	< 0.05	0.17	< 0.05	0.28	5,400	35,000	950	540,000	74,000	150,000
	Fluoranthene	0.13	< 0.05	< 0.05	1.7	< 0.05	3.3	560	1600	130	23,000	3,100	6,300
	Pyrene	0.1	< 0.05	< 0.05	1.6	< 0.05	3.2	1,200	3,800	270	54,000	7,400	15,000
	Benzo(a)anthracene	< 0.05	< 0.05	< 0.05	0.95	< 0.05	1.7	11	14	6.5	170	29	56
	Chrysene	< 0.05	< 0.05	< 0.05	0.83	< 0.05	1.5	22	31	9.4	350	57	110
	Benzo(b)fluoranthene	< 0.05	< 0.05	< 0.05	1.2	< 0.05	2	3.3	4	2.1	44	7.2	15
	Benzo(k)fluoranthene	< 0.05	< 0.05	< 0.05	0.41	< 0.05	0.91	93	110	75	1200	190	410
	Benzo(a)pyrene	< 0.05	< 0.05	< 0.05	0.86	< 0.05	1.7	2.7	3.2	2.00	35	5.7	12
	Indeno(1,2,3-cd)pyrene	< 0.05	< 0.05	< 0.05	0.55	< 0.05	0.95	36	46	21	510	82	170
	Dibenz(a,h)anthracene	< 0.05	< 0.05	< 0.05	0.12	< 0.05	0.21	0.28	0.32	0.27	3.6	0.57	1.3
	Benzo(ghi)perylene	< 0.05	< 0.05	< 0.05	0.58	< 0.05	1.1	340	360	470	4000	640	1,500
BTEX	Benzene	< 5.0	-	-	-	< 5.0	-	0.17	0.70	0.034	47	**72**	**100**
	Toluene	< 5.0	-	-	-	< 5.0	-	290	1,900	51	*110,000 (1,920)v*	**56,000**	**95,000 (1,920)v**
	Ethybenzene	< 5.0	-	-	-	< 5.0	-	110	190	39	*13,000 (1,220)v*	**24,000**	*22,000 (1,220)v*
	O-Xylenes	< 5.0	-	-	-	< 5.0	-	140	210	67	*15,000 (1,120)s*	**42,000**	**24,000 (1,120)s**
	M-Xylene	< 5.0	-	-	-	< 5.0	-	140	190	74	*14,000 (1,470)v*	**42,000**	**24,000 (1,470)v**
	P-Xylene	< 5.0	-	-	-	< 5.0	-	130	180	69	*14,000 (1,350)s*	**42,000**	**23,000 (1,350)s**
	Methyl tert-Butyl Ether	< 5.0	-	-	-	< 5.0	-						
TOTAL PETROLEUM HYDROCARBONS (BANDED)	C6 - C8	-	< 1.0	< 1.0	< 1.0	-	< 1.0	230	230	600,000	17,000 (322)s	610,000	220,000 (322)s
	C8 - C10	-	< 1.0	< 1.0	< 1.0	-	< 1.0	65	65	770	4800	13,000	18,000 (190)v
	C10 - C12	-	< 1.0	< 1.0	4.9	-	< 1.0	180	590	31	28000	5,000	9700
	C12 - C16	-	< 4.0	< 4.0	< 4.0	-	< 4.0	330	2300	57	37000	5,100	10000
	C16 - C21	-	< 10	< 10	< 10	-	12	540	1900	110	28,000	3,800	7,700
	C21 - C40	-	< 10	< 10	54	-	37						
	C6 - C40	-	19	< 10	69	-	50						
(TPH) ALIPHATIC	C5 - C6	< 0.020	-	-	-	< 0.020	-	78	78	1,700	5,900 (558)s	590,000	130,000 (558)s
	C6 - C8	< 0.020	-	-	-	< 0.020	-	230	230	600,000	17,000 (322)s	610,000	220,000 (322)s
	C8 - C10	< 0.050	-	-	-	< 0.050	-	65	65	770	4,800 (190)v	13,000	18,000 (190)v
	C10 - C12	< 1.0	-	-	-	< 1.0	-						
	C12 - C16	< 2.0	-	-	-	< 2.0	-	330 (118)v	330 (118)v	4,400	23,000 (118)v	13,000	23,000 (118)v
	C16 - C21	< 8.0	-	-	-	< 8.0	-	2,400 (59)s	2,400 (59)s	13,000	82,000 (59)s	13,000	25,000 (59)s
	C21 - C35	< 8.0	-	-	-	< 8.0	-	92,000 (21)s	92,000 (21)s	270,000	1,700,000	250,000	480,000
	C5 - C35	< 10	-	-	-	< 10	-	92,000 (21)s	92,000 (21)s	270,000	1,700,000	250,000	480,000
(TPH) AROMATIC	C5 - C7	< 0.010	-	-	-	< 0.010	-	140	690	27	46,000 (2,260)s	56,000	84,000 (2,260)s
	C7 - C8	< 0.010	-	-	-	< 0.010	-	290	1,800	51	110,000 (1,920)s	56,000	95,000 (1,920)s
	C8 - C10	< 0.050	-	-	-	< 0.050	-	83	110	21	8,100 (1,500)v	5,000	8,500 (1,500)v
	C10 - C12	< 1.0	-	-	-	< 1.0	-	180	590	31	28,000 (899)s	5,000	9,700 (899)s
	C12 - C16	< 2.0	-	-	-	< 2.0	-	330	2,300 (419)s	57	37,000	5,100	10,000
	C16 - C21	< 10	-	-	-	< 10	-	540	1,900	110	28,000	3,800	7,700
	C21 - C35	< 10	-	-	-	< 10	-	1,500	1,900	820	28,000	3,800	7,800
	C5 - C35	< 10	-	-	-	< 10	-	1,500	1,900	820	28,000	3,800	7,800

