



Detailed Quantitative Risk Assessment and Remediation Strategy

Former Ickleford Mill, Arlesey Road, Ickleford, SG5 3UN

For Hill Partnership Ltd

CRM.1027.189.GE.R.002.A



Contact Details:

Enzygo Geoenvironmental Ltd
168 Cowley Road
Cambridge
CB4 0DL

Tel: 01799 809804
www: enzygo.com

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Author:	Radu-Mihai Ilie MSc PhD FGS - Senior Geoenvironmental Consultant
Reviewer:	Jeff Widd MSc ARSM FGS — Associated Director

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1.0 Introduction

1.1 Background

- 1.1.1 Enzygo Geoenvironmental Limited has been commissioned by Hill Partnerships Ltd to prepare a Site-Specific Controlled Waters Detailed Quantitative Risk Assessment (DQRA) and remediation strategy for land at the former Ickleford Mill, Arlesey Road, Ickleford, SG5 3UN.
- 1.1.2 This report follows previous phases of land contamination assessments and ground investigations at the site, as follows:
- WSP 2016, Desk study and preliminary risk assessment (ref. 70027704-10670(1), 2016).
 - Groundtech 2020, Ground investigation (report ref 19271/1209, January 2020).
 - Groundtech 2020, Ground gas risk assessment (ref 19271/1341, dated March 2020).
 - Xplor Environmental 2024, Ground investigation and contamination assessment (ref 23030-XPL-XX-XX-T-GO-501, rev C01, April 2024).
 - Enzygo 2024, Ground investigation and geoenvironmental report (ref CRM.1027.189.GE.R.001.A, August 2024)
- 1.1.3 The findings of the previous ground investigations and assessments are summarised in Enzygo Geoenvironmental Report (ref CRM.1027.189.GE.R.001.A, August 2024). The report made recommendations for further risk assessment for the protection of controlled water receptors (groundwater and the River Oughton).
- 1.1.4 This report presents the results of an additional targeted ground investigation to delineate the extent of contaminated soils and groundwater identified by the previous investigations, and supplementary risk assessment.

1.2 Proposed Development

- 1.2.1 The proposed development comprises residential use consisting of houses and apartments. The proposed development layout is incorporated into the site plan presented as Drawing 1.

1.3 Objectives

- 1.3.1 The objectives of this report are as follows:
- Undertake an additional targeted ground investigation to delineate the extent of ground contamination identified during the previous investigations, associated with three source areas, and to assess the impact on soil and groundwater.
 - Derive suitable risk-based remedial target concentrations for the contaminants of concern, comprising banded total petroleum hydrocarbons (TPH) and polycyclic aromatic hydrocarbons (PAH) compounds in soils which meet current Environmental Quality Standard (EQS) Directive 2008/105/EC and Priority Substances Directive 2013/39/EU.
 - Identify existing concentrations of selected PAHs and petroleum hydrocarbons at a modelled Compliance Point (CP); which can be compared to the risk-based remedial targets, with any exceedances to be remediated as part of the site development works.
 - The risk-based target values can be used with a remedial methodology to address the areas of contamination identified during the investigations.

- 1.3.2 A remediation strategy has been prepared based on the outcome of the previous ground investigations and risk assessment considering the latest ground investigation data. The remediation strategy for the site is outlined in Section 8.

2.0 Site Setting

2.1 Introduction

2.1.1 The site comprises the former Bowman's Mill to the north of the River Oughton, and a strip of managed grassland in the south. The mill included various vacant buildings and large silos, with external yards, parking and roads surfaced with concrete.

2.1.2 The previous ground investigations and assessments identified the following sources of ground contamination at the site which are the subject of this assessment:

Source area 1 – Formerly occupied by a mobile compressor unit, located adjacent to the southwest corner of Building 41 (warehouse) and contained a disused mobile compressor unit. Staining of the concrete ground and a residue of oily sand used as an absorbent were visible at surface. The area was previously targeted by exploratory holes WS09, WS10 and WS11 (Groundtech, 2020) with total petroleum hydrocarbon (TPH) contamination of the shallow soil. One groundwater monitoring well was installed, WS101 (Xplor, 2024) to the west of the source area identified low concentration of TPH.

Source area 2 - Former tank/boiler-related hotspot previously targeted by WS17 (Groundtech, 2020).

Source area 3 – Made Ground associated with historical infilling of the former mill race and pond, previously identified as a potential source of ground gases (WS107 – Enzygo, 2024).

2.1.3 The potential receptors at the site comprise:

- Human receptors comprise future site end users associated with the proposed residential development and groundworkers during construction.
- Building materials and below ground utilities, including potable water supply pipes.
- Planting in areas of future soft landscaping.

Controlled waters:

- The River Oughton passing through the central part of the site with flow to the east. It is assumed that the river is hydraulically connected to the shallow groundwater.
- Shallow groundwater within the Secondary A aquifer superficial deposits of the Alluvium and Glaciofluvial Deposits, which overlie Lowestoft Formation (boulder clay) and Gault Formation (unproductive strata) at depth.

2.1.4 The following potential contaminant pathways have been identified:

- Direct human contact with soil and/or dust during construction and within soft landscaping areas.
- Vapour migration through permeable strata into overlying proposed buildings and human exposure via vapour inhalation.
- Potential service pathway interactions (including potable water pipe permeation risk in hydrocarbon-impacted soils).

Controlled waters:

- Leaching of contaminants from soil to shallow groundwater.

- Lateral migration of dissolved phase and non-aqueous phase liquids (NAPL) contaminants in groundwater towards the river.
- 2.1.5 The above-mentioned source-pathway-receptor linkages informed the design of the targeted supplementary investigation and the subsequent detailed quantitative risk assessment presented in this report.

2.2 Baseline Conditions

- 2.2.1 Previous ground investigation identified elevated concentrations of individual polyaromatic hydrocarbons (PAH) and TPH in soil and groundwater associated with the contamination source areas summarised in Section 2.1. However, the extent of the investigation was limited and further investigation to delineate the plume and confirm contaminant trends was recommended. In addition, asbestos fibres were detected in the Made Ground soil.
- 2.2.2 The previous investigations confirmed the ground conditions as comprising variable thicknesses of Made Ground (up to 2.80m) over Alluvium, Glaciofluvial deposits and Lowestoft Formation. The Made Ground comprised granular subbase beneath hardstanding at the location of most exploratory holes. Details of the ground conditions are presented in Table 1.

Table 1 – Summary of Ground Conditions

Strata	Summary Description	Thickness (m)
Made Ground	Concrete (0.14m to 0.48m thick) or asphalt (0.05m thick) locally over ballast/crushed brick and concrete (subbase materials) (0.15 to 0.40m thick)	0.15 to 0.8
	Brown clayey gravelly SAND. Gravel is angular to rounded fine to coarse flint and concrete. Or firm brown slightly gravelly sandy CLAY. Gravel is subangular to rounded fine to coarse brick and concrete.	0.15 to 0.30
Deep Made Ground	Brown slightly gravelly clayey medium SAND. Gravel is angular to subangular concrete and flint. Locally soft brown sandy gravelly CLAY with anthropogenic materials.	1.75 to 2.8
Made Ground – Existing soft landscaping areas.	Grass over brown slightly gravelly clayey medium SAND. Gravel is angular to subangular concrete and flint	2.00
Alluvium	Very soft greyish brown clayey gravelly SILT (WS109)	>6.0
	Very soft and soft locally firm with depth dark grey and brown slightly sandy slightly gravelly silty CLAY. Sand is fine to coarse. Gravel is angular and rounded fine to coarse flint.	1.1 to 5.0
	Medium dense locally dense with depth orangish brown clayey gravelly SAND. Gravel is angular and rounded fine to coarse flint.	0.4 to 1.2
Glaciofluvial Deposits (WS110, WS112, 114, WS115)	Medium dense to dense orangish brown clayey sandy GRAVEL. Sand is medium to coarse. Gravel is angular and rounded fine to coarse flint.	0.7 to >1.0
Lowestoft Formation	Firm becoming stiff and very stiff dark grey slightly sandy slightly gravelly silty CLAY. Sand is fine to coarse. Gravel is angular to subangular and subrounded fine to coarse chalk and flint.	>19.5
Groundwater.	Shallow Seepages.	1.4mbgl to 3.0m bgl
	Deep seepage in superficial deposits.	13.5m bgl to 14.1mbgl

- 2.2.3 Groundwater was encountered at 1.40m to 3.00mbgl in the shallow boreholes associated with perched water in the Made Ground and Alluvium. Groundwater seepages were detected at

depth of 13.5m to 14.1mbgl in the Lowestoft Formation. The hydraulic gradient was inferred towards the south and south-east towards the river.

