BAYNHAM MEIKLE
Consulting Civil and Structural Engineers

28th May 2026

13885 – Havant Phase 3A: - Engineers Response to planning condition 30

Application Summary: -

Proposal: Nature and Extent of Contamination on site.

Condition 30 requires the following:

Prior to the commencement of each phase of development hereby approved (other than any above ground site clearance, demolition of above-ground structures, or consequential works for the purpose of ensuring structural stability of retained construction-), an assessment of the nature and extent of contamination at the site, whether originating from within or outside the curtilage, shall be submitted to and approved in writing by the Local Planning Authority for that phase.

Phase 3A Considerations:

The ground investigation report produced by Applied Geology describes apart from the presence of brick, concrete, asphalt and rare plastic fragments noted throughout the Made Ground, there was no visual or olafactory evidence of significant potential contamination was noted. Specifically, no visual or olofactory of hydrocarbon or solvent contamination was identified during the fieldwork.

Headspace testing undertaken on samples of the Made Ground recorded negligible VOC concentrations of between <0.1ppm and 0.2ppm.

Should any potential contaminants be discovered during the development works, there are to be reported and removed from site accordingly. The Site Investigation Report carried out by Applied Geology, Report ref: AG3744-26-AV11 - GI Report Ph3A can be found appended to this note.

APPLiED GEOLOGY

REPORT ON
GROUND INVESTIGATION
AT
LANGSTONE TECHNOLOGY PARK, HAVANT – PHASE 3A

nqa ISO 9001 QUALITY MANAGEMENT
UKAS MANAGEMENT SYSTEMS 0015
Constructionline Gold Member
CHAS Accredited Contractor CHAS.co.uk
BUILDER'S PROFILE
Acclaim Accreditation

REPORT STATUS SHEET

Client:	Havant Sarl
Report Title:	Report on Ground Investigation at Langstone Technology Park, Havant – Phase 3A
Report Number:	AG3744-26-AV11
Report Status:	Validated Issue 1
Date:	22/05/2026

		Date	Signed for and on behalf of Applied Geology Limited
Report Author	A Moore BSc (Hons) FGS Project Geologist	22/05/2026	[redacted]
	H Spencer BSc (Hons) MSc FGS Lead Project Geologist	22/05/2026	
Checked	P Gabrielle BSc (Hons) FGS Regional Director	22/05/2026	
Authorised	J B Cartwright BEng (Hons) MSc FGS Managing Director	22/05/2026	

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1.0 INTRODUCTION

1.1 Objectives and Scope of Investigation

An area of land at Langstone Technology Park, Havant (the site) known as Phase 3A, is being considered for redevelopment by Havant Sarl (the Client). The proposals for the site comprise construction of 2No new industrial units, with associated access road, service yard, parking, and minimal landscaping. It is understood that finished ground levels across the site will be raised by approximately 1m to provide flood protection.

The Phase 3A site sits within the wider Phase 3 development area, which includes Phase 3A and Phase 3B. A Phase I Desk Study/Geo-Environmental Risk Assessment for the wider Phase 3 development area was undertaken by Applied Geology on behalf of the Client (Report Ref: AG3645-26-AV04, April 2026). This report should be read in conjunction with the Desk Study/Phase I Geo-Environmental Risk Assessment. However, a summary of the pertinent desk study findings relevant to the Phase 3A area is presented in Section 3 below.

An intrusive ground investigation was undertaken across the southern part of the Phase 3A area and wider Langstone Technology Park. Clancy Consulting Ltd completed the works for AG Langstone B.V (Ref: 10/1425/001, October 2019). With reference to the southern part of the Phase 3A area only, one borehole (WS1) and two trial pits (HTP1–HTP2) were undertaken in July 2019.

Applied Geology was appointed by the Client to undertake a Phase II ground investigation in order to:

- assess the presence of hazardous substances or conditions at the site that might warrant mitigation or remediation appropriate to the intended end use proposed by the Client.
- establish geological conditions and geotechnical parameters to assist in the safe and economic engineering design of the proposed development.
- Support a future planning application

The terms of reference/brief for the works were mutually developed between Applied Geology Ltd and Baynham Meikle Partnership Ltd (The Client's Engineer) and are outlined in our proposal and estimate reference AG26-9280let001, dated 9th January 2026.

The scope of works undertaken by Applied Geology comprised a ground investigation together with sampling, monitoring, and a programme of laboratory testing, followed by assessment and reporting of the results.

Underground service plans for the site were obtained by Applied Geology on 3rd February 2026. A Topographical Survey drawing (Dwg ref: 38869_T, dated January 2021 by Greenhatch Group), a copy of which was provided by the Engineer, is presented in Appendix A.

1.2 Report Layout

This report presents a brief description of the site, a summary of the relevant desk study information for the Phase 3A development area and the factual results of the intrusive investigations carried out. An interpretation of the ground conditions and a discussion/assessment of the findings is presented in the later report text sections. The main text of the report has been produced in a concise format, including the use of data tables to summarise key information where possible. The report should be read in conjunction with the general procedures detailed in Appendix E and General Notes given at the end of the main text, which provide details of investigation techniques, assessment methodology and standards, health & safety and limitations and exceptions of the report. Drawings and factual data including exploratory hole records, laboratory testing results and desk study records are presented in the other Appendices.