		LEACHATE					
Sample Ref		HP1	WFD *(Groundwater)*	WFD *(Fresh Surface Water)*	EA EQS	UK DWS	WHO
Sample Depth (m)		0.5					
Sample of		MADE GROUND					
DETERMINAND (µg/l)							
TOXIC METALS	Arsenic	15	**7.5**	37.5	**50**	**10**	
	Boron	47					
	Cadmium	< 0.08	3.8	0.08	0.08-0.25	5	
	Chromium VI	6.3					
	Chromium	6.8	37.5	3.4	4.7	50	
	Lead	< 1.0	7.5	7.2	7.2	10	
	Mercury	< 0.5	0.8	0.07	0.07	1	
	Nickel	0.5	15	<1	20	20	
	Selenium	< 4.0	75			10	
PHYTOTOXIC METALS	Copper	3.8	1,500	1	1-28	2,000	
	Zinc	53		12.3	8-125	5,000	
SPECIATED POLYAROMATIC HYDROCARBONS (PAH)	Total PAH	< 0.2					
	Naphthalene	< 0.01	0.075	1.03-4.24	2.4	0.1	
	Acenaphthylene	< 0.01				0.1	
	Acenaphthene	< 0.01				0.1	
	Fluorene	< 0.01				0.1	
	Phenanthrene	< 0.01				0.1	
	Anthracene	< 0.01		0.052-0.193		0.1	
	Fluoranthene	< 0.01	0.075	0.0033-0.0122		0.1	
	Pyrene	< 0.01				0.1	
	Benzo(a)anthracene	< 0.01				0.1	
	Chrysene	< 0.01				0.1	
	Benzo(b)fluoranthene	< 0.01		0.016-0.058	0.03	0.1	
	Benzo(k)fluoranthene	< 0.01			0.03	0.1	
	Benzo(a)pyrene	< 0.01		0.000089-0.000328	0.05	0.01	
	Indeno(1,2,3-cd)pyrene	< 0.01				0.1	
	Dibenz(a,h)anthracene	< 0.01			Sum of = 0.002	0.1	
	Benzo(ghi)perylene	< 0.01				0.1	

CIEH/LQM s= GAC/S4UL presented exceeds the solubility saturation limit, which is presented in brackets

CIEH/LQM v= GAC/S4UL presented exceeds the vapour saturation limit, which is presented in brackets

CIEH/LQM S4UL d= S4UL based on a threshold protective of direct skin contact with phenol (guideline in brackets based on health effects following long term exposure provided for illustration only)

S4UL LQM/CIEH published Suitable for use levels (2015)

DEFRA ♠= C4SL (2014)

ND= None detected

Based on Soil Organic Matter of 2.5% (all levels expressed as mg/kg)

WFD (groundwater) WFD (fresh surface water) WFD "Water Framework Directive Standards & Classification (England & Wales)" 2015

EA EQS River Basin Districts Typology, Standards & Groundwater Threshold Values (Water Framework Directive) (England & Wales) Directions 2010

UK DWS UK Drinking Water Standards "The Water Supply (Water Quality) Regulations 2000"

WHO World Health Organisation Guidelines

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Analytical Report Number : 23-73918

Replaces Analytical Report Number: 23-73918, issue no. 1
Additional analysis undertaken.
Quantification added to positive sample as per client's requested.