- 2.2.4 No significant visual or olfactory evidence of contamination was encountered during the investigation completed by Enzygo Geoenvironmental Ltd in 2024. However, the previous investigations have identified faint hydrocarbons odours around the former tank positions.
- 2.2.5 The laboratory analysis of soil and groundwater samples that were obtained recorded the presence of elevated PAH and TPH concentrations in the soil and groundwater.

3.0 Supplementary Ground Investigation

3.1 General

- 3.1.1 The additional targeted ground investigation and site-specific risk assessment have been completed to better define the extent and quality of soil and groundwater contamination associated with the previously identified contamination sources:
- **Source area 1** – Formerly occupied by a mobile compressor unit and spillage (WS09, WS10 and WS11 – Groundtech, 2020).
 - **Source area 2** - Former tank/boiler-related hotspot (WS17 – Groundtech, 2020).
 - **Source area 3** – Made Ground associated with historical infilling of the former mill race and pond (WS107 – Xplor, 2024).
- 3.1.2 The supplementary ground investigation was undertaken between 10th and 19th November 2025 comprising:
- Five window sample boreholes (WS201 to WS205) to depths in the range of 2.7m to 5.5m below ground level (bgl), with groundwater monitoring installations in each borehole.
 - Five trial pits and TP1 to TP5 to depth in the range of 1.3m to 2.5m bgl. TP1, TP2 and TP3 were targeted to the infilled former mill race (source area 3) and TP4 and TP5 to source area 1.
 - One return ground gas and groundwater monitoring and sampling visit undertaken on the 18 and 19 November 2025. Monitoring occurred from WS201 – WS205 and four existing installations (Table 3). Monitoring including dipping groundwater level and use of interface probe. Ground water was sampled using low-flow methods following purging of the wells.
- 3.1.3 Exploratory holes were located around previously identified contamination sources areas. WS202, WS204 and WS205 had to be repositioned several metres downgradient from their original positions due to the excessive thickness of the concrete encountered. Locations of exploratory holes are presented on Drawing 2.
- 3.1.4 Representative soil samples were collected for chemical testing. Soil samples destined for chemical analysis were collected in appropriate containers provided by the analytical laboratory. Samples were stored in cool boxes prior to dispatch to the laboratory for analysis. All samples were collected using appropriate sampling equipment that was cleaned at each sampling location.
- 3.1.5 In general, samples were collected from Made Ground, which may contain potential inclusions of anthropogenic materials and also materials displaying evidence of potential contamination, as described in Section 4.2.
- 3.1.6 A return visits was undertaken to monitor standpipes for groundwater and ground gas. This was completed in addition to the 9no. ground gas monitoring visits completed between 2019 and 2024.

3.2 Laboratory Testing

- 3.2.1 Samples for chemical analysis were sent to the laboratory of Eurofins who are UKAS and MCERTS accredited. The following analysis was completed:

- 11 soil samples were tested for PAHs (speciated – USEPA 16), TPH CWG and BTEX and MTBE suites. Two samples from TP1 (1.10-1.80m) and TP3 (2.00-2.30m) were also tested for leachate PAHs.
- Nine groundwater samples were tested for a suite of commonly occurring contaminants, including metals and metalloids, nitrate, sulphate, chloride, hydrogen sulphide, methane, carbon dioxide, alkalinity, electric conductivity, speciated TPH with Criteria Working Group (CWG) banding, BTEX and MTBE, Total Organic Carbon and Chemical Oxygen Demand.

3.2.2 The laboratory reports are included in Appendix 3.

4.0 Ground and Groundwater Conditions

4.1 Ground Conditions

4.1.1 Ground conditions encountered by the Enzygo 2025 supplementary ground investigation are summarised in Table 2.

Table 2 Summary of Ground Conditions (Enzygo, 2025)

Strata	Summary Description	Thickness (m)
Made Ground	Concrete (0.14m to 0.5m thick) or asphalt (0.05m thick) locally over ballast/crushed brick and concrete (subbase materials) (0.15 to 0.40m thick)	0.20 to 0.60
	Brown clayey gravelly SAND. Gravel is angular to rounded fine to coarse flint and concrete. Or firm brown slightly gravelly sandy CLAY. Gravel is subangular to rounded fine to coarse brick and concrete.	0.50 to 1.90
Alluvium	Greenish grey mottled black and dark brown silty CLAY.	1.60
	Light grey to yellowish brown silty SAND and GRAVEL. Gravel is angular and rounded fine to coarse flint. Sand is fine to medium.	1.1 to 5.0
	Brown mottled dark brown to light grey SILT with organic matter.	0.40 to 2.20
Groundwater.	Shallow Seepages.	1.7mbgl to 3.30m bgl

4.1.2 Perched water was noted in TP5 at 0.5m below ground level.

4.1.3 Groundwater monitoring was undertaken on the following monitoring wells:

Table 3 Monitoring Well Response Zones and Groundwater Depths

Exploratory Hole		Seepage during drilling (m bgl)	Response zone		Groundwater Depth (m bgl)				
			Strata	Depth (m bgl)	23.12.19	31.07.24	6.8.24	13.8.24	18.11.25
WS09 (2019)	Shallow	1.0	Made ground and Alluvium	1.0 – 3.0	0.36	0.9	0.9	1.1	0.863
WS107	Shallow	3.0	Made Ground	2.0 – 3.0		0.51	0.69	0.92	0.655
WS201	Shallow	3.3	Made ground and Alluvium	2.0 – 5.0					0.937
WS202	Shallow	2.6	Made ground and Alluvium	1.0 – 3.0					0.560
WS203	Shallow	3.0	Made ground and Alluvium	2.0 – 5.0					1.003
WS204	Shallow	2.0	Glaciofluvial Deposits	0.5 – 2.5					0.980
WS205	Shallow	3.1	Made ground and Glaciofluvial Deposits	0.5 – 3.5					1.132
BH03	Deep	2.2	Lowestoft Clay	17 - 20		0.7	0.7	0.85	0.990
BH04	Deep	15	Lowestoft Clay	17 - 20		1.31	1.09	1.37	0.572

4.2 Visual and Olfactory Evidence of Contamination

4.2.1 Faint oil odours and sheens were noted in the perched water seepages from TP1, TP3 and TP5. Sulphuric odour noted in TP2 between 0.55m and 2.3m.

4.2.2 No light non-aqueous-phase liquid (LNAPL) was observed in any monitoring well during the 2025 investigation.

Exploratory Hole	Atmos pressure (Mb)	Flow (l/hr)	CH ₄		CO ₂		O ₂
			Concentration (%)	GSV (l/hr)	Concentration (%)	GSV (l/hr)	Concentration (%)
18.11.25							
WS107*	1002 (S)*	<0.10*	39.3*	0.0393*	1.8*	0.0018*	0.3*
WS201	1005 (S)	<0.10	<0.10	<0.0001	0.3	0.0003	19.8
WS202	1002 (S)	<0.10	<0.10	<0.0001	0.2	0.0002	19.6
WS203	1001 (S)	<0.10	<0.10	<0.0001	3.4	0.0034	18.6
WS204	1003 (S)	<0.10	<0.10	<0.0001	<0.10	<0.0001	20.2
WS205	1003 (S)	<0.10	<0.10	<0.0001	0.3	0.0003	19.5
BH03	1003 (S)	<0.10	<0.10	<0.0001	0.3	0.0003	19.5
BH04	1003 (S)	<0.10	<0.10	<0.0001	<0.10	<0.0001	19.6
Notes:							
* WS107 was entirely flooded and the gas concentrations measured in WS107 are not representative for the site conditions *							

5.0 Contamination Risk Assessment

5.1 General

- 5.1.1 An assessment of contamination data from the current and previous investigations has been undertaken. Based on the contamination a revised Conceptual Model has been prepared, which is presented later in this section. Where significant risks are identified remedial measures are recommended. A remediation strategy is provided in Section 8.

5.2 Human Health

- 5.2.1 Assessment of the risks to human health has been undertaken by comparing the soil quality data with reference values obtained from the Contaminated Land Exposure Assessment (CLEA), and Generic Acceptance Criteria (GAC) published by LQM/CIEH. The LQM/CIEH S4ULs values are used and summary tables of the reference values are included in Appendix 3.
- 5.2.2 The proposed development will comprise a residential apartment block along with houses, gardens, hardstanding areas, access roads, car parking, and communal landscaped spaces. The areas to the south and north-west of River Oughton are proposed to be developed as public open space.
- 5.2.3 Based on the proposed end use of the site the GAC values for residential use with plant uptake are used as an initial screening criteria. Within the area of the proposed communal landscaping and apartment block values for residential use without plant uptake are used. For areas proposed to be developed as public open space, the relevant GAC (POS_{resi}) values are used.
- 5.2.4 The soil quality analysis from the previous ground investigations have been compared against relevant GAC values. A summary of the determinands recorded at concentrations above the GAC is presented in Table 5.