2.0 SITE DESCRIPTION AND PROPOSALS

2.1 Site Description

The proposed development site (Phase 3A) is located in the central area of Langstone Technology Park, approximately 1km south-west of Havant town centre. The Ordnance Survey grid reference for the approximate centre of the site is 471342 105682 as shown on the Site Location Plan (Dwg. No AG3744-26-3A-01), in Appendix A.

The Phase 3A site is rectangular in plan shape, with approximate dimensions of 85m by 110m, covering an area of approximately 0.95ha. Topographically, the site falls steadily from approximately 4.20m AOD across the western boundary to 4.05m AOD across the eastern part of the site.

The Phase 3A site is bounded on all sides by the wider Langstone Technology Park, with Building 4000 to the north, Building 7000 to the east, an access road to the south, with commercial units and associated car parking beyond, and Building 5000 to the west.

A site inspection/walkover was undertaken by Applied Geology on 11th February 2026 as part of the Phase I Desk Study. No significant changes had occurred to the site between the time of the site walkover and the ground investigation fieldwork, with the site remaining vacant.

2.2 Site Proposals

The proposals for the Phase 3A site comprise the construction of two new commercial/industrial units (Units 8 and 9) on the footprint of the former Building 6000 (2,707 m² and 1,989 m² respectively). It is understood that existing ground levels across the site will be raised by approximately 1m to provide flood protection. At this stage, the detailed nature of the proposed upfill is not confirmed, although it is anticipated that this would comprise a combination of stockpiled granular demolition arisings and imported granular material.

The current proposals are shown on the B6000 Feasibility Layout Option 5 by PRC (Drawing No. 11392-ME-XX-XX-XX-X-52), dated November 2025. A copy of the drawing is presented in Appendix A.

3.0 DESK STUDY SUMMARY AND CONCEPTUAL SITE MODEL

The desk study and initial Conceptual Site Model for the site (which includes the Phase 3A and Phase 3B development areas) are presented in the Phase I Desk Study/Geo-Environmental Assessment (Report Ref: AG3744-26-AV04, April 2026), which should be referred to for full details of the anticipated geology, geoenvironmental site setting, site history and preliminary risk assessment.

With reference to the Phase 3A development area only, the initial conceptual site model established a low - medium risk to end users (Human Health) via inhalation, ingestion, dermal contact pathways and a low to medium risk to the underlying Principal Aquifer and Secondary 'A' Aquifer (Controlled Waters) via migration and leaching, due to potential contaminants in the Made Ground. The initial conceptual site model as part of the Phase 1 desk study for the Phase 3A development area is summarised in the table below.

Source	Pathway	Receptor	Risk*
Potential contaminants (e.g. heavy metals, hydrocarbons, asbestos VOCs) within Made Ground associated with historical and existing site development inc. unspecified heap shown on the southeastern corner.	Inhalation, ingestion, dermal contact	End users	Low
	Migration and leaching	Principal Aquifer / Secondary A Aquifer and surface water feature	Medium
Potential contaminants (e.g. heavy metals, hydrocarbons and VOCs) within off-site Made Ground or resulting from historical off-site usage.	Migration and leaching onto site	Principal Aquifer / Secondary A Aquifer and surface water feature	Medium
Localised hydrocarbon/ fuel leakages/spillages from vehicles (car park areas), industrial uses and tanks (on and off-site)	Inhalation, ingestion, dermal contact	End users	Low
	Migration and leaching	Principal Aquifer / Secondary A Aquifer and surface water feature	Low-medium
Ground gas/volatile vapours from Made Ground / Alluvium (Mainly methane, carbon dioxide)	Inhalation	End users	Low-Medium
	Migration into buildings, service ducts etc.	End users	Low
Elevated sulphates in Made ground or natural soils	Direct contact, leaching and contact with groundwater	Buried concrete	Low

*** Definition of Risk Categories**
Negligible - Contaminants that might have unacceptable impact on key receptors, are unlikely to be present, or, no pathway is envisaged.

Low Risk: Contaminants may be present but are unlikely to be at levels to have unacceptable impact on key receptors, or pathways are likely to be minimal.
Medium Risk: Contaminants are probably present and might have an unacceptable impact on key receptors. Pathways may also be present therefore remedial measures may be necessary to reduce the risks.
High Risk – Contaminants probably or certainly present and pathways are probably also present. Therefore, contaminants are likely to have an unacceptable impact on key receptors and remedial measures are likely to be necessary to reduce the risks to acceptable levels.

4.0 GROUND INVESTIGATION WORKS

4.1 Fieldwork

Fieldwork across the Phase 3A site area was undertaken between 23rd and 26th February 2026 and is summarised in the following table:

Type	Number	Reference	Max depth (m bgl)	Rationale
Cable Percussion Borehole	2	CP04 and CP05	17.30	General coverage to confirm deeper ground conditions, permit the collection of geotechnical and geo-environmental samples and the installation of ground gas and groundwater monitoring standpipes.
Trial Pits	5	TP01 – TP05	2.6	To provide general geotechnical and geoenvironmental coverage and permit the collection of geotechnical and geo-environmental samples
Driven Continuous Samples	1	DCS09	3.45	General coverage to supplement the cable percussive boreholes and trial pits, permitting the collection of geotechnical and geo-environmental samples and the installation of ground gas and groundwater monitoring standpipes.

