

LIVERPOOL FC ACADEMY PHASE 2 GROUND INVESTIGATION REPORT

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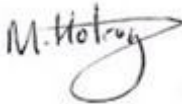
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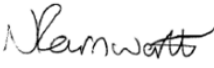
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P03	Update following comments	JL	NF	03 February 2026
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EXECUTIVE SUMMARY

Appointment	Curtins were instructed by Rider Levett Bucknall on behalf of Liverpool FC to undertake an Intrusive ground investigation at Liverpool FC Academy, The Academy Way, Liverpool, L33 7ED. The site is centred on National Grid Reference 342370, 398490, and covers an area of approximately 5.63 Ha. It is understood that the development proposals comprise of the construction of a new indoor pitch, new show pitch with spectator stand, extension of the existing car park, extension and refurbishment of the existing Academy Building, all with associated hard and soft landscaping.
Current Site Status	The site is located in Kirkby, Knowsley and is currently occupied by the Liverpool FC Academy which comprise of two academy buildings, an indoor pitch, two outdoor pitches and a hardstanding carpark with associated soft landscaping.
Summary of Phase 1	Earliest available mapping (1850) shows the site as agricultural land, with a farm building labelled 'Fazakerley's Farm' and an orchard located at its centre, and an access track extending from the building to the northwestern boundary. 'Potter's Lane' is shown to pass through the southern corner of the site, running west to northeast. No significant changes on site occur until 1968 when the farm building, orchard and access track are no longer present. There is now part of a football ground labelled 'Kirkby Town FC' and electric substation present along the southern boundary, the rest of the site is a playing field. By 1994, mapping shows the football ground and electrical substation are no longer present. The entire site is now a playing field. By 2001 the site is now occupied by the buildings, football pitches, hardstanding car park and hard/soft landscaping associated with the Liverpool FC Academy. There is also an electric substation located along the northwestern site boundary. In 2018, a building known as the family suite was constructed to the north of the astroturf pitch. In 2023 an attenuation tank was constructed immediately south of the caretaker's yard. No further changes have occurred on site to the present day. BGS maps indicate the site to be underlain by Shirdley Hill Sands underlain by the Kinnerton Chester Formation (Sandstone). The Shirdley Hill Sands is classified as a Secondary A Aquifer, with the Chester Formation deposit classified as a Principal Aquifer.
Fieldworks Undertaken	Intrusive site investigation works were undertaken between the 10th and 21st of November 2025, and comprised 3 No. window samples, 6 No. rotary cored boreholes, 2 No. machine excavated trial pits for soakaways and 15 No. hand excavated trial pits. Ground gas and groundwater monitoring standpipes were installed in 6 No. rotary cored boreholes and 2 No. window sample boreholes. 6 No. return gas and groundwater monitoring visits have been undertaken between the 01st of December 2025 and 18th of March 2026.
Encountered Ground Conditions	Topsoil was encountered in thirteen locations from ground level to maximum depths ranging between 0.10m to 0.31m bgl (38.52m to 36.07m AOD). Topsoil was largely Localised in two locations, including the football pitch and associated soft landscaping located in the west of the site and the soft landscaping in the north of the site. Granular Made Ground was encountered either underlying Topsoil or from ground level and was recorded to maximum depths of 0.30m to 4.00m bgl (37.91m to 34.19m AOD). This deposit typically comprised of a 'greyish brown to dark brown slightly clayey gravelly sand with variable cobble content' or 'brown to dark brown fine to coarse sand'. The greatest extent of granular Made Ground soils is present along the sites northeastern and southwestern boundaries. Anthropogenic materials recorded in the granular Made Ground generally comprised of brick, concrete, sandstone, limestone, plastic, pottery and slag. Cohesive Made Ground was encountered in four locations either underlying or interbedded with granular Made Ground soils. Cohesive Made Ground was encountered from depths ranging between 0.50m to 1.30m bgl (35.93m to 35.22m AOD) with thicknesses of the deposit ranging between 0.10m and 2.20m. Deposits consistent with the Shirdley Hill Sands were encountered in four boreholes. This deposit was recorded to be underlying the Made Ground soils and was encountered from depths ranging between 0.60m and 3.00m bgl (38.02m to 33.38m AOD). The thickness of the Shirdley Hill Sands ranged between 0.20m and 1.45m. This deposit was typically described as a 'Light brown to brown slightly gravelly fine to coarse sand'; however, was recorded to contain Localised lenses of peat. Localised peat lenses were generally limited in thickness ranging between 0.20m and 0.40m and appeared to be Localised to the northern and southern extents of the site. Glacial Till was largely encountered as a cohesive deposit from depths ranging between 0.84m to 4.00m bgl (35.68m to 34.19m AOD) with thickness of cohesive Glacial Till ranging between 0.30m and 1.47m. This deposit did not appear to be Localised and was recorded to be underlying the entirety of the site dipping in a northern to southern direction. This deposit was typically described as a 'Soft to stiff brown or grey sandy, slightly gravelly occasionally silty clay'. Granular Glacial Till deposits were encountered from depths ranging between 0.50m and 4.70m bgl (36.10m and 33.49m AOD), with thicknesses ranging between 0.20m and 1.48m. This deposit was typically described as 'reddish brown, brown or grey slightly clayey, gravelly sand'. Granular soils indicative of weathered bedrock of the Chester Formation was encountered within seven No. locations immediately underlying the Glacial Till deposits encountered from depths of 1.58m to 5.05m bgl (39.94m to 33.14m AOD), with proven thicknesses ranging between 0.48m and 1.40m.