Table 5 Summary of contaminants in soil at concentrations above the relevant GAC

Determinand	Exploratory Hole	Concentration (mg/kg) – 1% SOM			
		Max Conc.	Residential GAC		POS _{Resi} GAC
			With plant uptake	Without plant uptake	
TPH (>C ₁₀ -C ₁₂ Aliphatic)	WS09 (1.00mbgl) WS11 (1.00mbgl) WS11 (1.50mbgl)	901.4	130	130	13000
TPH (>C ₁₂ -C ₁₆ Aliphatic)	WS11 (1.50mbgl)	2519	1100	1100	13000
TPH (>C ₁₀ -C ₁₂ Aromatic)	WS107 (0.65mbgl) WS09 (0.50mbgl) WS09 (1.00mbgl) WS11 (1.00mbgl) WS11 (1.50mbgl)	390.7	74	250	5000
TPH (>C ₁₂ -C ₁₆ Aromatic)	WS107 (0.65mbgl) WS09 (0.50mbgl) WS09 (1.00mbgl) WS11 (1.00mbgl) WS11 (1.50mbgl)	1687	140	1800	5100
TPH (>C ₁₆ -C ₂₁ Aromatic)	WS107 (0.65mbgl) BH04 (0.3-0.5mbgl) WS09 (0.50mbgl) WS09 (1.00mbgl) WS11 (1.00mbgl) WS11 (1.50mbgl)	1776	260	1900	3800
Chrysene	BH01 (0.3-0.7mbgl)	17	15	30	57
Benzo(a)anthracene	BH01 (0.3-0.7mbgl) TP1 (2025) (1.10-1.80mbgl)	16	7.2	11	29
Benzo(b)fluoranthene	BH01 (0.3-0.7mbgl) WS02 (1.00mbgl) WS18 (0.50mbgl) WS21 (0.40mbgl) WS28 (0.50mbgl) TP1 (2025) (1.10-1.80mbgl) TP1 (2025) (1.80-2.00mbgl)	19	2.6	3.9	7.1
Benzo(a)pyrene	BH01 (0.3-0.7mbgl) WS02 (1.00mbgl) WS21 (0.40mbgl) TP1 (2025) (1.10-1.80mbgl)	14	2.2	3.2	5.7
Dibenz(a,h)anthracene	WS103(0.40mbgl) WS103A (0.70mbgl) WS02(1.00mbgl) WS21 (0.40mbgl) TP1 (2025) (1.10-1.80mbgl) TP1 (2025) (1.80-2.00mbgl) WS202 (0.20-0.80mbgl) WS203 (0.40-0.80mbgl) WS204 (1.20-1.50mbgl)	1.50	0.24	0.31	0.57

5.2.5 PAHs in soil above the GAC were identified in the Made Ground soil, typically in the upper 1m.

- 5.2.6 TPH in soil above the GAC was identified associated with visual and olfactory evidence of contamination at source area 1 (WS09 and WS11) and source area 3 (WS107).
- 5.2.7 TPH Aliphatic >C₈-C₁₀ and >C₁₀-C₁₂ in groundwater at source are 1 exceeded the GAC_{GWvap}¹ for a residential land use during sampling undertaken in 2020 (see Table 6). However subsequent sampling and testing in 2024 and 2025 revealed low concentrations, below levels posing a potential vapour risk.
- 5.2.8 Loose fibres and clumps of chrysotile and amosite were identified in concentrations between <0.001 to 0.002%w/w in the soil samples from WS107 (1.90mbgl), WS13 (0.50mbgl), WS16 (0.40mbgl), WS18 (0.50mbgl), WS19 (0.50mbgl), and TP02 (0.10mbgl). Based on the existing information, it is considered that the asbestos is sporadically distributed within the Made Ground, indicating isolated shallow occurrences of limited extent and a single local deeper inclusion (WS107).

5.3 Ground Gas Assessment

- 5.3.1 Based on the classification scheme detailed in BS8485, the Gas Screening Values (GSV) for methane and carbon dioxide detected across the site (including the previous ground gas monitoring data obtained between 2019 and 2024) would be classified as Characterisation Situation 1, which for any new developments current guidance suggests that no special gas protection precautions are required.

5.4 Controlled Waters Assessment

- 5.4.1 The controlled water receptors at the site comprise the groundwater in the superficial deposits and the adjacent River Oughton. Water quality standards adopted for the controlled water risk assessment comprise the freshwater EQS.
- 5.4.2 Leachate analysis from selected soil samples during the 2025 ground investigation indicated that all PAH concentrations were below the laboratory limits of detection.
- 5.4.3 The groundwater samples collected during the current site investigation (2025) have not identified any concentrations exceeding the FEQS values.
- 5.4.4 Groundwater results from groundwater samples obtained during the previous ground investigations that exceed the relevant water quality standard are presented in the Table 6.

Table 6 Summary of contaminants in groundwater at concentrations above the relevant water quality standards

Determinant	Units	EQS Freshwater Threshold	Drinking Water Threshold (WHO, 2017**)	Location of exceedance	Maximum Concentration
Naphthalene	µg/l	2	-	WS09	5.1
Anthracene	µg/l	0.1	1	WS09 WS18	0.723
Benzo(a)pyrene	µg/l	0.00017	0.01	WS17	0.170
Fluoranthene	µg/l	0.0063	4	WS09 WS17 WS18 WS107	1.840

¹ Society of Brownfield Risk Assessment, Development of Generic Assessment Criteria for Assessing Vapour Risk to Human Health from Volatile Contaminants in Groundwater, September 2024

Determinant	Units	EQS Freshwater Threshold	Drinking Water Threshold (WHO, 2017**)	Location of exceedance	Maximum Concentration
Benzo(b,k)fluoranthene	µg/l	0.00017	0.01	WS09 WS17	0.277
TPH Aliphatic >C ₈ -C ₁₀	µg/l	-	300	WS09	601
TPH Aliphatic >C ₁₀ -C ₁₂	µg/l	-	300**	WS09 WS17	10678
TPH Aliphatic >C ₁₂ -C ₁₆	µg/l	-	300**	WS09 WS17	36770
TPH Aliphatic >C ₁₆ -C ₂₁	µg/l	-	300**	WS09 WS17	62140
TPH Aliphatic >C ₂₁ -C ₃₅	µg/l	-	300**	WS09 WS17	15200
TPH Aromatic >C ₈ -C ₁₀	µg/l	30*	300	WS09	20 (incorrectly reported as an exceedance in the report ref no 19271/1209)
TPH Aromatic >C ₁₀ -C ₁₂	µg/l	2*	90**	WS09 WS17	4716
TPH Aromatic >C ₁₂ -C ₁₆	µg/l	-	90**	WS09 WS17	25510
TPH Aromatic >C ₁₆ -C ₂₁	µg/l	-	90**	WS09 WS17	30860
TPH Aromatic >C ₂₁ -C ₃₅	µg/l	-	90**	WS09 WS17	10200
Notes:					
* Indicator compounds used based on CL:AIRE (2017), Petroleum hydrocarbons in groundwater: Guidance on assessing petroleum hydrocarbons using existing hydrogeological risk assessment methodologies					

- 5.4.5 Elevated concentrations of TPH and certain PAH species have been previously identified (in 2020) in groundwater at WS09 (source area 1) and WS17 (source area 2), however the latest groundwater sampling in 2025 revealed no elevated concentrations at these locations. Nearby monitoring wells installed in 2025, including from downgradient locations closer to the river, did not identify elevated contaminations.
- 5.4.6 Elevated contamination in groundwater was limited to shallow groundwater response zones (in the Made Ground and Alluvium). No evidence of contamination in the deeper geology was observed.
- 5.4.7 Surface-water samples collected during the 2024 site investigation recorded no exceedances of the relevant assessment criteria.

5.5 Detailed Quantitative Risk Assessment

- 5.5.1 To provide a better understanding of the risk posed to controlled water and to generate site specific remediation target levels if a significant risk to controlled water is identified, a Tier 3 Detailed Quantitative Controlled Water Risk Assessment has been prepared. The Site-Specific Risk Assessment has been completed using the Environment Agency Hydrogeological Risk Assessment Remedial Targets Worksheet for Contaminated Land (Version 3.2). The guidance presents a tiered approach that becomes progressively more detailed for assessing risks to

the water environment from contaminated soils and groundwater. These stages are summarised below:

- Level 1 examines how a contaminant separates from the solid phase into the aqueous phase and compares the resulting pore-water concentration to the target concentration.
- Level 2 evaluates whether dilution in the receiving groundwater will lower contaminant concentrations to acceptable levels.
- Level 3 evaluates whether natural attenuation processes (dispersion, retardation, degradation) during transport through the saturated zone to the receptor will lower contaminant concentrations to acceptable levels.