Project / Site name:	New Street, Cheltenham	Samples received on:	08/12/2023
Your job number:	5254	Samples instructed on/ Analysis started on:	08/12/2023
Your order number:	5254-DB	Analysis completed by:	27/12/2023
Report Issue Number:	2	Report issued on:	27/12/2023
Samples Analysed:	1 leachate sample - 6 soil samples		

Signed:

Dominika Liana
Junior Reporting Specialist
For & on behalf of i2 Analytical Ltd.

Standard Geotechnical, Asbestos and Chemical Testing Laboratory located at: ul. Pionierów 39, 41-711 Ruda Śląska, Poland.

Accredited tests are defined within the report, opinions and interpretations expressed herein are outside the scope of accreditation.

Standard sample disposal times, unless otherwise agreed with the laboratory, are :

soils	- 4 weeks from reporting
leachates	- 2 weeks from reporting
waters	- 2 weeks from reporting
asbestos	- 6 months from reporting

Excel copies of reports are only valid when accompanied by this PDF certificate.

Any assessments of compliance with specifications are based on actual analytical results with no contribution from uncertainty of measurement.
Application of uncertainty of measurement would provide a range within which the true result lies.
An estimate of measurement uncertainty can be provided on request.

Analytical Report Number: 23-73918
Project / Site name: New Street, Cheltenham
Your Order No: 5254-DB

Lab Sample Number				2905232	2905233	2905234	2905235	2905236
Sample Reference				WS1	WS2	WS3	HP1	HP1
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.10-0.30	1.00-1.20	0.20-0.40	0.40-0.50	0.70-0.80
Date Sampled				07/12/2023	07/12/2023	07/12/2023	07/12/2023	07/12/2023
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
Stone Content	%	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Moisture Content	%	0.01	NONE	5.9	6.2	14	12	3.4
Total mass of sample received	kg	0.001	NONE	0.5	0.5	0.6	0.6	0.7
Asbestos in Soil Screen / Identification Name	Type	N/A	ISO 17025	-	-	-	Chrysotile	-
Asbestos in Soil	Type	N/A	ISO 17025	Not-detected	-	Not-detected	Detected	-
Asbestos Quantification (Stage 2)	%	0.001	ISO 17025	-	-	-	0.004	-
Asbestos Quantification Total	%	0.001	ISO 17025	-	-	-	0.004	-
Asbestos Analyst ID	N/A	N/A	N/A	DSA	N/A	DSA	DSA	N/A
General Inorganics								
pH - Automated	pH Units	N/A	MCERTS	8.4	8.2	8.2	8.6	8
Organic Matter (automated)	%	0.1	MCERTS	-	-	-	3.6	0.6
Speciated PAHs								
Naphthalene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	0.07	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Fluorene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Phenanthrene	mg/kg	0.05	MCERTS	0.07	< 0.05	< 0.05	0.59	< 0.05
Anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	0.17	< 0.05
Fluoranthene	mg/kg	0.05	MCERTS	0.13	< 0.05	< 0.05	1.7	< 0.05
Pyrene	mg/kg	0.05	MCERTS	0.1	< 0.05	< 0.05	1.6	< 0.05
Benzo(a)anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	0.95	< 0.05
Chrysene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	0.83	< 0.05
Benzo(b)fluoranthene	mg/kg	0.05	ISO 17025	< 0.05	< 0.05	< 0.05	1.2	< 0.05
Benzo(k)fluoranthene	mg/kg	0.05	ISO 17025	< 0.05	< 0.05	< 0.05	0.41	< 0.05
Benzo(a)pyrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	0.86	< 0.05
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	0.55	< 0.05
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	0.12	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	0.58	< 0.05
Total PAH								
Speciated Total EPA-16 PAHs	mg/kg	0.8	ISO 17025	< 0.80	< 0.80	< 0.80	9.54	< 0.80

Analytical Report Number: 23-73918
Project / Site name: New Street, Cheltenham
Your Order No: 5254-DB