Environmental Laboratory Testing and Ground Gas Monitoring Results	With respect to the proposed end use of (Commercial) Tier 1 thresholds for human health were not exceeded in any of the samples. All soil samples were screened for asbestos with one sample being positively identified as containing asbestos HP11 at 0.3m bgl (<0.001%w/w). This is in conjunction with asbestos previously identified during the MML ground investigation (WS01 at 1m bgl (0.0025% w/w) and RBH01 at 0.5m bgl (<0.001% w/w). Minor exceedances of UK Drinking Water Standards and the World Health Organization Standards in five contaminants including Metals, and PAHs from 2 groundwater sampling locations. Risks to controlled waters from site soils are limited in nature and are unlikely to significantly benefit from either further contaminant modelling or remedial action. The gas screening value for the site is taken as 0.0113 l/hr for carbon dioxide, corresponding with a CS-1 classification, not requiring gas protection measures. It is noted that elevated concentrations of carbon dioxide were recorded in several boreholes, including WS01 (Made Ground), RBH04 (relic topsoil and Shirdley Hill Sand) and WS02 (Shirdley Hill Sand). Elevated carbon dioxide concentrations are attributed to biological respiration, which is a naturally occurring process and does not pose a risk of hazardous gas emissions. As such, it is considered that increasing the characteristic situation to CS-2 due to marginally elevated carbon dioxide concentrations sourced from biological respiration is not required. Marginally elevated concentrations of methane were recorded within Made Ground from WS01 are unlikely to present a risk to site end users. The main risk driver of elevated methane sourced from ground gas generation is the risk associated with explosive atmospheres. The monitoring data shows that methane concentrations ranging from <0.1 % v/v to 2.2 % v/v, with corresponding oxygen concentrations ranging between <0.1% v/v and 0.9 % v/v. Guidance indicates that these concentrations would lie in the zone where the atmosphere is not capable of forming explosive mixtures with air. Coupled with steady state air flow rates of <0.1 l/hr throughout the monitoring period, it is considered that increasing the characteristic situation to CS-2 due to marginally elevated methane concentration is not required. Overall, it is considered that CS-1 is appropriate for the site, and that no ground gas protection measures are required.
Ground Contamination and Ground Gas Assessment	A Moderate/Low risk rating is identified to site end-users and construction workers from contamination in Made Ground soils from direct contact, dermal uptake, soil and dust ingestion and inhalation. There were no exceedances of Commercial GACs; however, asbestos fibres in soils were identified during both the MML and Curtins ground investigation. containing materials have been encountered. Contractors must prepare suitable risk assessments risk assessments and methods statements, and mitigation measures which may not be limited to the use of suitable PPE and provision of suitable welfare and sanitary facilities during works. Clean capping in localised new soft landscaping may be required. A Moderate/Low risk rating is identified to controlled waters (Groundwater), and a Low risk rating is identified to controlled waters (Surface Waters) as the ground investigation encountered no olfactory, visual or gross contamination. A Low risk rating is identified to site end users from ground gases following the monitoring visits, with a CS-1 assigned to the site, the development requires no ground protection measures.
Geotechnical Assessment	Based on the required loadings and the ground conditions encountered during Curtins intrusive ground investigation shallow foundations are not considered suitable for the proposed development. Alternatively, a piled foundation solution is likely to be feasible, to transfer loads to more competent sandstone bedrock. End bearing piles socketing into the Chester Formation sandstone are likely to be a suitable foundation solution for high loads. Based on the findings of the ground investigation it is recommended that consideration is given to constructing suspended ground floor slabs, bearing on pile caps and supported by a network of beams. Based on the laboratory testing results discussed in Section 6.2.2, the cohesive Glacial Till encountered on site has a low volume change potential. 2 No. soakaways were undertaken as part of the ground investigation. Infiltration rates were determined as N/A, due to the water level remaining the same throughout the length of the test. Soakaways are not considered to be a suitable drainage strategy for the proposed development. It is known that earthworks will be required to facilitate the scheme. It is anticipated that a Cut and Fill will be required for the site. It is important that the earthworks are undertaken under an Earthworks Specification in accordance with CC 601 Earthworks Guidance. The preliminary design of buried concrete according to Table C2 of BRE Special Digest 1:2005 should be in accordance with the classification as DS-1 and ACEC Class AC-2z.
Recommendations	Based on the findings of the ground investigation, the following recommendations are made: - Construction workers to be provided with appropriate PPE and sanitary facilities with reference to environmental testing certificates appended herein. - Adopt an Asbestos Management Plan during groundworks and construction works.