5.5.2 The principal objectives of the remedial target methodology are to determine which of the following are required:

- No remedial action, as the contamination levels do not or are unlikely to result in a risk to controlled waters at the compliance point (adjacent to the River Oughton) located hydraulically downgradient of the sources and upgradient of the receptor.
- Remedial action to protect an identified groundwater receptor.
- Further analysis and data collection to quantify the degree of risk to the receptor.

5.5.3 From the findings of the various phases of site investigation three source areas have been identified which are subject to the assessment, as outlined in Section 3.1.

5.6 Hydrogeological Conceptual Site Model (CSM)

5.6.1 In order to evaluate risk a site-specific Conceptual Site Model (CSM) is used to define significant risks requiring further assessment and where appropriate, remediation. The CSM is a simplified qualitative representation of ground conditions, pollutant source(s), pathways, pollutant linkages with associated uncertainties.

5.6.2 The CSM in the context of Hydrogeological Risk Assessment has been undertaken with reference to Environment Agency guidance, *Guide to good practice for the development of conceptual models and the selection and application of mathematical models of contaminant transport in the subsurface. National Groundwater and Contaminated Land Centre Report NC/99/38/2*.

5.6.3 The CSM identifies a residual, unquantified risk to future residential development from the potential mobilisation of determinands by infiltrating water, resulting in dissolved-phase concentrations that may pose a significant risk to the surface water receptor (the River Oughton).

5.6.4 Ground investigation data show that the potential for downward migration through the natural deposits is very low due to the predominantly cohesive geology of the Alluvium and Lowestoft Formation.

5.6.5 The River Oughton flows through the site from south-west to north-east through the central part of the site. A point downgradient of the contamination source areas, adjacent to the river has been taken as the point of compliance.

5.7 Input Parameters

5.7.1 The key parameters considered within this risk assessment are summarised in the Tables 7-9.

Table 7 Input parameters for the RTM controlled waters risk assessment (Source area 1 (WS09))

WS09 Hotspot		
Input Parameter	Value	Source of parameter value
Length of contaminant source in direction of groundwater flow	6.5m	Distance from source to the nearest monitoring well.
Saturated aquifer thickness	1.79m	Based on geological log for borehole WS09.
Hydraulic conductivity in which dilution occurs	0.041 m/d	Derived from site specific infiltrations tests completed within the shallow granular Alluvium.
Hydraulic gradient of water table	0.0428	Based on site specific data (water-level elevations in the same aquifer).
Distance to compliance point from source area	49m	Distance from source to River Oughton on hydraulic down gradient side.
Width of contaminant source perpendicular to groundwater flow	10m	Distance based on existing site data.
Fraction of organic carbon (f_{oc})	0.2436	Site specific data.

Table 8 Input parameters for the RTM controlled water risk assessment (Source area 2 (WS17))

WS17 Hotspot		
Input Parameter	Value	Source of parameter value
Length of contaminant source in direction of groundwater flow	3.0m	Estimated based on site data.
Saturated aquifer thickness	1.32m	Based on geological log for borehole WS105 as a worst-case scenario. In WS17, CLAY was encountered to 4.45m with no granular aquifer.
Hydraulic conductivity in which dilution occurs	0.041 m/d	Derived from site specific infiltration tests completed within the shallow granular alluvium deposits.
Hydraulic gradient of water table	0.0416	Based on site specific data (water-level elevations in the same aquifer).
Distance to compliance point from source area	25m	Distance from source to River Oughton on hydraulic down gradient side.
Width of contaminant source perpendicular to groundwater flow	3.0m	Estimated based on site data.
Fraction of organic carbon (f_{oc})	0.0928	Site specific data.

Table 9 Input parameters for controlled water risk assessment (Source area 3 (WS107))

WS107		
Input Parameter	Value	Source of parameter value
Length of contaminant source in direction of groundwater flow	5m	Distance from source to the nearest monitoring well.
Saturated aquifer thickness	3.49m	Based on geological log for borehole WS107.
Hydraulic conductivity in which dilution occurs	0.041 m/d	Derived from site specific infiltration tests completed within the shallow granular alluvium deposits.
Hydraulic gradient of water table	0.0697	Based on site specific data (water-level elevations in the same aquifer).
Distance to compliance point from source area	25m	Distance from source to River Oughton on hydraulic down gradient side.
Width of contaminant source perpendicular to groundwater flow	5m	Assumed value based on existing site data.
Fraction of organic carbon (f_{oc})	0.02204	Site specific data.

- 5.7.2 Values of effective porosity (n), air filled porosity and water filled porosity have been calculated using the Porosity calculator. These values are based on bulk densities obtained as part of the previous geotechnical site investigation.
- 5.7.3 Values for organic carbon co-efficient (K_{oc}) and for Henry's Law constant (H) are taken from setting contained in the toxicological reports from the Environment Agency, RBCA model and other recognised sources. Half-lives for the determinants are obtained from CL:AIRE, 2017. Petroleum Hydrocarbons in Groundwater: Guidance on assessing petroleum hydrocarbons using existing hydrogeological risk assessment methodologies, Nobel Morgan: The Effect of Contaminants Concentration on Potential Natural Attenuation R&D Technical Report P2-228/TR, EA 2002 and Howard, Boethling, Jarvis, Meylan, Michalenko, Handbook of Environmental Degradation Rates 1991. For all degradation rates are based on the presence of anaerobic conditions and thus the worst-case values have been adopted.
- 5.7.4 Values for infiltration were based on annual rainfall, less average run-off for the area and evapotranspiration. A value of 0.00041m/d was assumed.

5.8 Compliance Target Concentrations

- 5.8.1 The target concentration at the receptor for each compound is based on the Freshwater Environmental Quality Standards.

5.9 Modelling

- 5.9.1 The site-specific risk assessment has been completed using the Environment Agency Remedial Targets Worksheet v3.2 (RTM). The model has been used to back-calculate suitable risk-based remedial targets for soils on site that do not pose an unacceptable risk to controlled waters at the defined compliance point (the River Oughton).
- 5.9.2 The model was run for naphthalene, fluoranthene and benzo(a)pyrene to cover various degrees of PAH solubility. Naphthalene has the highest solubility and is the least hydrophobic in comparison with fluoranthene, anthracene, benzo(a)pyrene, benzo(b)fluoranthene and benzo(k)fluoranthene. Fluoranthene is more soluble than anthracene, while the benzo-fluoranthenes and benzo(a)pyrene are highly hydrophobic. The benzo(b)fluoranthene and benzo(k)fluoranthene are less prone to dissolve than benzo(a)pyrene.
- 5.9.3 In general, 'heavy' hydrocarbons (i.e. those with a high molecular weight) are significantly less mobile in the environment and less (eco) toxic than lighter fractions. However, they are more persistent in the environment. Based on the measured concentrations in groundwater, petroleum hydrocarbon fractions $>C_8$ to C_{35} (aliphatic and aromatic species) will be considered as the main contaminants of concern.

Table 10 Input parameters for the RTM controlled water risk assessment

Contaminant	Risk Assessment Level	Maximum concentration at source (Soil and groundwater - all results)	Remedial Target Level at source, with compliance point (mg/L)	Predicted concentration at compliance point (mg/l)	Predicted contaminant transport at compliance point (years)
Source Area 1 (WS09)					
Aliphatic $>C_8 - C_{10}$	Soil (Level 3)	9.2	No impact	No impact	>10000
	Groundwater	0.601	3348	0.0000538	>10000
Aliphatic $>C_{10} - C_{12}$	Soil (Level 3)	327.9	No impact	No impact	>10000
	Groundwater	10678	3348	0.0009	>10000