Lab Sample Number				2905232	2905233	2905234	2905235	2905236
Sample Reference				WS1	WS2	WS3	HP1	HP1
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.10-0.30	1.00-1.20	0.20-0.40	0.40-0.50	0.70-0.80
Date Sampled				07/12/2023	07/12/2023	07/12/2023	07/12/2023	07/12/2023
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
Heavy Metals / Metalloids								
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	12	9.2	9.9	30	7.4
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	< 0.2	0.5	< 0.2	< 0.2
Chromium (hexavalent)	mg/kg	1.2	NONE	< 1.2	< 1.2	< 1.2	< 1.2	< 1.2
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	11	12	10	17	7.1
Copper (aqua regia extractable)	mg/kg	1	MCERTS	5.2	12	19	74	11
Lead (aqua regia extractable)	mg/kg	1	MCERTS	5.4	5.8	47	170	15
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	< 0.3	0.4	1	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	10	12	11	22	7.5
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	37	30	110	230	39
Monoaromatics & Oxygenates								
Benzene	µg/kg	5	MCERTS	< 5.0	-	-	-	< 5.0
Toluene	µg/kg	5	MCERTS	< 5.0	-	-	-	< 5.0
Ethylbenzene	µg/kg	5	MCERTS	< 5.0	-	-	-	< 5.0
p & m-xylene	µg/kg	5	MCERTS	< 5.0	-	-	-	< 5.0
o-xylene	µg/kg	5	MCERTS	< 5.0	-	-	-	< 5.0
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	5	NONE	< 5.0	-	-	-	< 5.0
Petroleum Hydrocarbons								
TPH-CWG - Aliphatic >EC5 - EC6 $_{HS\_1D\_AL}$	mg/kg	0.02	NONE	< 0.020	-	-	-	< 0.020
TPH-CWG - Aliphatic >EC6 - EC8 $_{HS\_1D\_AL}$	mg/kg	0.02	NONE	< 0.020	-	-	-	< 0.020
TPH-CWG - Aliphatic >EC8 - EC10 $_{HS\_1D\_AL}$	mg/kg	0.05	NONE	< 0.050	-	-	-	< 0.050
TPH-CWG - Aliphatic >EC10 - EC12 $_{EH\_CU\_1D\_AL}$	mg/kg	1	MCERTS	< 1.0	-	-	-	< 1.0
TPH-CWG - Aliphatic >EC12 - EC16 $_{EH\_CU\_1D\_AL}$	mg/kg	2	MCERTS	< 2.0	-	-	-	< 2.0
TPH-CWG - Aliphatic >EC16 - EC21 $_{EH\_CU\_1D\_AL}$	mg/kg	8	MCERTS	< 8.0	-	-	-	< 8.0
TPH-CWG - Aliphatic >EC21 - EC35 $_{EH\_CU\_1D\_AL}$	mg/kg	8	MCERTS	< 8.0	-	-	-	< 8.0
TPH-CWG - Aliphatic (EC5 - EC35) $_{EH\_CU+HS\_1D\_AL}$	mg/kg	10	NONE	< 10	-	-	-	< 10
TPH-CWG - Aromatic >EC5 - EC7 $_{HS\_1D\_AR}$	mg/kg	0.01	NONE	< 0.010	-	-	-	< 0.010
TPH-CWG - Aromatic >EC7 - EC8 $_{HS\_1D\_AR}$	mg/kg	0.01	NONE	< 0.010	-	-	-	< 0.010
TPH-CWG - Aromatic >EC8 - EC10 $_{HS\_1D\_AR}$	mg/kg	0.05	NONE	< 0.050	-	-	-	< 0.050
TPH-CWG - Aromatic >EC10 - EC12 $_{EH\_CU\_1D\_AR}$	mg/kg	1	MCERTS	< 1.0	-	-	-	< 1.0
TPH-CWG - Aromatic >EC12 - EC16 $_{EH\_CU\_1D\_AR}$	mg/kg	2	MCERTS	< 2.0	-	-	-	< 2.0
TPH-CWG - Aromatic >EC16 - EC21 $_{EH\_CU\_1D\_AR}$	mg/kg	10	MCERTS	< 10	-	-	-	< 10
TPH-CWG - Aromatic >EC21 - EC35 $_{EH\_CU\_1D\_AR}$	mg/kg	10	MCERTS	< 10	-	-	-	< 10
TPH-CWG - Aromatic (EC5 - EC35) $_{EH\_CU+HS\_1D\_AR}$	mg/kg	10	NONE	< 10	-	-	-	< 10
TPH Texas (C6 - C8) $_{HS\_1D\_TOTAL}$	mg/kg	1	NONE	-	< 1.0	< 1.0	< 1.0	-
TPH Texas (C8 - C10) $_{HS\_1D\_TOTAL}$	mg/kg	1	NONE	-	< 1.0	< 1.0	< 1.0	-
TPH Texas (C10 - C12) $_{EH\_CU\_1D\_TOTAL}$	mg/kg	1	MCERTS	-	< 1.0	< 1.0	4.9	-
TPH Texas (C12 - C16) $_{EH\_CU\_1D\_TOTAL}$	mg/kg	4	MCERTS	-	< 4.0	< 4.0	< 4.0	-
TPH Texas (C16 - C21) $_{EH\_CU\_1D\_TOTAL}$	mg/kg	10	MCERTS	-	< 10	< 10	< 10	-
TPH Texas (C21 - C40) $_{EH\_CU\_1D\_TOTAL}$	mg/kg	10	MCERTS	-	< 10	< 10	54	-
TPH Texas (C6 - C40) $_{EH\_CU+HS\_1D\_TOTAL}$	mg/kg	10	NONE	-	19	< 10	69	-