- A clean capping layer may be required in some areas of new soft landscaping, or else further assessment of risk recommended with respect to proposed development plans.
- It is recommended that a Remediation Strategy is produced to detail the above requirements.
- It is recommended that an Earthworks Specification is undertaken once final cut and fill volumes have been finalised.
- It is recommended that a specialist piling contractor is consulted to assess the suitability of a piled foundation solution for the proposed development.

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1 INTRODUCTION

1.1 Project Background

Curtins were instructed by Rider Levett Bucknall on behalf of Liverpool FC to undertake an Intrusive ground investigation at Liverpool FC Academy, The Academy Way, Liverpool, L33 7ED. The site is centred on National Grid Reference 342370, 398490, and covers an area of approximately 5.63 Ha.

It is understood that the development proposals comprise of the construction of a new indoor pitch, new show pitch with spectator stand, extension of the existing carpark, extension and refurbishment of the existing Academy Building, all with associated hard and soft landscaping.

A proposed site plan is included in *Appendix A*.

1.2 Scope of Services

This investigation aims to characterise the geo-environmental and geotechnical conditions for the proposed works.

Specifically, the Phase 2 report is intended to determine:

- a) If there is a risk of the proposed end user being adversely impacted upon by potential contamination in shallow site soils that may be present on the site due to its known current, recent and historical use;
- b) If there is a risk of groundwater and/or surface water being adversely impacted upon by potential contamination that may be present on the site due to its known current, recent and historical use;
- c) If there is a risk to the end user from soil gases including methane, carbon dioxide, carbon monoxide and hydrogen sulphide; and,
- d) Likelihood of the proposed works being adversely impacted by potential geo-hazards across the site.

In addition, engineering recommendations for the proposed development comprising of a new indoor pitch, new show pitch with spectator stand, extension of the existing carpark, extension and refurbishment of the existing Academy Building, all with associated hard and soft landscaping are provided.

Detailed flood risk assessment, ecology and archaeological studies are outside the scope of this report.

2 PHASE 1 PRELIMINARY SITE ASSESSMENT SUMMARY

This section presents a summary of the current site setting, history, geology, and hydrogeology/hydrology, previously detailed in the Phase 1 Preliminary Risk Assessment Report (Ref. 2). As such, it is advised that this report is read in conjunction with the Phase 1 Preliminary Risk Assessment Report (Ref. 2). A summary of the pertinent Phase 1 Preliminary information specifically for the proposed development site is presented in the following sub-sections.