Contaminant	Risk Assessment Level	Maximum concentration at source (Soil and groundwater - all results)	Remedial Target Level at source, with compliance point (mg/L)	Predicted concentration at compliance point (mg/l)	Predicted contaminant transport at compliance point (years)
Aliphatic >C ₁₂ – C ₁₆	Soil (Level 3)	905	No impact	No impact	>10000
	Groundwater	36.77	518.67	0.0212	>10000
Aliphatic >C ₁₆ – C ₂₁	Soil (Level 3)	1044	No impact	No impact	>10000
	Groundwater	46.94	9.66	1.45	>10000
Aliphatic >C ₂₁ – C ₃₅	Soil (Level 3)	345	No impact	No impact	>10000
	Groundwater	15.2	9.66	0.47	>10000
Aromatic >C ₈ – C ₁₀	Soil (Level 3)	0.3	2.80E+272	8.13E-271	>10000
	Groundwater	0.02	3348	1.79	>10000
Aromatic >C ₁₀ – C ₁₂	Soil (Level 3)	130.6	No impact	No impact	>10000
	Groundwater	4.71	1004	0.0004	>10000
Aromatic >C ₁₂ – C ₁₆	Soil (Level 3)	579	No impact	No impact	>10000
	Groundwater	25.51	155.60	0.014	>10000
Aromatic >C ₁₆ – C ₂₁	Soil (Level 3)	619	No impact	No impact	>10000
	Groundwater	30.86	2.89	0.95	>10000
Aromatic >C ₂₁ – C ₃₅	Soil (Level 3)	210	No impact	No impact	>10000
	Groundwater	10.2	2.90	0.31	>10000
Naphthalene	Soil (Level 3)	0.26	7.87E+183	7.80E-185	>10000
	Groundwater	0.0051	60.97	1.67	>10000
Source Area 2 (WS17)					
Aliphatic >C ₁₀ – C ₁₂	Soil (Level 3)	No data	-	-	-
	Groundwater	0.057	40.29	0.0004	>10000
Aliphatic >C ₁₂ – C ₁₆	Soil (Level 3)	No data	-	-	-
	Groundwater	0.36	17.55	0.0061	>10000
Aliphatic >C ₁₆ – C ₂₁	Soil (Level 3)	No data	-	-	-
	Groundwater	0.60	3.34	0.0538	>10000
Aliphatic >C ₂₁ – C ₃₅	Soil (Level 3)	No data	-	-	-
	Groundwater	0.33	3.34	0.0296	>10000
Aromatic >C ₁₀ – C ₁₂	Soil (Level 3)	No data	-	-	-
	Groundwater	0.07	12.08	0.0052	>10000
Aromatic >C ₁₂ – C ₁₆	Soil (Level 3)	No data	-	-	-
	Groundwater	0.29	5.26	0.0049	>10000
Aromatic >C ₁₆ – C ₂₁	Soil (Level 3)	No data	-	-	-
	Groundwater	0.39	5.27	0.0066	>10000
Aromatic >C ₂₁ – C ₃₅	Soil (Level 3)	No data	-	-	-
	Groundwater	0.11	1.00	0.0098	>10000
Benzo(a)pyrene	Soil (Level 3)	No data	-	-	-
	Groundwater	0.00017	0.0017	0.00001	>10000
Source Area 3 (WS107)					
Fluoranthene	Soil (Level 3)	2	3.35	2.93	>10000
	Groundwater	0.00007	0.00004	0.00001	>10000

5.10 Discussion of Site-Specific Controlled Water Risk Assessment

5.10.1 The site-specific controlled-waters risk assessment identifies that dissolved concentrations in groundwater are predominantly below the risk-based remedial target levels. Exceptions were

observed for aliphatic hydrocarbons ($>C_{10}-C_{12}$) at WS09, aliphatic and aromatic hydrocarbons ($>C_{16}-C_{21}$ and $>C_{21}-C_{35}$) at WS09 and WS17, and fluoranthene at WS107.

- 5.10.2 The latest results (November 2025) were below the laboratory reporting limits. The results indicate a significant downward trend in dissolved concentrations in comparison with the previous two sampling rounds. These values denote an improvement in groundwater quality.
- 5.10.3 Based on the findings of the RTM Level 3 groundwater assessment, the existing concentrations are not considered to pose an unacceptable risk to surface water (point of compliance being adjacent to the River Oughton).

6.0 Revised Conceptual Model

6.1.1 The conceptual model presented in Section 8.5 of report prepared by Enzygo Geoenvironmental Ltd in August 2024 (ref CRM.1027.189.GE.R.001.A) has been revised based on the findings of the supplementary investigation. The revised conceptual model is presented Table 11.

Table 11 Revised Conceptual Site Model

Source	Location	Exposure Pathway	Potential Receptor	Probability of Exposure	Details
Human Health					
PAHs and hydrocarbons.	Made Ground	Ingestion dermal and inhalation.	Construction Workers	Very Low	Appropriate construction practices, environmental pollution controls and PPE required to address risk.
			Site users	Low	Elevated concentrations were identified. Clean capping is required in areas proposed to be developed as soft landscaping.
			Off-site receptors	Very Low	Appropriate environmental controls to be adopted during construction to prevent generation of dust.
Metals and hydrocarbons.	Unforeseen Contamination.	Ingestion dermal and inhalation.	Construction Workers	Very Low	Previously unidentified contamination may be associated with areas not previously investigated beneath existing building. May be addressed following demolition of the existing buildings, to include confirmatory investigation and watching brief for contamination.
			Site users	Low	
			Off-site receptors	Very Low	
Asbestos	Asbestos fibres in Made Ground soils	Ingestion dermal and inhalation	Construction Workers	Low	Asbestos fibres identified in the Made Ground. Exposure to be prevented or limited to as low as reasonably practicable in accordance with the Control of Asbestos Regulations 2012. Asbestos survey and removal from the buildings to be undertaken (beyond the remit of this report).
			Site users	Very Low	Clean cover soils to comprise minimum 600mm of clean cover in future soft landscaping. Presence of hardstanding will break the contaminant linkage and therefore mitigating risk.
TPH (around the former tank)	Fuel spillages and plume	Ingestion dermal and inhalation	Construction Workers	Very Low	Appropriate construction practices, environmental pollution controls and PPE required to address risk
			Site users	Low	Existing ground investigation results indicated low risk. Full delineation of hydrocarbon impacts soils at source area 1 to be addressed as part of post demolition investigation.
Made Ground with backfilled Mill race and Mill Pond	Made Ground - Metal, asbestos and Hydrocarbons	Ingestion dermal and inhalation	Future maintenance workers	Very Low	Appropriate PPE to be worn when accessing materials below 600mm soil capping layer.
			Site users	Very Low	Materials will be covered by 600m of clean cover no future access to these materials. Potential pathway generated with pile installation. Pile risk assessment recommended.
Ground Gas	Made Ground	Inhalation & Explosive	Site users	Very Low	CS1 conditions identified. No gas protection measures required.
			Off-site receptors	Very Low	Low permeability clay soils.

Source	Location	Exposure Pathway	Potential Receptor	Probability of Exposure	Details
	Made Ground with backfilled Former Mill race and Pond	Inhalation & Explosive	Construction Workers	Very Low	Based on the classification scheme detailed in BS8485, the Gas Screening Values (GSV) for methane and carbon dioxide detected across the site would be classified as Characterisation Situation 1, which for any new developments no special gas protection precautions are required.
			Site users	Very Low	
			Off-site receptors	Very Low	Low permeability clay soils, however potential pathway to river through previous Mill race.
Groundwater					
Hydrocarbon	Plume from former spillage (source areas 1 and 2)	Vertical Migration	Groundwater.	Very Low	DQRA identified the presence of a downward trend in dissolved concentrations and that the existing concentrations are not considered to pose an unacceptable risk to surface water.
Hydrocarbon and metals	Made Ground across the site	Vertical Migration	Groundwater.	Very Low	Secondary A aquifer in direct connectivity with the river. DQRA identified the presence of a downward trend in dissolved concentrations and that the existing concentrations are not considered to pose an unacceptable risk to groundwater.
Hydrocarbon and metals	Natural soils	Vertical Migration	Groundwater.	Very Low	DQRA identified the presence of a downward trend in dissolved concentrations and that the existing concentrations are not considered to pose an unacceptable risk to groundwater. In addition, the sources will be removed during the redevelopment of the site.
Surface Water					
Hydrocarbon, PAHs and metals.	Unforeseen Contamination.	Horizontal Migration	River Network.	Very Low	DQRA identified the presence of a downward trend in dissolved concentrations and that the existing concentrations are not considered to pose an unacceptable risk to groundwater.
Building Services					
On site contaminants		Direct	Proposed Buildings.	High	Proposed buildings
		Permeate into pipework	Water Pipes.	Moderate	Requirements of Water Authority to be followed

7.0 Geoenvironmental Conclusions and Recommendations

7.1 Conclusions

- 7.1.1 The Human Health Risk Assessment has determined that there are concentrations of PAH, TPH and asbestos fibres within the Made Ground that present a risk to human health of future residents of the proposed development. Remediation in the form of a clean cover of certified landscaping soils is recommended to mitigate the risk.
- 7.1.2 Based on previous ground investigation (in 2020) two contamination source areas in soil and groundwater, were located adjacent to former mobile compressor unit and spillage, and former tank / boiler to the north of the River Oughton. Associated contaminants comprised PAHs and TPH. In addition, PAH contamination was identified in the infill to mill race and pond int eh west of the site.
- 7.1.3 The 2025 supplementary investigation was designed to delineate the mobile hydrocarbon contaminants previously identified. Groundwater monitoring standpipes were installed between the previously identified source areas and the river. No widespread contamination was observed, indicating relatively limited source areas. However fully delineation of contamination extent could not be completed due to the very thick concrete in the area.
- 7.1.4 A downward trend in dissolved phase hydrocarbons in groundwater to below the relevant water quality standards has been observed. The latest 2025 groundwater sampling and testing identified very low concentrations that would not present unacceptable level of risk to the quality of the underlying aquifer or surface waters.
- 7.1.5 The detailed quantitative risk assessment for controlled waters (groundwater and surface water in the River Oughton) which indicates the concentrations on site are not considered to pose an unacceptable risk to surface water.
- 7.1.6 The monitoring and risk assessment for bio-genic ground gas concluded that there are no concentrations at levels that would pose an unacceptable risk to human health and the proposed development.
- 7.1.7 The levels of petroleum hydrocarbons established by the latest ground investigation are below levels which are considered to pose a vapour risk to the future development. Further recommendations are made to assess the extent of any contamination as part of a post demolition investigation.
- 7.1.8 The risk assessment in respect to water supply infrastructure identified that the concentrations of hydrocarbons within the made ground are at levels that would pose a potential risk to the integrity of PE pipework.