Fieldwork was generally carried out, where relevant, in accordance with BS5930 (2015+A1-2020) “Code of Practice for Site Investigations” and was supervised by an experienced Geoenvironmental Engineer.

The borehole and trial pit records, along with the SPT calibration certificates are included in Appendix B. Trial pit photographs are also presented in Appendix B.

The locations of the exploratory holes were selected and set out on site by Applied Geology Limited by trained personnel using a calibrated CAT and Genny in conjunction with the consultation of statutory service drawings. The locations were locally constrained by the presence of underground supply services and by the presence of two stockpiles located in the north-eastern and south-eastern areas of the site. Surveying and service clearance of each location was undertaken by Safe Dig Surveys Ltd between the 23rd and 24th February 2026. The exploratory hole locations are presented on Drawing No. AG3744-26-3A-02 in Appendix A. Levels and locations are presented on the exploratory hole records included in Appendix B.

On-site UXO specialist support was provided by EOD Contracts Ltd between the 23rd and 26th February 2026.

A Photo-ionisation VOC detector (PID) was used on samples of the Made Ground and shallow natural strata to determine if VOCs were present at detectable concentrations.

Four out of the five trial pits (TP02, TP03, TP04 and TP05) were terminated at depths of between 1.90m and 2.60m below ground level (bgl) due to continuous collapse of the trial pit walls in granular strata. DCS09 was terminated at 3.45m, also due to continuous collapse of the borehole in granular strata. CP04 and CP05 were terminated at between 17.00m and 17.30m bgl on SPT refusals in Undifferentiated Chalk.

4.2 Instrumentation and Monitoring

On completion of boring, 50mm diameter standpipes were installed in CP04, CP05 and DCS09 as follows, with further details included in the relevant borehole logs in Appendix B:

Stratum	BH No.	Response Zone (m bgl)	Diameter (mm)	Rationale
River Terrace Deposits	DCS09	1.00-2.00	50	Primarily gas monitoring
	CP05	1.00-6.00	50	Groundwater monitoring/ sampling and gas monitoring
River Terrace Deposits/Undifferentiated Chalk	CP04	1.00-7.00	50	Groundwater monitoring/ sampling and gas monitoring

Washed silica gravel (6-10mm) was used as the filter medium and a 300-micron filter sock was wrapped around the slotted section of the standpipe. Each standpipe was fitted with a push-in bung and single gas tap and was finished with flush metal cover concreted in place.

Ground gas and groundwater monitoring visits were undertaken on 4 occasions between 9th March to 17th April 2026 during two periods of falling atmospheric pressure. An additional 5th monitoring visit was completed on 17th April 2026, as monitoring points CP04 and DCS09 were inaccessible during the third visit on 25th March 2026. Each monitoring well was monitored for concentrations of carbon dioxide, methane, oxygen and VOCs (by PID), flow rates and differential pressures and groundwater level. The monitoring records are included in Appendix C.

Groundwater sampling was carried out on 17th March 2026. The standpipes installed in CP04 and CP05 were developed during the initial site visit on 9th March 2026 and subsequently sampled during the second visit on 17th March using dedicated bailers. All groundwater sampling was conducted in accordance with BS 6068-6.1 and BS ISO 5667-11. The groundwater sampling records are included in Appendix C.

4.3 Laboratory Testing

Geotechnical laboratory testing was scheduled by Applied Geology on selected samples recovered. Testing was undertaken in accordance with BS1377 and carried out at UKAS accredited laboratories Professional Soils Laboratory (PSL) Ltd (UKAS

lab No. 4043) and SOCOTEC UK Ltd (UKAS Lab No. 1252) (i.e. for the BRE suites) and comprised the following:

- 2 No natural moisture content tests;
- 2 No Atterberg limit tests;
- 5 No particle size distribution tests;
- 3 No saturated moisture content of chalk tests;
- 1 No quick undrained triaxial test; and
- 11 No BRE SD1 suite tests.

Chemical testing was scheduled by Applied Geology based upon the desk study, walkover and site observations during the fieldwork. Testing was carried out at UKAS accredited laboratory (SOCOTEC UK Ltd) (UKAS Lab No. 1252) with asbestos testing by The Testing Lab PLC (UKAS Lab No. 7758). Six samples of the Made Ground soils were analysed for the following suite of contaminants:

- Selected metals suite [arsenic, boron, beryllium, cadmium, chromium (total, trivalent and hexavalent), copper, lead, mercury, nickel, selenium, vanadium and zinc];
- Speciated (16 US EPA) Polycyclic Aromatic Hydrocarbons (PAH);
- Total Petroleum Hydrocarbons Criteria Working Group (TPH CWG);Benzene, Toluene, Ethylbenzene, and Xylene (BTEX);
- Methyl-tertiary-butyl-ether (MTBE);
- Phenols;
- pH;
- Soluble sulphate, and;
- Soil organic matter.

Six samples of the Made Ground soils were also submitted for Asbestos testing (presence, identification, and quantification, where applicable).