U/S = Unsuitable Sample I/S = Insufficient Sample ND = Not detected

Analytical Report Number: 23-73918
Project / Site name: New Street, Cheltenham
Your Order No: 5254-DB

Lab Sample Number				2905237
Sample Reference				HP2
Sample Number				None Supplied
Depth (m)				0.40-0.65
Date Sampled				07/12/2023
Time Taken				None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status	
Stone Content	%	0.1	NONE	< 0.1
Moisture Content	%	0.01	NONE	11
Total mass of sample received	kg	0.001	NONE	0.6

Asbestos in Soil Screen / Identification Name	Type	N/A	ISO 17025	-
Asbestos in Soil	Type	N/A	ISO 17025	Not-detected
Asbestos Quantification (Stage 2)	%	0.001	ISO 17025	-
Asbestos Quantification Total	%	0.001	ISO 17025	-
Asbestos Analyst ID	N/A	N/A	N/A	DSA

General Inorganics

pH - Automated	pH Units	N/A	MCERTS	9.1
Organic Matter (automated)	%	0.1	MCERTS	-

Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	0.1
Acenaphthylene	mg/kg	0.05	MCERTS	0.12
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05
Fluorene	mg/kg	0.05	MCERTS	0.05
Phenanthrene	mg/kg	0.05	MCERTS	1.1
Anthracene	mg/kg	0.05	MCERTS	0.28
Fluoranthene	mg/kg	0.05	MCERTS	3.3
Pyrene	mg/kg	0.05	MCERTS	3.2
Benzo(a)anthracene	mg/kg	0.05	MCERTS	1.7
Chrysene	mg/kg	0.05	MCERTS	1.5
Benzo(b)fluoranthene	mg/kg	0.05	ISO 17025	2
Benzo(k)fluoranthene	mg/kg	0.05	ISO 17025	0.91
Benzo(a)pyrene	mg/kg	0.05	MCERTS	1.7
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	0.95
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	0.21
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	1.1

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	ISO 17025	18.1

Analytical Report Number: 23-73918
Project / Site name: New Street, Cheltenham
Your Order No: 5254-DB