7.2 Recommendations

- 7.2.1 Parts of the site beneath the existing structures, and in areas of very thick external concrete pavement, were inaccessible to previous phases of investigation. To provide a robust assessment of the site it is recommended that a supplementary phase of ground investigation is completed after demolition.
- 7.2.2 This should comprise a combination of sampling locations to provide general coverage beneath the existing structures, and targeted positions e.g. to fully delineate shallow petroleum contamination at source area 1.

- 7.2.3 A remediation strategy (RS) to implement the above measures should be drafted for agreement with the local planning authority. On completion of the remediation, verification should be undertaken to ensure suitable and sufficient works have been undertaken.
- 7.2.4 Due to the presence of the hydrocarbon compounds, barrier pipework is recommended for potable water supply pipes. It is recommended that the relevant water supply company be contacted at an early stage to confirm its requirements for assessment, which may not necessarily be the same as those recommended by UKWIR.
- 7.2.5 If any suspected contamination, underground storage tanks or chambers not previously identified is encountered during the construction contact should be made with an Environmental Consultant to determine suitable action to be undertaken.

8.0 Remediation Strategy and Validation

8.1 Proposed Remediation

- 8.1.1 Elevated PAH, aliphatic and aromatic TPH and asbestos have been encountered within Made Ground below the site. It is considered that areas designated for hardstanding and building footprints will act as a physical barrier, preventing direct contact between any residual contamination and site users, thereby breaking the contaminant linkage. No further remediation of contamination is required in these areas.
- 8.1.2 Remediation within soft landscape areas is proposed comprising cover soils to break the potential contaminant linkage with future site residents. These cover soils will also act to provide a suitable planting medium for future vegetation. In general, areas requiring remediation are concentrated in the central and southern parts of the site to the north of the River Oughton.
- 8.1.3 No gas protection measures are required.
- 8.1.4 A discovery strategy for previous unidentified contamination should be adopted during the groundworks stage of construction.
- 8.1.5 Due to the presence of the hydrocarbon compounds, barrier pipework is recommended for potable water supply pipes. It is recommended that the relevant water supply company be contacted at an early stage to confirm its requirements for assessment. It is recommended that drinking water supply pipework should be placed within a clean corridor.

8.2 Post demolition ground investigation

- 8.2.1 A post-demolition ground investigation is recommended to establish the ground conditions beneath the existing buildings and areas of very thick external concrete. The final extent of remediation will be confirmed after post-demolition targeted investigation and any changes reflected in an update to this remediation strategy.

8.3 Soft Landscape Areas

- 8.3.1 Where necessary, existing Made Ground will be removed to an appropriate sub-formation level based on final site levels. Soil to landscaping areas will be placed above this.
- 8.3.2 Areas of soft landscaping will be covered with clean cover soils which will break any residual pollutant linkage. It is proposed that a 600mm thickness of cover soils will be provided for the private garden areas and 400mm for the communal gardens and open space areas. A geotextile separator (Terram 1000 or similar) will be placed at the base of the cover soils and above the sub-formation. Where appropriate cover soil thicknesses will be increased to accommodate deeper planting in accordance with the requirements of the landscape architect.
- 8.3.3 These cover soils will need to be confirmed as clean and pass the chemical requirements given below. These are based on the GAC values for residential use with plant uptake within domestic garden areas and GAC values for residential use without plant uptake in areas of communal open space.
- 8.3.4 The works would involve the following:
 - Excavation to sub-formation level, as required.

- Additional excavations may be undertaken to accommodate tree planting pits as required by the landscape architect.
- Inspection of the exposed sub-formation to validate that areas of unforeseen contamination are not present.
- Placement of a geotextile no dig barrier which will also act as a separator between the topsoil/subsoil to prevent mixing with underlying sub-formation. It is proposed that the geotextile will comprise Terram 1000 or similar material. This will be placed across the formation and wrapped around the sides and base of any tree planting pits.
- The geotextile will be placed and overlapped in accordance with the supplier's requirements.
- Imported cover soils will be placed across the soft landscape areas, taking care not to damage the geotextile.

8.3.5 It is proposed that the cover soils are placed on to the geotextile and that care is taken to prevent damage to the geotextile.

8.3.6 The cover soils will comprise at least 150mm of imported Topsoil, certified in accordance with British Standards BS3882: Specification for Topsoil. This will be underlain by clean sub soil.

8.4 Specification of Cover Soils

8.4.1 Topsoil is to be general purpose topsoil and shall be tested to confirm that it meets the requirements of British Standards BS3882, Specification for Topsoil. Imported topsoil is to be inspected by the Contractor who should ensure that it is free from any foreign matter, including but not limited to:

- Fragments and roots of aggressive weeds.
- Sticks and straws.
- Sub-soil.
- Fragments of brick, concrete, glass, wire, timber, large lumps of clay or vegetation.

8.4.2 Imported soils showing evidence of foreign inclusions should be rejected. If foreign material is encountered once the Topsoil has been placed these will be removed by the Contractor.

8.4.3 Where compost is to be added to imported soils this should meet the requirements of PAS 100 and shall comprise sanitized and stabilised compost. Peat or peat products are not to be used without prior approval of the Landscape Architect.

8.4.4 Subsoil should comprise clean natural soils which meet the GAC values identified above. In addition, the Subsoil should be free from any foreign matter, including but not limited to:

- Fragments and roots of aggressive weeds.
- Sticks and straws.
- Fragments of brick, concrete, glass, wire, or vegetation.

- 8.4.5 Topsoil certificate should be obtained from each supplier of Topsoil to confirm that it meets the requirements of British Standards BS3882: Specification for Topsoil and also the remedial requirements identified above.

8.5 Methodology For Handling of Cover Soils

- 8.5.1 Importation, stockpiling and placement of cover soils should be in accordance with British Standards BS3882: Specification for Topsoil.
- 8.5.2 Topsoil should not be stockpiled on site unless necessary in order to minimise multiple handling.
- 8.5.3 Topsoil and Subsoil are not to be mixed. Furthermore, care must be taken to prevent contamination of the Topsoil or Subsoil with stones, hard-core, rubbish or materials from demolition works.
- 8.5.4 Topsoil is not to be handled during driest conditions possible and is not to be handled during or after heavy rainfall or when wetter than the plastic limit as defined by BS3882, Annex N2.
- 8.5.5 Plant used for the placement and spreading of Topsoil and also Subsoil is to be selected based on minimising disturbance, trafficking and compaction. In order to retain a friable texture Topsoil is not to be compacted but shall be gently firmed.
- 8.5.6 Topsoil is to be tipped and graded to approximate levels in one operation with minimum of trafficking by plant.

8.6 Verification of Cover Soils

- 8.6.1 Given the proposed plan and the landscaping requirements across the site it is recommended that the thickness of the imported materials together with the geotextile separator is verified. The proposed locations are shown on Drawing CRM.1265.009.GE.D.002.
- 8.6.2 The density and location of validation pits is based on guidance prepared by NHBC. A minimum of one trial pit per two plots for semi-detached houses or two trial pits for blocks containing three houses. Within areas of communal landscaping trial pits will be excavated at a ratio of one trial pit per 500m². Samples of the top soil and subsoil from each pit will be obtained.
- 8.6.3 Verification should comprise the excavation of hand pits within the soft landscaping area to confirm the thickness of cover soils and the presence of a geotextile separator. This will be undertaken by an experienced Environmental Consultant and will involve measuring the thickness of the cover soils and photograph each pit with a measuring tape of staff used to show the thickness of the cover soils.
- 8.6.4 Soil samples should be collected from each pit from within the cover soils in appropriate containers provided by the analytical laboratory. Samples will be stored in cool boxes prior to dispatch to the laboratory for analysis. All samples will be collected using appropriate sampling equipment that is cleaned at each sampling location.
- 8.6.5 Samples should be analysed at an UKAS and MCERTS accredited laboratory. Samples were tested for the CLEA metal suite, pH, sulphate, cyanide, phenols, speciated Polycyclic Aromatic Hydrocarbons (PAH), organic carbon, Speciated Total Petroleum Hydrocarbon (TPH) and asbestos screen.
- 8.6.6 Should soils fail the GAC values included within Appendix C these will be excavated and discarded off-site. Additional testing will be undertaken around the excavation to confirm that the adjacent soils are clean. Fresh soils will be imported and used to re-construct the cover soils.