Two samples of groundwater were obtained from the standpipes installed in CP04 (River Terrace Deposits and Undifferentiated Chalk) and CP05 (River Terrace Deposits) and were tested for the following suite of contaminants:

- Selected metals suite [arsenic, boron, beryllium, cadmium, chromium (total, trivalent and hexavalent), copper, lead, mercury, nickel, selenium, vanadium and zinc];
- Speciated (16 US EPA) Polycyclic Aromatic Hydrocarbons (PAHs);
- Phenols (total);
- Total Petroleum Hydrocarbons Criteria Working Group (TPH CWG);
- Hardness;
- pH;
- Water soluble sulphate; and
- Total Organic Carbon.

Laboratory test results are included in Appendix D.

5.0 GROUND CONDITIONS

5.1 Strata Encountered

The investigation has proven Made Ground to depths of between 0.50m and 1.60m bgl, locally increasing to 2.60m bgl towards the southwestern site boundary, overlying natural Superficial strata of River Terrace Deposits, proven to depths of between 4.50m and 6.50m bgl. Solid strata of Undifferentiated Chalk were encountered beneath the Superficial Deposits and were proven to depths of between 17.00m and 17.30m bgl.

Full details of the strata encountered are given on the exploratory hole records presented in Appendix B. SPT N value results are plotted against depth in Appendix A. A generalised ground profile is presented below to summarise the information.

Stratum	Depth to Top of Strata (m bgl)	Thickness (range) (m)	Comments
Made Ground	GL	0.50–1.60 and locally up to 2.60	Encountered across the entire site, increasing in thickness towards the southwestern part of the site. The base of the Made Ground was proven in all exploratory holes, with the exception of TP03 (base depth of 2.60m bgl)
River Terrace Deposits	0.50–1.60	4.00–5.90	Encountered at all locations, apart from TP03, where the base of the Made Ground was not proven.
Undifferentiated Chalk	4.50–6.50	10.80+	Encountered in the CP boreholes (CP04 and CP05) only. Depth to the top of the stratum generally increased towards the north. Base not proven.

5.2 Made Ground

Granular Made Ground was encountered in all exploratory holes from ground level, generally to depths of between 0.50m and 1.60m bgl, locally increasing to 2.60m bgl towards the south-western site boundary.

The previous ground investigation undertaken by Clancy Consulting Ltd in 2019 along the southern boundary of Phase 3A identified Made Ground to depths of 1.20m (WS1), 1.40m (HTP1) and 1.20m bgl (HTP2), which generally correlates with the findings of this recent investigation. The base of the Made Ground was proven at a depth of 1.30m bgl in WS1.

The Made Ground generally comprised greyish brown/brown sandy silty gravel, locally with a low to medium cobble content. The gravel comprised fine to coarse angular to subrounded flint, concrete, brick, chalk and asphalt, with frequent wood, metal and plastic fragments.

No odours were reported within the Made Ground. Headspace testing undertaken on samples of the Made Ground recorded negligible VOC concentrations of between less than the instrument limit of detection (<0.1ppm) and 0.2 ppm.

5.3 River Terrace Deposits

Natural superficial strata of River Terrace Deposits were encountered directly beneath the Made Ground in all exploratory holes, (apart from TP03 where the base of the Made Ground was not proven at depth of 2.60m bgl) across the site and were proven to depths of between 4.50m and 6.50m bgl, achieving thicknesses of between 4.0m and 5.90m.

The stratum was predominately described as yellowish brown/greyish brown sandy clayey/silty gravel. The gravel comprised fine to coarse angular to subangular flint and chalk.

The stratum was encountered as a cohesive soil between 3.60m and 4.50m bgl in CP04, in the southeastern corner of the site. The material comprised firm yellowish brown slightly sandy slightly gravelly clay. The gravel comprised fine to coarse angular to subangular flint and chalk.

The previous ground investigation undertaken by Clancy Consulting Ltd along the southern boundary of Phase 3A encountered River Terrace Deposits in WS1 at a depth of 1.3m bgl, proven to a depth of 3.70m bgl. The material was described as very soft to soft brown brownish white sandy very gravelly clay. The gravel included flint and chalk.

Five particle size distribution tests undertaken on samples of the River Terrace Deposits generally recorded fines contents of between 2% and 49%, sand contents of between 9% and 22%, and gravel contents of between 29% and 89%, indicating the soil to be silty/clayey sandy gravel and slightly sandy, slightly gravelly silt/clay, which is in general accordance with the field descriptions.

A single Atterberg limit test carried out on a sample of the cohesive River Terrace Deposits (CP04 at 4.00m) recorded a plastic limit of 14%, a liquid limit 24%, a plasticity index of 10% (corrected to 8%), indicating the soil to be clay of low plasticity and low volume change potential. A moisture content test recorded a value of 16%.

Ten in-situ Standard Penetration Tests (SPTs) undertaken in the granular River Terrace Deposits generally recorded ‘N’ values of between N=13 and N=20 (medium dense). As single SPT N value of N=5 (loose) was recorded at 2.0m bgl in DCS09. However, it is noted that this coincided with a water strike at the same depth and as such is considered unlikely to be wholly representative. A single SPT was undertaken in the cohesive River Terrace Deposits at a depth of 3.60m bgl in CP04 and recorded a ‘N’ value N=11.