Lab Sample Number				2905237
Sample Reference				HP2
Sample Number				None Supplied
Depth (m)				0.40-0.65
Date Sampled				07/12/2023
Time Taken				None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status	
Heavy Metals / Metalloids				
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	26
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	1.5
Chromium (hexavalent)	mg/kg	1.2	NONE	< 1.2
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	16
Copper (aqua regia extractable)	mg/kg	1	MCERTS	63
Lead (aqua regia extractable)	mg/kg	1	MCERTS	220
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	1.5
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	22
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	410
Monoaromatics & Oxygenates				
Benzene	µg/kg	5	MCERTS	-
Toluene	µg/kg	5	MCERTS	-
Ethylbenzene	µg/kg	5	MCERTS	-
p & m-xylene	µg/kg	5	MCERTS	-
o-xylene	µg/kg	5	MCERTS	-
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	5	NONE	-
Petroleum Hydrocarbons				
TPH-CWG - Aliphatic >EC5 - EC6 $_{HS\_1D\_AL}$	mg/kg	0.02	NONE	-
TPH-CWG - Aliphatic >EC6 - EC8 $_{HS\_1D\_AL}$	mg/kg	0.02	NONE	-
TPH-CWG - Aliphatic >EC8 - EC10 $_{HS\_1D\_AL}$	mg/kg	0.05	NONE	-
TPH-CWG - Aliphatic >EC10 - EC12 $_{EH\_CU\_1D\_AL}$	mg/kg	1	MCERTS	-
TPH-CWG - Aliphatic >EC12 - EC16 $_{EH\_CU\_1D\_AL}$	mg/kg	2	MCERTS	-
TPH-CWG - Aliphatic >EC16 - EC21 $_{EH\_CU\_1D\_AL}$	mg/kg	8	MCERTS	-
TPH-CWG - Aliphatic >EC21 - EC35 $_{EH\_CU\_1D\_AL}$	mg/kg	8	MCERTS	-
TPH-CWG - Aliphatic (EC5 - EC35) $_{EH\_CU+HS\_1D\_AL}$	mg/kg	10	NONE	-
TPH-CWG - Aromatic >EC5 - EC7 $_{HS\_1D\_AR}$	mg/kg	0.01	NONE	-
TPH-CWG - Aromatic >EC7 - EC8 $_{HS\_1D\_AR}$	mg/kg	0.01	NONE	-
TPH-CWG - Aromatic >EC8 - EC10 $_{HS\_1D\_AR}$	mg/kg	0.05	NONE	-
TPH-CWG - Aromatic >EC10 - EC12 $_{EH\_CU\_1D\_AR}$	mg/kg	1	MCERTS	-
TPH-CWG - Aromatic >EC12 - EC16 $_{EH\_CU\_1D\_AR}$	mg/kg	2	MCERTS	-
TPH-CWG - Aromatic >EC16 - EC21 $_{EH\_CU\_1D\_AR}$	mg/kg	10	MCERTS	-
TPH-CWG - Aromatic >EC21 - EC35 $_{EH\_CU\_1D\_AR}$	mg/kg	10	MCERTS	-
TPH-CWG - Aromatic (EC5 - EC35) $_{EH\_CU+HS\_1D\_AR}$	mg/kg	10	NONE	-
TPH Texas (C6 - C8) $_{HS\_1D\_TOTAL}$	mg/kg	1	NONE	< 1.0
TPH Texas (C8 - C10) $_{HS\_1D\_TOTAL}$	mg/kg	1	NONE	< 1.0
TPH Texas (C10 - C12) $_{EH\_CU\_1D\_TOTAL}$	mg/kg	1	MCERTS	< 1.0
TPH Texas (C12 - C16) $_{EH\_CU\_1D\_TOTAL}$	mg/kg	4	MCERTS	< 4.0
TPH Texas (C16 - C21) $_{EH\_CU\_1D\_TOTAL}$	mg/kg	10	MCERTS	12
TPH Texas (C21 - C40) $_{EH\_CU\_1D\_TOTAL}$	mg/kg	10	MCERTS	37
TPH Texas (C6 - C40) $_{EH\_CU+HS\_1D\_TOTAL}$	mg/kg	10	NONE	50

U/S = Unsuitable Sample I/S = Insufficient Sample ND = Not detected

Analytical Report Number: 23-73918
Project / Site name: New Street, Cheltenham
Your Order No: 5254-DB

Certificate of Analysis - Asbestos Quantification

Methods:

Qualitative Analysis

The samples were analysed qualitatively for asbestos by polarising light and dispersion staining as described by the Health and Safety Executive in HSG 248.

Quantitative Analysis

The analysis was carried out using our documented in-house method A006-PL based on HSE Contract Research Report No: 83/1996: Development and Validation of an analytical method to determine the amount of asbestos in soils and loose aggregates (Davies et al, 1996) and HSG 248. Our method includes initial examination of the entire representative sample, then fractionation and detailed analysis of each fraction, with quantification by hand picking and weighing.

The limit of detection (reporting limit) of this method is 0.001 %.

The method has been validated using samples of at least 100 g, results for samples smaller than this should be interpreted with caution.

Both Qualitative and Quantitative Analyses are UKAS accredited.

Sample Number	Sample ID	Sample Depth (m)	Sample Weight (g)	Asbestos Containing Material Types Detected (ACM)	PLM Results	Asbestos by hand picking/weighing (%)	Total % Asbestos in Sample
2905235	HP1	0.40-0.50	109	Asbestos Cement	Chrysotile	0.004	0.004

Opinions and interpretations expressed herein are outside the scope of UKAS accreditation.