8.7 Gas Protection Measures

8.7.1 No gas protection measures are required.

8.8 Utilities

8.8.1 Results of the chemical analysis will be provided to the water authority and any requirements in relation to protecting potable waste supply pipes will be incorporated into the scheme. It is anticipated that barrier pipes will be used.

8.9 Unforeseen Contamination

8.9.1 If unforeseen contamination is encountered during construction works such as localised spillage outside the areas investigated an Environmental Consultant will be available on a 'call out' basis to undertake an assessment of risk. If 'unforeseen contamination' is encountered the discovery strategy will be to remove the source as it is likely to be very limited in extent and the Local Planning Authority advised.

8.10 Asbestos Management Strategy

8.10.1 Asbestos fibres were identified in the Made Ground. Exposure to be prevented or limited to as low as reasonably practicable in accordance with the Control of Asbestos Regulations 2012.

8.10.2 To protect construction workers measures should be incorporated into the Contractors Construction Stage Health and Safety Plan as required under the Construction Design and Management (CDM) Regulations to mitigate risk to construction works. Measures may include:

- Designing temporary works to minimise disturbance of the Back-fill material;
- Separating material and disposal of soils containing asbestos;
- Wetting down during excavation;
- Sheeting of stockpiles where asbestos is suspected;
- Testing of soils and off-site disposal of any soils found or suspected of containing asbestos;
- Preventing access to the construction site by members of the public;
- Use of good hygiene measures, including washing down of plant; and
- Use of appropriate PPE, including face masks.

8.11 Verification Report

8.11.1 A remediation verification report will be prepared based on the inspections which will include:

- Details of the cover soils placed, including photographs;
- Chemical results from the cover soil validation;
- The site observations and notes of any agreed changes to the remedial methodology;

- Any areas of un-known contamination encountered and the remedial measures undertaken;
- Details of barrier pipe installations (where applicable), including photographs;
- Waste disposal notes where appropriate.
- Confirmation that the works observed complied with the remedial methodology.

Appendix 1 – Supplementary Geoenvironmental Site Investigation (2025)



KEY:

- Borehole Installation
- Rotary Borehole (BH01-BH04)
- Window Sampler Borehole (WS101-WS115 / WS201-WS205)
- Window Sampler Borehole (TP1 - TP5)
- Previous GroundTech Sample Locations

NOTES:

DO NOT SCALE FROM THIS DRAWING

ALL DIMENSIONS ARE IN METRES UNLESS STATED OTHERWISE

THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT DRAWINGS AND DOCUMENTS ASSOCIATED WITH THIS PROJECT.

ALL EXISTING AND PROPOSED DIMENSIONS, LEVELS AND LOCATIONS TO BE CHECKED AND VERIFIED BY THE MAIN CONTRACTOR ON SITE PRIOR TO THE COMMENCEMENT OF THE WORKS AND ANY ANOMALIES REPORTED TO THE ENGINEER.

P03	02.12.25	Boreholes Updated	LB	RR	RR
P02	16.07.24	Proposed Boreholes Added	LB	RH	RH
P01	16.07.24	Issued for comment / approval	LB	RH	RH
Rev	Date	Description	DRA	CHK	APP

Project
Ickleford Mill

Client
Hill Partnership Ltd

Drawing Title
Proposed - Borehole Location Plan - Topo

Scale 1:1,000 @ A3	Date 16.07.24	Status Preliminary
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DWG No. CRM1027189-ENZ-XX-XX-DR-G-0002.1	Revision P03
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Manchester

0161 413 6444

Sheffield

0114 321 5151

Cardiff

02920 023 700

Cambridge

01799 542 473

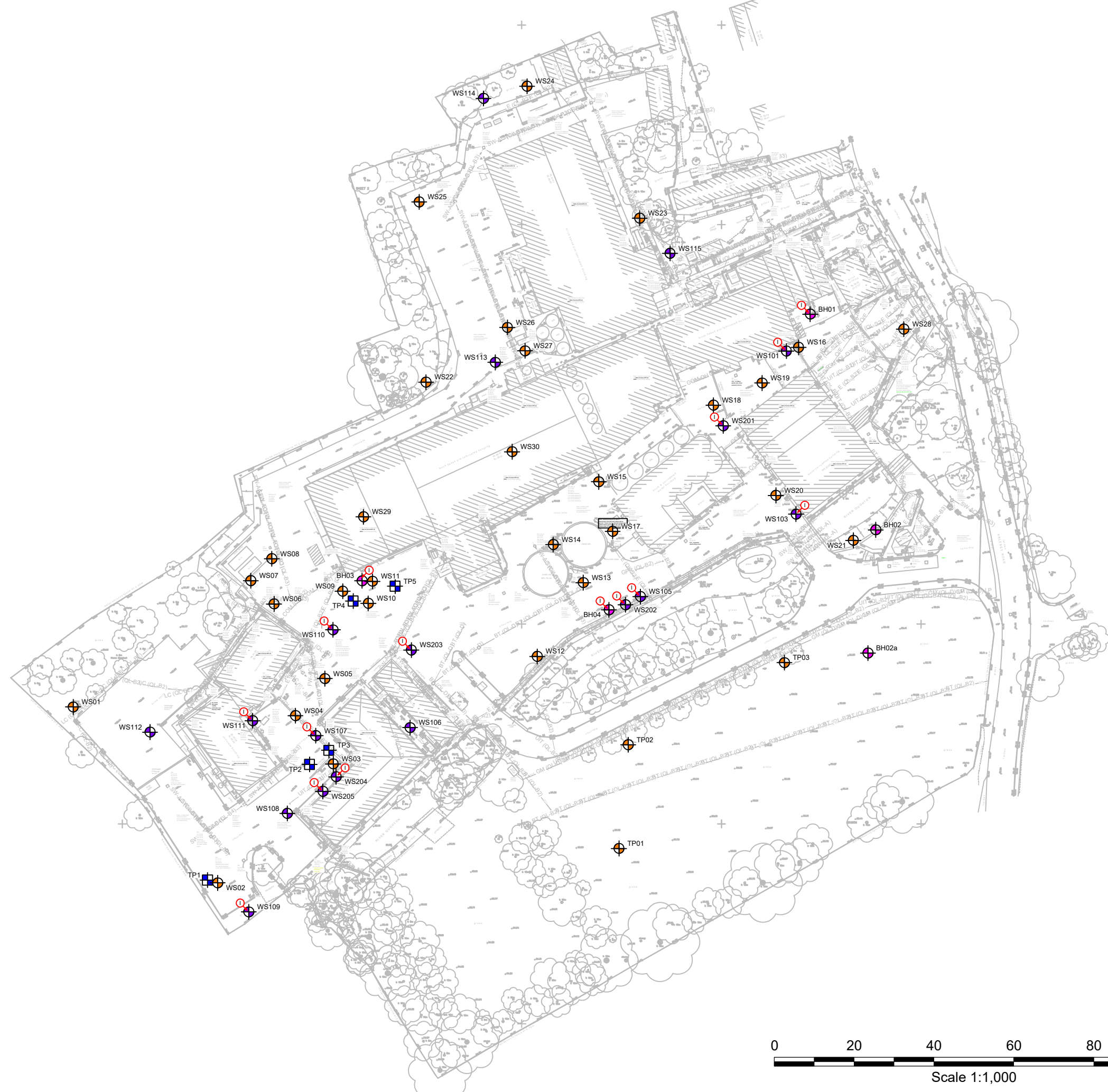
Belfast

07377673948

@enzygo

enzygo.com

hello@enzygo.com



Appendix 2 – Groundwater Contour Levels (November 2025)



KEY:

- Borehole Installation
- Rotary Borehole (BH01-BH04)
- Window Sampler Borehole (WS101-WS115 / WS201-WS205)
- Window Sampler Borehole (TP1 - TP5)
- Previous GroundTech Sample Locations

NOTES:

DO NOT SCALE FROM THIS DRAWING

ALL DIMENSIONS ARE IN METRES UNLESS STATED OTHERWISE

THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT DRAWINGS AND DOCUMENTS ASSOCIATED WITH THIS PROJECT.