5.4 Undifferentiated Chalk

Undifferentiated Chalk was encountered directly beneath the River Terrace Deposits in the cable percussion boreholes (CP04 and CP05), from depths of between 4.50m bgl and 6.50m bgl and was proven to depths of between 17.00m and 17.30m bgl. The base of the Undifferentiated Chalk was not proven.

The cable percussion drilling method severely disturbs any structure present within Chalk strata, resulting in the recovery of highly disturbed samples. Although full engineering descriptions were generally not possible, the Undifferentiated Chalk was generally described as structureless chalk recovered as cream gravelly silt, Grade

Dc. The clasts comprised extremely weak, cream-coloured chalk fragments of gravel size, and the matrix comprised cream-coloured calcareous silt.

Sixteen in-situ SPT test were carried out within the Undifferentiated Chalk, recording 'N' values of between N=12 and N=>50. Consistent 'SPT refusals' with extrapolated N values of between N=64 and N=556, were generally recorded from depths of 11.00m bgl.

Three Saturation Moisture Content (SMC) tests were undertaken on samples of Chalk and recorded dry density values of between 1.61Mg/m^3 and 1.67Mg/m^3, indicating medium density chalk. The tests also recorded saturated moisture contents of between 23% and 25%.

During the previous Clancy Consulting Ltd investigation, a single borehole WS1 encountered a white gravelly clay, interpreted as weathered bedrock from a depth of 3.70 m bgl and proven to 5.45m bgl. This is generally consistent with the findings recorded in CP04 along the southern boundary. Two SPTs undertaken in the shallow weathered chalk in WS1recorded values of N=13 and N=15, which is in accordance with the findings of the current investigation.

5.5 Groundwater

Groundwater strikes were encountered during the ground investigation as summarised in the table below.

Location	Stratum	Depth of Groundwater
CP04	Undifferentiated Chalk	7.30m bgl no rise
CP05	River Terrace Deposits	2.10m rising to 1.80m bgl
DCS09	River Terrace Deposits	2.00m bgl
TP02	River Terrace Deposits	1.40m bgl
TP03	Made Ground	0.60m bgl
TP04	River Terrace Deposits	1.70m bgl
TP05	River Terrace Deposits	1.60m bgl

TP01 located along the northwestern corner of the Phase 3A area, remained dry during the ground investigation.

The previous boreholes along the southern site boundary, by Clancy Consulting Ltd, recorded groundwater at a depth of 2.00m, rising to 1.80m bgl after 20 minutes within the River Terrace Deposits, which is generally consistent with the findings of the recent investigation.

Subsequent groundwater level monitoring was undertaken on four occasions between 9th March and 25th March 2026. An additional monitoring visit was also completed on 17th April 2026, as CP04 and DCS09 were inaccessible during the third visit on 25th March 2026. Groundwater levels recorded during the monitoring visits are summarised in the table below:

Location	Stratum	Response Zone (m bgl)	Water level (m bgl)
CP04	River Terrace Deposits / Chalk	1.00–7.00	1.80 - 1.96 (3.02–2.86m AOD)
CP05	River Terrace Deposits	1.00–6.00	1.16 - 1.72 (3.33–2.77m AOD)
DCS09		1.00–2.00	Dry - 1.46 (2.82m AOD)

DCS09 was recorded as Dry during 3 out of the 4 groundwater visits.

It should also be noted that groundwater levels may vary beyond that observed during the fieldwork period due to seasonal effects throughout the year.

Based on the data collected, it is considered that the River Terrace Deposits and Chalk are likely to be in hydraulic continuity. The groundwater flow direction was unable to be determined as the levels are generally consistent across the site, however, it is likely to be towards the east and Lavant Stream.

5.6 Ground Gas

Variable thicknesses of Made Ground were encountered in all exploratory hole locations across the Phase 3A area. Apart from this, no other significant on-site sources of ground gas were observed during the site investigation.

Monitoring of the standpipes on a total of four occasions has recorded methane concentrations at less than detection limit (0.1% by volume). Carbon dioxide concentrations were recorded between less than detection limit (0.1% by volume) and 0.2% by volume. Oxygen concentrations were recorded between 11.3% (depleted) and 20.4% (atmospheric) by volume.

The boreholes were also screened using a Photo Ionisation Detector (PID) to determine the presence of VOCs, which recorded concentrations generally between less than the instrument detection limit (0.1ppm) and up to 0.4ppm in the standpipes (i.e. negligible).

Flow readings were taken over a three-minute period and reported maximum steady flow rates of less than the instrument detection limit (0.1l/hr).

Gas Screening Values (GSVs) have been calculated for each borehole, and the results are detailed in the table below.

Stratum	BH	Response Zone (m bgl)	Ground water level (m bgl)	Max. Methane (%)	Max. Carbon Dioxide (%)	Max. Steady Flow (l/hr)	GSV Methane (l/hr)	GSV Carbon Dioxide (l/hr)
RTD	DCS09	1.00 – 2.00	Dry – 1.46	0.1	0.1	0.1	0.0001	0.0001
	CP05	1.00 – 6.00	1.16 – 1.72	0.1	0.2	0.1	0.0001	0.0002
RTD/Chalk	CP04	1.00 – 7.00	1.80 – 1.96	0.1	0.1	0.1	0.0001	0.0001

RTD = River Terrace Deposits; Chalk = Undifferentiated Chalk
Green highlighted cells indicate CS-1 conditions.