Analytical Report Number: 23-73918
Project / Site name: New Street, Cheltenham

Your Order No: 5254-DB

Lab Sample Number				2905238
Sample Reference				HP1
Sample Number				None Supplied
Depth (m)				0.50-0.50
Date Sampled				07/12/2023
Time Taken				None Supplied
Analytical Parameter (Leachate Analysis)	Units	Limit of detection	Accreditation Status	
Speciated PAHs				
Naphthalene	µg/l	0.01	NONE	< 0.01
Acenaphthylene	µg/l	0.01	NONE	< 0.01
Acenaphthene	µg/l	0.01	NONE	< 0.01
Fluorene	µg/l	0.01	NONE	< 0.01
Phenanthrene	µg/l	0.01	NONE	< 0.01
Anthracene	µg/l	0.01	NONE	< 0.01
Fluoranthene	µg/l	0.01	NONE	< 0.01
Pyrene	µg/l	0.01	NONE	< 0.01
Benzo(a)anthracene	µg/l	0.01	NONE	< 0.01
Chrysene	µg/l	0.01	NONE	< 0.01
Benzo(b)fluoranthene	µg/l	0.01	NONE	< 0.01
Benzo(k)fluoranthene	µg/l	0.01	NONE	< 0.01
Benzo(a)pyrene	µg/l	0.01	NONE	< 0.01
Indeno(1,2,3-cd)pyrene	µg/l	0.01	NONE	< 0.01
Dibenz(a,h)anthracene	µg/l	0.01	NONE	< 0.01
Benzo(ghi)perylene	µg/l	0.01	NONE	< 0.01
Total PAH				
Total EPA-16 PAHs	µg/l	0.2	NONE	< 0.2
Heavy Metals / Metalloids				
Arsenic (dissolved)	µg/l	1	ISO 17025	15
Boron (dissolved)	µg/l	10	ISO 17025	47
Cadmium (dissolved)	µg/l	0.08	ISO 17025	< 0.08
Chromium (hexavalent)	µg/l	5	ISO 17025	6.3
Chromium (dissolved)	µg/l	0.4	ISO 17025	6.8
Copper (dissolved)	µg/l	0.7	ISO 17025	3.8
Lead (dissolved)	µg/l	1	ISO 17025	< 1.0
Mercury (dissolved)	µg/l	0.5	ISO 17025	< 0.5
Nickel (dissolved)	µg/l	0.3	ISO 17025	0.5
Selenium (dissolved)	µg/l	4	ISO 17025	< 4.0
Zinc (dissolved)	µg/l	0.4	ISO 17025	53

U/S = Unsuitable Sample I/S = Insufficient Sample ND = Not detected

Analytical Report Number : 23-73918
Project / Site name: New Street, Cheltenham

* These descriptions are only intended to act as a cross check if sample identities are questioned. The major constituent of the sample is intended to act with respect to MCERTS validation. The laboratory is accredited for sand, clay and loam (MCERTS) soil types. Data for unaccredited types of solid should be interpreted with care.

Stone content of a sample is calculated as the % weight of the stones not passing a 10 mm sieve. Results are not corrected for stone content.

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
2905232	WS1	None Supplied	0.10-0.30	Brown gravelly sand.
2905233	WS2	None Supplied	1.00-1.20	Brown gravelly sand.
2905234	WS3	None Supplied	0.20-0.40	Brown gravelly sand.
2905235	HP1	None Supplied	0.40-0.50	Brown loam and sand with gravel and vegetation.
2905236	HP1	None Supplied	0.70-0.80	Brown sand.
2905237	HP2	None Supplied	0.40-0.65	Brown loam and sand with gravel.