This information will feed into the geotechnical assessment (refer to Section 6.0) and geo-environmental risk assessments (refer to Section 7.0).

2.1 Current Setting

The site is located in Kirkby, Knowsley and is currently occupied by the Liverpool FC Academy which comprises of two academy buildings, an indoor pitch, two outdoor pitches and a hardstanding carpark with associated soft landscaping.

The site is irregularly shaped and covers an approximate area of 5.63 Ha.



Figure 1 – Site Location Plan (site boundary shown in Red)

The site surrounding land use is summarised in Table 1.

Table 1 – Surrounding Area

Surrounding Area	N	The northern boundary of the site is marked by soft landscaping and an access track into the wider Liverpool FC Training Grounds, beyond which football pitches are present.
	E	The eastern boundary of the site is marked by soft landscaping and vegetation. Arbour Lane is present just beyond the boundary, followed by an industrial park development.
	S	The southern boundary of the site is marked by soft landscaping and vegetation. Commercial developments are present just beyond the boundary, followed by County Road (A5208).
	W	The western boundary of the site is marked by soft landscaping and vegetation. Simonswood Lane is present just beyond the boundary, followed by a residential development.

2.2 Previous Site Use

A review of the available historical map information for the site, as presented within the Phase 1 Preliminary Risk Assessment Report (Ref. 2) has been undertaken with specific reference to potential sources of contamination and geohazards.

Earliest available mapping (1850) shows the site as agricultural land, with a farm building labelled 'Fazakerley's Farm' and an orchard located at its centre, and an access track extending from the building to the northwestern boundary. 'Potter's Lane' is shown to pass through the southern corner of the site, running west to northeast.

No significant changes on site occur until 1968 when the farm building, orchard and access track are no longer present. There is now part of a football ground labelled 'Kirkby Town FC' and electric substation present along the southern boundary, the rest of the site is a playing field.

By 1994, mapping shows the football ground and electrical substation are no longer present. The entire site is now a playing field. By 2001 the site is now occupied by the buildings, football pitches, hardstanding car park and hard/soft landscaping associated with the Liverpool FC Academy. There is also an electric substation located along the northwestern site boundary.

In 2018, a building known as the family suite was constructed to the north of the astroturf pitch. In 2023 an attenuation tank was constructed immediately south of the caretaker's yard.

No further changes have occurred on site to the present day.

2.3 Published Geology

A review of the Curtins' Phase 1 Report (Ref 2), indicates the following geological sequence:

- Shirdley Hill Sands Alluvium (Superficial); and
- Chester Formation (Bedrock)

2.3.1 Made Ground Deposits

The BGS maps indicate Made Ground soils underlying the southeast of the site. Given the phases of construction that have taken place on site it is considered likely that Made Ground soils may underlie its entirety.

2.3.2 Superficial Deposits

Superficial deposits are recorded as the Shirdley Hill Sands comprising of moderately to well sorted coastal blown sands with layers of peat in its lower part.

2.3.3 Bedrock Deposits

Bedrock deposits are indicated to comprise the Chester Formation, comprising cross bedded, pebbly sandstone with subordinate beds of sandstone.

2.3.4 Mining and Quarrying

The Curtins Phase 1 Report (Ref 2), confirmed that the site is not located within a coal mining reporting area and as such the risk from historic coal mining has not been considered further.

There is one BGS recorded mineral site located within 250m of the site associated with the extraction of sandstone; however. Extraction has ceased and it is not considered to pose risk to the proposed development.

2.3.5 Other Pertinent Existing Geological Records

There are no BGS recorded faults either onsite or within 150m of the site.

Ground stability hazards are generally of no hazard to very low hazard on site, a low potential for running sands is noted onsite, likely associated with the Shirdley Hill Sands noted on BGS mapping.

2.4 Hydrogeology and Hydrology

The Shirdley Hill Sands deposit is classified as a Secondary A Aquifer, defined as:

“Secondary A Aquifers comprise permeable layers that can support local water supplies, and may form an important source of base flow to rivers.”