5.7 Contamination

Apart from the presence of brick, concrete, asphalt and rare plastic fragments noted throughout the Made Ground there was no visual or olfactory evidence of significant potential contamination was noted. Specifically, no visual or olfactory of hydrocarbon or solvent contamination was identified during the fieldwork.

Headspace testing undertaken on samples of the Made Ground recorded negligible VOC concentrations of between <0.1ppm and 0.2ppm.

6.0 GEOENVIRONMENTAL ASSESSMENT

6.1 Human Health Risk Assessment

Although the current proposals allow for some minor areas of soft landscaping, mostly to the perimeter of the site, the proposed development generally comprises a large percentage of hardcover. Considering this and the context of the proposed development (commercial/industrial warehouses) and that the site levels will be raised in the order of 1m (although not confirmed, anticipated to comprise a combination of stockpiled granular demolition arisings and imported granular material), the source-pathway-receptor linkages to potential end users are effectively broken, and as such, there is considered to be a negligible risk to Human Health from potential contaminants in the ground. However, to account for the potential minor areas of proposed soft landscaping, a comparison of the chemical test results against generic screening criteria for a commercial/industrial end usage has been undertaken. The results of chemical testing on soils have been assessed as described in Appendix E, assuming 1% SOM in the soil.

The spreadsheets summarising the laboratory results and relevant screening values for each dataset are presented in Appendix D.

In respect of benzo(a)pyrene and other genotoxic PAHs, various PAH ratios have been plotted and compared against data from the Culp et al study and found to be generally within the same range, therefore the use of the surrogate marker approach is justified.

None of the chemical testing undertaken on the Made Ground samples exceeded their corresponding screening values based upon the currently proposed commercial/ industrial end usage.

All volatile compounds, including Naphthalene, BTEX and ‘lighter end’ hydrocarbon fractions ($<C_{10}$) were recorded below the laboratory limit of detection. Total phenols were also recorded below the laboratory limit of detection.

Measurable concentrations of PAHs have been detected in the Made Ground across the site, although well below the adopted screening criteria. Based on the source signature double ratio plots, the PAHs identified are considered likely to be predominantly coal derived.

Although no exceedances have been identified when compared to the adopted screening criteria, measurable concentrations of heavier end petroleum hydrocarbon fractions (C_{10}-C_{35}) were reported in four of the five samples of Made Ground, at total TPH concentrations of between 52.5mg/kg and 423mg/kg. The highest concentration

of 423mg/kg was reported in DCS09, at 0.3m bgl adjacent to the western site boundary. This could however be attributed to the presence of PAHs in the same samples.

Laboratory screening for asbestos did not detect any ACM within any of the samples screened.

The spreadsheet summarising the laboratory results and relevant screening values are presented in Appendix E.

Based on the above assessments to date, it is considered that the site presents a negligible risk to end users with regards to Human Health. As the site levels are to be raised by c. 1.0m, any material used to achieve this uplift must comprise clean, suitable imported fill that does not pose a risk to future site users.

6.2 Controlled Waters Risk Assessment

Although no exceedances against the relevant Human Health screening criteria have been identified (or visual evidence of hydrocarbon impacted soils) across the Phase 3A development area, the soil testing has recorded some elevated concentrations of PAH and heavier end TPH (C_{10}-C_{35}) in the Made Ground soils.

Considering the results of chemical testing on the soil samples and the site history, testing was also undertaken on two groundwater samples during the investigation, collected from CP04 and CP05 at depths of 1.80m and 1.72m bgl within the natural strata respectively. The response zones are detailed below:

Stratum	BH No.	Response Zone (m bgl)	Aquifer classification
River Terrace Deposits	CP05	1.00 – 6.00	Secondary 'A' Aquifer
River Terrace Deposits/ Undifferentiated Chalk	CP04	1.50 – 7.00	Secondary 'A' Aquifer/ Principal Aquifer

The testing undertaken on the groundwater samples has identified only marginal exceedances of some PAHs from the sample collected at CP05. However considering that the proposed development will mostly comprise hardstanding this will therefore limit any leaching potential and migration of contaminants from the Made Ground into the underlying groundwater. It is also noted that historically the surrounding area has been utilised for numerous industrial uses which could potentially impact groundwater.

Therefore, based on the context of the site and the proposed redevelopment, there is considered to be a negligible to low risk to Controlled Waters.

The spreadsheet summarising the laboratory results and relevant screening criteria of the dataset is presented in Appendix D.

6.3 Disposal of Soil Arisings

The results of chemical testing on the Made Ground indicates that much of the material tested would likely be classified as non-hazardous waste if sent for disposal at landfill (for which WAC testing is not required).

The natural soils are likely to be classified as inert waste, , however if natural soils are to be disposed of from site, inert WAC testing will likely be required to classify the soils for disposal.

The results of chemical testing should be used to assist with the classification of the soils for disposal.

General comments regarding the procedures for the assessment of waste soil for off-site disposal purposes is included in Appendix E.