ALL EXISTING AND PROPOSED DIMENSIONS, LEVELS AND LOCATIONS TO BE CHECKED AND VERIFIED BY THE MAIN CONTRACTOR ON SITE PRIOR TO THE COMMENCEMENT OF THE WORKS AND ANY ANOMALIES REPORTED TO THE ENGINEER.

P03	02.12.25	Boreholes Updated	LB	RR	RR
P02	16.07.24	Proposed Boreholes Added	LB	RH	RH
P01	16.07.24	Issued for comment / approval	LB	RH	RH
Rev	Date	Description	DRA	CHK	APP

Project
Ickleford Mill

Client
Hill Partnership Ltd

Drawing Title
Proposed - Borehole Location Plan - Topo

Scale 1:1,000 @ A3	Date 16.07.24	Status Preliminary
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DWG No. CRM1027189-ENZ-XX-XX-DR-G-0002.1	Revision P03
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Bristol

01454 269 237

Manchester

0161 413 6444

Sheffield

0114 321 5151

Cardiff

02920 023 700

Cambridge

01799 542 473

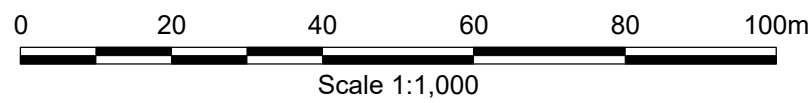
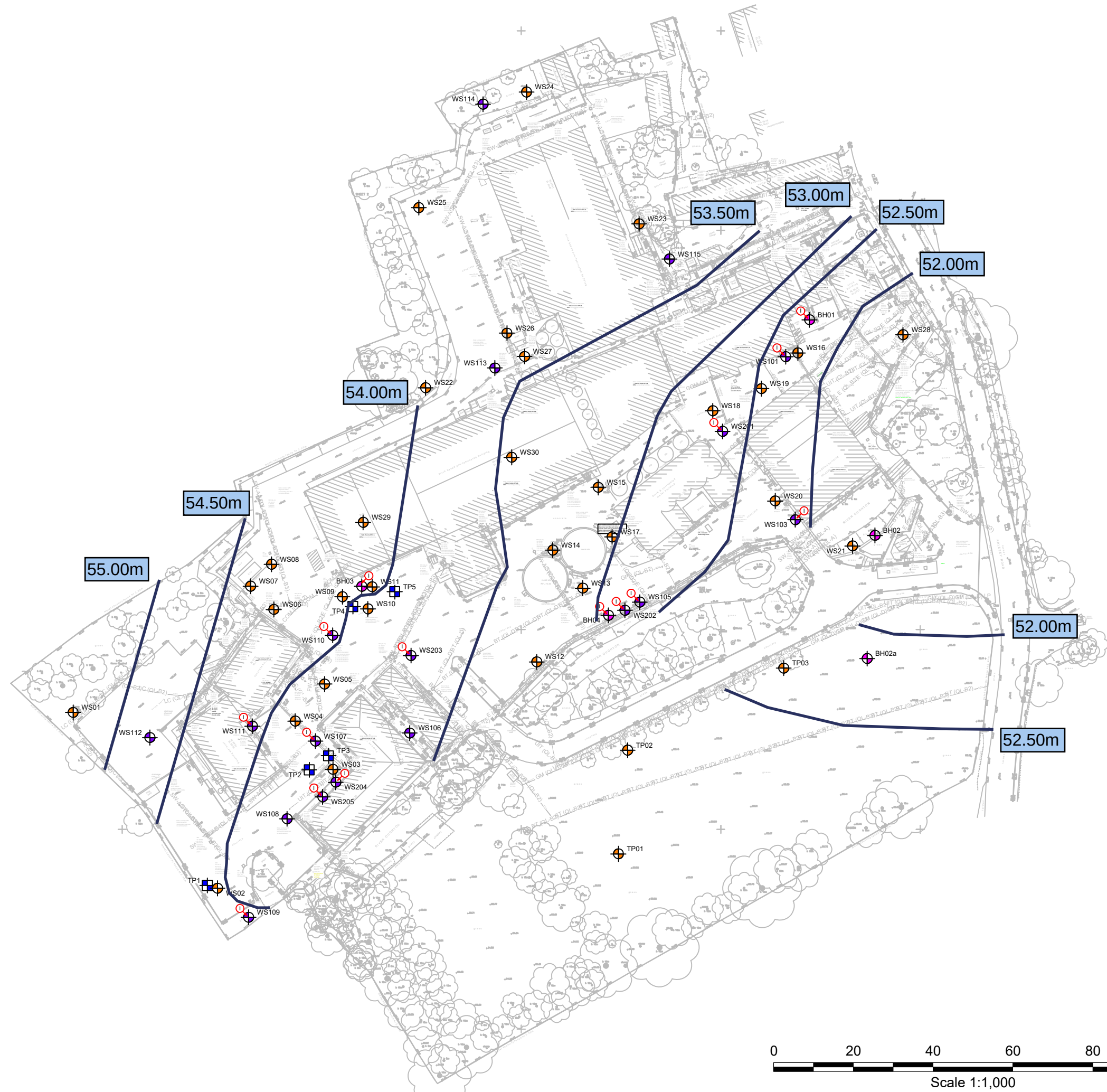
Belfast

07377673948

@enzygo

enzygo.com

hello@enzygo.com



Appendix 3 – Chemical Laboratory Analysis



Unit 7-8 Hawarden Business Park
Manor Road (off Manor Lane)
Hawarden
Deeside
CH5 3US

Tel: (01244) 528777
email: hawardencustomerservices@alsglobal.com
Website: www.alsenvironmental.co.uk

Eurofins Chemtest Limited
Willie Snaith Rd
Newmarket
Suffolk
CB8 7SQ

Attention: Subcontracting Lab

CERTIFICATE OF ANALYSIS

Date of report Generation:	04 December 2025
Customer:	Eurofins Chemtest Limited
Sample Delivery Group (SDG):	251125-59
Your Reference:	25-37526
Location:	
Report No:	784953
Order Number:	25-37526

We received 7 samples on Tuesday November 25, 2025 and 7 of these samples were scheduled for analysis which was completed on Thursday December 04, 2025. Accredited laboratory tests are defined within the report, but opinions, interpretations and on-site data expressed herein are outside the scope of ISO 17025 accreditation.

Should this report require incorporation into client reports, it must be used in its entirety and not simply with the data sections alone.

Chemical testing (unless subcontracted) performed at ALS Laboratories (UK) Limited Hawarden.

All sample data is provided by the customer. The reported results relate to the sample supplied, and on the basis that this data is correct.

Incorrect sampling dates and/or sample information will affect the validity of results.

The customer is not permitted to reproduce this report except in full without the approval of the laboratory.

Approved By:



Justin Keeton
Business Unit Leader - Land



CERTIFICATE OF ANALYSIS

Validated

SDG: 251125-59
Client Ref.: 25-37526

Report Number: 784953
Location:

Superseded Report:

Received Sample Overview

Lab Sample No(s)	Customer Sample Ref.	AGS Ref.	Depth (m)	Sampled Date
32510757	2056270 W1			19/11/2025
32510758	2056271 W1			19/11/2025
32510759	2056272 W1			19/11/2025
32510760	2056275 W1			19/11/2025
32510761	2056276 W1			19/11/2025
32510762	2056277 W1			19/11/2025
32510763	2056278 W1			19/11/2025

Only received samples which have had analysis scheduled will be shown on the following pages.



CERTIFICATE OF ANALYSIS

Validated

SDG: 251125-59
Client Ref.: 25-37526

Report Number: 784953
Location:

Superseded Report:

Results Legend



Test



No Determination
Possible

Sample Types -

S - Soil/Solid
UNS - Unspecified Solid
GW - Ground Water
SW - Surface Water
LE - Land Leachate
PL - Prepared Leachate
PR - Process Water
SA - Saline Water
TE - Trade Effluent
TS - Treated Sewage
US - Untreated Sewage
RE - Recreational Water
DW - Drinking Water
Non-regulatory
UNL - Unspecified Liquid
SL - Sludge
G - Gas
OTH - Other

Determination of Dissolved Gases

All

NDPs: 0
Tests: 7

Lab Sample No(s)

Customer
Sample Reference

AGS Reference

Depth (m)

Container

Sample Type

32510763	2056278 W1				Vial (ALE297)	GW
32510762	2056277 W1				Vial (ALE297)	GW
32510761	2056276 W1				Vial (ALE297)	GW
32510760	2056275 W1				Vial (ALE297)	GW
32510759	2056272 W1				Vial (ALE297)	GW
32510758	2056271 W1				Vial (ALE297)	GW
32510757	2056270 W1				Vial (ALE297)	GW
X	X	X	X	X	X	X