The Chester Formation deposit is classed as a Principal Aquifer, defined where:

“Strategically important rock units that have high permeability and a high water storage capacity.”

The site is located within a Zone III Source Protection Zone.

The nearest surface water feature is recorded to be an inland river located c. 680m north of the site.

2.5 Landfill & Pollution

There are no Historical or BGS Recorded Landfill sites located within 250m of the site.

There are two licenced waste management facilities within 250m of the site boundary. The closest of which is located 94m east of the site, the category is not supplied.

There are two Local Authority Pollution Prevention and Control Permits located within 250 m of the site. The closest record is located 156 m east of site for mobile screening and crushing processes (PG3/16).

2.6 Previous Reports

A ground investigation report has been made available to Curtins for review undertaken across the wider LFC training ground site including the development of the AXA training centre to the north. Specific information pertaining to the LFC Academy development area have been extracted from the report and is summarised below.

It is understood that no reliance can be placed on this information.

2.6.1 Proposed Training Campus for Liverpool Football Club and Enhancements, Mott Macdonald (May 2017)

Mott Macdonald Ltd (MML) were commissioned by Liverpool Football Club and Athletic Grounds Ltd (LFC) to design and interpret an intrusive ground investigation in 2017 to provide ground data and supporting information to support redevelopment of the club's training ground at Kirkby in the metropolitan borough of Knowsley in Merseyside.

Relevant ground investigation data used within MML's interpretative assessment pertaining to the Liverpool FC Academy development site is summarised below.

2.6.1.1 Ground Conditions Encountered

The most relevant exploratory hole locations under the proposed indoor pitch have been reviewed. Made ground was encountered to a maximum depth of 4.70 m bgl and typically comprised granular material with demolition debris, some locations also encountered cohesive material with demolition debris. Beneath the Made Ground, two natural granular deposits occur Glaciofluvial Sand (reddish brown with ~15% subangular gravel) and completely Weathered Sandstone derived from bedrock. Sandstone bedrock was confirmed at 1.40 m bgl (35.06 m AOD) at the in the northwest corner and approximately 5.10 m bgl (33.11 m AOD) in the southeast corner of the proposed indoor pitch.

Groundwater levels with a response zone in the sandstone bedrock had levels stable levels varying from 5.20 m bgl (33.01 m AOD) to 2.70 m bgl (33.80 m AOD), indicating the groundwater table is situated near the surface of the underlying sandstone bedrock. The monitoring point with a response zone in granular Made Ground had groundwater levels fluctuating between 1.50 m bgl (34.96 m AOD) and 1.90 m bgl (34.96 m AOD) indicating a locally higher groundwater level, probably water percolating downwards from the ground surface perched on clay horizons within Made Ground.

2.6.1.2 Pertinant Findings

Analysis of the soils by MML identified asbestos within two locations. No other soil contaminant concentration exceedances of relevant screening criteria were identified.

Gas screening values were calculated from measured methane and carbon dioxide concentrations in keeping with BS 8485. Most screening values fell were constantly below 0.07 l/hr. Screening values calculated from the concentration and flows measured during the first round of monitoring did yield screening values of 0.180 and 0.07 l/hr. However, these values were not maintained over subsequent monitoring visits, and the ground was therefore not considered to be actively gassing. From the overall trend in Gas Screening Values, the Characteristic Situation of the site was considered to be Characteristic Situation 1 (CS1) by MML.

No exceedances were identified in groundwaters sampled within the area of the development site. However, a number of exceedances of UKDWS and EQS detection limits along with other contaminants were identified in leachates and groundwaters across the wider site. An examination of the contaminants and results has shown that risks to controlled waters from site soils are limited in nature and are unlikely to significantly benefit from either further contaminant modelling or remedial action. The majority of the generally low-level leachable contaminants were identified across the site within Made Ground Deposits and topsoil with no specific historic or, current point source identified.

A Detailed UXO risk assessment was procured by MML and concluded a high risk from UXO on site. This considers an elevated risk from German UXO and allied UXO.

2.6.1.3 Conclusions and Recommendations

Minor exceedances were encountered against risks to Controlled Waters. Removal of Made Ground from the site was not considered sustainable or cost-beneficial for the risks identified by MML.