7.0 GEOTECHNICAL ASSESSMENT

7.1 General

The proposals for the Phase 3A development area comprise the construction of two new commercial/industrial units (8 and 9), together with associated yard/loading areas and car parking. It is understood that site levels across the site will also be raised in the order of approximately 1.0m above existing ground level. No loading information was available at the time of writing this report, though conventional commercial/industrial loadings are envisaged.

The ground investigation has identified granular Made Ground, generally to depths of between 0.50m and 1.60m bgl, locally increasing to 2.60m bgl towards the south-western site boundary. The base of the Made Ground was not proven in the southwestern part of the site. The Made Ground was underlain by Superficial strata comprising granular River Terrace Deposits, proven to base depths of between 4.50m bgl and 6.50m bgl. Solid strata comprising Undifferentiated Chalk were encountered at depths of 4.5m and 6.5m and proven to depths of between 17.0m and 17.30m bgl.

Groundwater strikes were predominantly recorded in the Superficial River Terrace Deposits at depths of between 1.4m and 3.0m bgl, with a single groundwater strike recorded in the Undifferentiated Chalk at 7.3m bgl. Subsequent monitoring of the standpipes has generally recorded groundwater levels at depths of between c1.00m and 1.96m bgl.

7.2 Foundation Design and Floor Slabs

Prior to foundation construction, we understand that existing levels will be raised by approximately 1.00m. At this stage, the detailed nature of the proposed upfill is not known, though it is understood this would likely comprise a combination of stockpiled granular demolition crush and imported granular material. Prior to placement of upfill, it is recommended that any hardstanding and known obstructions are removed as they would represent potential obstructions to future construction and create hard spots which could influence future settlement of placed fills and foundations.

Placement of upfill above the existing ground surface will result in induced settlements within the underlying Made Ground and natural strata as a result of the additional surcharge. The majority of settlements within the granular Made Ground and granular River Terrace Deposits would occur quickly, though induced settlements within the cohesive River Terrace Deposits would be ongoing for a longer period. A detailed geotechnical assessment would be required to determine both the magnitude and duration of potential total and differential settlements.

A number of foundation solutions for column loads may be feasible, though these would need to be carefully considered alongside options for floor slabs, due to the proposed upfilling, as follows:

Deep Spread Foundations on Natural Strata

Based on the strata encountered, traditional pad foundations could be considered, founded on the medium-dense granular River Terrace Deposits encountered at depths of between 1m and c.2.5m below existing ground level across the site. Pad foundations placed within granular River Terrace Deposits may be designed to an allowable bearing pressure of up to 125kN/m^2. This is based on a lower-bound SPT N value of N=13 and using traditional methods of bearing capacity calculations e.g. as set out in Tomlinson 7th Edition and a factor of safety against a factor safety of 3 against bearing capacity failure whilst limiting total settlement to 25mm.However, taking into account the depth of the Made Ground and the proposal to raise site levels by the order of 1m, the River Terrace Deposits would be at increased depth following upfilling, resulting in potential overbreak/collapse and the requirement to remove greater volumes of soil.

Ground Improvement

Ground improvement by vibro-replacement or rigid inclusions could also be considered to support column loads and slabs following upfilling (or potentially prior to upfilling in association with upfill acting as an engineered load transfer platform), subject to the nature of the proposed upfill. This would however be subject to consultation with specialist contractors to assess the suitability of the soils to be treated. We understand this approach has been adopted on earlier development phases to the immediate south. Other proprietary forms of ground improvement may also be feasible and the advice of specialist contractors should be sought.

Where vibro-replacement was proposed prior to upfilling, proposed upfill could comprise suitably engineered granular material, or potentially other suitably engineered fill (including possible modified or stabilised clay fills). It should however be noted that the placement of the upfill material (either prior to or following vibro-replacement ground improvement), would result in total and differential consolidation settlement of any cohesive Made Ground and ground improvement would not wholly prevent this. It should be possible to manage this settlement with time and possibly some additional surcharging, although this would require careful technical appraisal and time allowance for the induced settlement to take place. The same effects would also need to be taken into account beneath ground floor slabs. It is recommended that discussions are undertaken with specialist contractors to establish whether they consider this solution to be feasible. Subject to specialist contractors confirming suitability for treatment and appropriate management of surcharge induced settlements, shallow reinforced foundations could be possible together with ground bearing floor slabs. Allowable bearing pressures would be defined by the appointed specialist contractor, though typically we would expect allowable bearing pressures in the range 100 – 150kN/m^2 to be feasible, potentially higher. Such a solution would reduce the required depth of excavation compared to spread foundations in natural strata and minimise risk of groundwater entry into foundation excavations.

Piled Foundations

A piled solution for both the foundations and floor slabs may be considered, which represents a low-risk solution to address the various technical considerations. This would also minimise the volume of arisings for potential disposal. Piles would need to extend through any imported upfill, existing Made Ground, Superficial Deposits and gain support via skin friction and end bearing, within the Undifferentiated Chalk. The use of bored, CFA or driven piles is likely to prove suitable for the site, however it is recommended that the advice of a specialist piling contractor is sought with regard to detailed design, including suitable pile diameters, capacities and confirmation of suitable pile types. The nature and thickness of the upfill material will also need to be taken in to account with regards to pile mat design.