Analytical Report Number : 23-73918
Project / Site name: New Street, Cheltenham

Water matrix abbreviations:
Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters (PrW) Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Metals in soil by ICP-OES	Determination of metals in soil by aqua-regia digestion followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L038-PL	D	MCERTS
NRA Leachate Prep	10:1 extract with de-ionised water shaken for 24 hours then filtered.	In-house method based on National Rivers Authority	L020-PL	W	NONE
Asbestos identification in soil	Asbestos Identification with the use of polarised light microscopy in conjunction with dispersion staining techniques.	In house method based on HSG 248	A001-PL	D	ISO 17025
Metals by ICP-OES in leachate	Determination of metals in leachate by acidification followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L039-PL	W	ISO 17025
Boron in leachate	Determination of boron in leachate. Sample acidified and followed by ICP-OES.	In-house method based on MEWAM	L039-PL	W	ISO 17025
Hexavalent chromium in leachate	Determination of hexavalent chromium in leachate by acidification, addition of 1,5 diphenylcarbazide followed by colorimetry.	In-house method	L080-PL	W	ISO 17025
Moisture Content	Moisture content, determined gravimetrically. (30 oC)	In house method.	L019-UK/PL	W	NONE
Speciated EPA-16 PAHs in leachate	Determination of PAH compounds in leachate by extraction in dichloromethane followed by GC-MS with the use of surrogate and internal standards.	In-house method based on USEPA 8270	L102B-PL	W	NONE
Speciated EPA-16 PAHs in soil	Determination of PAH compounds in soil by extraction in dichloromethane and hexane followed by GC-MS with the use of surrogate and internal standards. Refer to CoA for analyte specific accreditation.	In-house method based on USEPA 8270	L064-PL	D	MCERTS
pH in soil (automated)	Determination of pH in soil by addition of water followed by automated electrometric measurement.	In house method.	L099-PL	D	MCERTS
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight.	In-house method based on British Standard Methods and MCERTS requirements.	L019-UK/PL	D	NONE
TPH Texas (Soil)	TPH Texas bands C6-C10 by HS/GC-MS & C10-C40 (SPE) by GC-FID	In-house method	L088/L076	D	MCERTS
BTEX and MTBE in soil (Monoaromatics)	Determination of BTEX in soil by headspace GC-MS. Individual components MCERTS accredited	In-house method based on USEPA8260. Refer to CoA for analyte specific accreditation	L073B-PL	W	MCERTS
TPHCWG (Soil)	Determination of hexane extractable hydrocarbons in soil by GC-MS/GC-FID. Refer to CoA for band specific accreditation.	In-house method with silica gel split/clean up.	L088/76-PL	D	MCERTS
Asbestos Quantification - Gravimetric	Asbestos quantification by gravimetric method - in house method based on references.	HSE Report No: 83/1996, HSG 248, HSG 264 & SCA Blue Book (draft).	A006-PL	D	ISO 17025
Organic matter (Automated) in soil	Determination of organic matter in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate.	In house method.	L009-PL	D	MCERTS

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Water matrix abbreviations:
Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters (PrW) Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Hexavalent chromium in soil (Lower Level)	Determination of hexavalent chromium in soil by extraction in water then by acidification, addition of 1,5 diphenylcarbazide followed by colorimetry.	In-house method by continuous flow analyser.	L080-PL	W	NONE

For method numbers ending in 'UK or A' analysis have been carried out in our laboratory in the United Kingdom (WATFORD).
For method numbers ending in 'F' analysis have been carried out in our laboratory in the United Kingdom (East Kilbride).
For method numbers ending in 'PL or B' analysis have been carried out in our laboratory in Poland.
Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.
Unless otherwise indicated, site information, order number, project number, sampling date, time, sample reference and depth are provided by the client. The instructed on date indicates the date on which this information was provided to the laboratory.

Information in Support of Analytical Results

List of HWOL Acronyms and Operators

Acronym	Descriptions
HS	Headspace Analysis
MS	Mass spectrometry
FID	Flame Ionisation Detector
GC	Gas Chromatography
EH	Extractable Hydrocarbons (i.e. everything extracted by the solvent(s))
CU	Clean-up - e.g. by Florisil®, silica gel
1D	GC - Single coil/column gas chromatography
2D	GC-GC - Double coil/column gas chromatography
Total	Aliphatics & Aromatics
AL	Aliphatics
AR	Aromatics
#1	EH_2D_Total but with humics mathematically subtracted
#2	EH_2D_Total but with fatty acids mathematically subtracted
_	Operator - understore to separate acronyms (exception for +)
+	Operator to indicate cumulative e.g. EH+HS_Total or EH_CU+HS_Total

Sample Deviation Report

Analytical Report Number : 23-73918
Project / Site name: New Street, Cheltenham

This deviation report indicates the sample and test deviations that apply to the samples submitted for analysis.Please note that the associated result(s) may be unreliable and should be interpreted with care.

Key: a - No sampling date b - Incorrect container c - Holding time d - Headspace e - Temperature

Sample ID	Other ID	Sample Type	Lab Sample Number	Sample Deviation	Test Name	Test Ref	Test Deviation
HP1	None Supplied	S	2905236	b	BTEX and MTBE in soil (Monoaromatics)	L073B-PL	b
HP1	None Supplied	S	2905236	b	TPHCWG (Soil)	L088/76-PL	b
WS1	None Supplied	S	2905232	b	BTEX and MTBE in soil (Monoaromatics)	L073B-PL	b
WS1	None Supplied	S	2905232	b	TPHCWG (Soil)	L088/76-PL	b