Earthworks

Another potential option would be to excavate the existing Made Ground and replace suitable soils to an engineered specification. This would however require careful and detailed assessment and would require further ground investigation works in order to obtain bulk samples for earthworks testing. It should be noted that the engineered fill would also need to be placed to raise levels. Following such earthworks, shallow reinforced foundations on engineered fill should be possible together with ground bearing floor slabs. Allowable bearing pressures would be a function of the earthworks specification, though it is envisaged that allowable bearing pressures for pads in the range 100 – 150kN/m^2 would typically be feasible following a competent, controlled earthworks exercise.

If ground conditions encountered during construction differ from those recorded during the investigation, further geotechnical input should be sought to refine the foundation design.

7.3 Floor Slab Gas Protection

Based on the gas monitoring undertaken to date and the calculated GSVs the site is likely to be characterised as Characteristic Situation 1 (CIRIA C665). The site is also not in a Radon affected area. Therefore, gas protection measures are not considered necessary for the proposed development.

7.4 Excavations

Excavation depths will depend on the chosen foundation solution at the site. Any excavations on site can be expected to be in a combination of granular Made Ground and predominantly granular River Terrace Deposits. During the investigation, instability of the trial pit walls was observed in four out of five trial pits.

In general, excavations will likely be prone to some instability particularly where advanced into the granular River Terrace Deposits and in particular once groundwater is encountered. As such, excavations into these soils may need to be graded back to a stable angle or trench support be provided. Trench support or the angle of batter should be designed by an appropriately qualified engineer or competent person to suit the required depth and the ground and groundwater conditions. Furthermore, due to the potential for groundwater ingress (from depths of 1.4m below existing ground level), it is recommended provision for groundwater control is made, particularly if any deeper excavations are proposed.

7.5 Buried Concrete and Services

The Design Sulphate Class and the Aggressive Chemical Environment for Concrete (ACEC) class have been assessed for each of the strata encountered. The characteristic values calculated for each stratum are outlined in the table below.

Strata	No of samples tested	Soluble Sulphate (g/l)*1	Total Potential Sulphate (%)	Potentially Pyritic	pH	Design Sulphate Class	ACEC*2
Made Ground	8	548	-	No	8.5	DS-2	AC-2
River Terrace Deposits	6	217	-	No	8.8	DS-1	AC-1
Undifferentiated Chalk	2	17	-	No	9.1	DS-1	AC-1
Groundwater (River Terrace Deposits/Chalk)	2	19	-	-	7.4	DS-1	AC-1

Notes:
*1: Characteristic values are rounded to the nearest 10mg/l. In a data set of less than 5 samples, the highest sulphate value and lowest pH is taken as the characteristic value. In a data set of between 5 and 9 the mean of the highest two sulphate test results has been taken as the characteristic value. In a data set in excess of 9, the mean of the highest 20% has been taken as the characteristic value.
*2: Assumes mobile groundwater.

The results of the sulphate tests carried out have identified the Design Sulphate Class to be DS-2 with the Aggressive Chemical Environment for Concrete (ACEC) being AC-2 for the Made Ground as defined by the BRE Special Digest 1, Concrete Aggressive Ground, 2005 for a brownfield site and mobile groundwater regime. For the River Terrace Deposits and Undifferentiated Chalk, the sulphate test results indicate DS-1 and AC-1 conditions. Groundwater samples collected from standpipes in the River Terrace Deposits and Undifferentiated Chalk, also indicate DS-1 and AC-1 conditions.

Further reference should be made to BRE Special Digest 1 for requirements in respect of types of cement and aggregate to be used and variations in type of concrete construction.

No 'light end' (less than C_{10}) TPHs, BTEX, or MTBEs, were detected during the ground investigations undertaken. Locally, typically low concentrations of 'heavier end' (C_{12} to C_{35}) TPH fractions were detected in the Made Ground at concentrations of between 52.5mg/kg and 423mg/kg. Subject to detailed proposals, some restrictions on buried water supply pipeline materials may be necessary. However, the chosen pipeline materials should be discussed and agreed with the local Water Authority once water supply pipe routes and depths are known.

8.0 CONCLUSIONS AND RECOMMENDATIONS

8.1 Geo-environmental

The risk assessments in Section 7.0 have indicated a negligible risk to human health and low risk to Controlled Water receptors based on the proposed development. Therefore, no further action is considered warranted. However, should any suspected

contamination be encountered during redevelopment appropriate advice should be sought.

8.2 Geotechnical

Based on the findings of the recent ground investigation, ground improvement techniques such as vibro-replacement or rigid inclusions are considered likely to provide an appropriate foundation solution for the proposed units and associated floor slabs. However, further consultation with specialist ground improvement contractors will be required to verify the suitability of the in-situ soils for treatment and to confirm the most appropriate method.

The proposed upfill will influence the design of ground improvement solutions (and piling if adopted) and will also influence the design of the external areas, in terms of induced settlements (which need to be assessed), likely CBR values, working platform design, sulphate classification etc.

Based on the gas monitoring undertaken on site, it is considered that Characteristic Situation 1 (CIRIA C665) applies, and gas protection measures are not required.

A Design Sulphate Class of DS-2 and ACEC Class AC-2 is considered appropriate for buried concrete.

Applied Geology Limited
Suite 19, Lowton Business Park
Newton Road
Lowton St. Mary's
Warrington
WA3 2AN

Tel: 01925 738599