MML recommended that specialist advice should be sought regarding the significance and appropriate mitigation of the asbestos identified within two exploratory locations in the Proposed Indoor Pitch Area.

Risk from unexploded ordnance was flagged a high due to bombing raids on the Royal Ordnance Factory Kirkby that took place during WWII. Risks to ground investigation operatives were mitigated by the use of magnetometer techniques within boreholes pre-empt detect buried metallic bodies. No anomalies were identified.

2.7 Unexploded Ordnance (UXO) Risk Assessment

It should be noted that the following assessment is only applicable to the Curtins Ground Investigation described in this report only. Where the client is looking to determine the risk from UXO throughout the entire enabling works and development, the Principal Contractor appointed for the enabling and construction works must obtain their own Detailed UXO Risk Assessment Report to advise their specific works.

UXO Risk Mapping indicates that the risk posed by UXO associated with WW2 bombing to be **High-Risk** within the site. Areas designated as High-Risk are those that shows a bombing density of 50 bombs per 1000 acre or more. This assessment accounts for the following:

- *ROF Kirkby* was situated partially on-site and immediately east and would have been considered a primary bombing target during WWII
- ARP recorded bomb strikes on site and within the surrounding area, and the proximity to *ROF Kirkby*.
- Since WWII, Ordnance has been discovered within close proximity to the Study Site and it is considered probable that they were linked to *ROF Kirkby*. Additional ammunition may have been deliberately buried.
- Since WWII, several buildings have been constructed on site. It is likely that any UXO within the structural footprint of post-war buildings would have been discovered and removed, however, the potential for UXO to be present below existing foundations and within undeveloped areas is assessed to remain extant.

In relation to ground investigation works, the report made a number of risk mitigation recommendations including:

- i) UXO risk management plan.
- ii) UXO safety awareness briefings
- iii) EOD banksman support.

iv) Magnetometer survey.

If unexploded ordnance is discovered during any works, stop immediately, prevent access to the area, and inform the police. If the site boundary or location changes then the UXO risk should be reassessed.

2.8 Summary of Phase 1 PCSM

A summary of potential pollutant linkages at the development site identified in the Phase 1 Preliminary Risk Assessment Report (Ref. 2) presented in Table 2, were identified as requiring further investigation to enable the safe redevelopment of the site.

Table 2 – Summary of Phase 1 PCSM

Potential Source	Pathway	Receptor	PCL	Risk
Potential for uncontrolled deposition of Made Ground associated with local construction works.	Direct contact, ingestion, inhalation (dust and vapours).	End User of Site (Residents)	1	Moderate/Low
		Adjacent Site Users	2	Low
Potential for Localised fuel spills and leakages associated with hard standing carparks and roads located onsite.	Vertical migration through superficial deposits.	Controlled Waters (Groundwater)	3	Low
	Horizontal migration over and through superficial deposits.	Controlled Waters (Surface Water)	4	Low
Onsite and offsite soils with the potential to generate ground gases.	Vertical and horizontal migration through existing service corridors and the underlying superficial deposits.	End User of Site (Indoor Football Pitch)	5	Low

Potential contaminants of concern associated with the sources identified within the Conceptual Site Model include but are not limited to: broad range aliphatic and aromatic hydrocarbons present within any fuel oils; polycyclic aromatic hydrocarbons (PAHs); inorganic compounds including heavy metals; asbestos present in discarded building materials and Made Ground.

Potential contaminants associated with the airborne dust/particulates include but are not limited to: polycyclic aromatic hydrocarbons and inorganic compounds including toxic metals that are also accounted for by potential onsite contaminants of concern.

The qualitative risk assessment determined PCL 1 associated with the proposed development of the site warrant further investigation. Confirmatory investigation/assessment was also recommended for PCL 2-5.

It was recommended that a ground investigation is conducted to both confirm this assessment and provide data in support of the structural and civil engineering design. The scope of the investigation undertaken in detailed in *Section 3.0*.

3 PHASE 2 INVESTIGATION SCOPE OF WORKS

Site investigation works were undertaken between the 10th and 21st of November 2025.

The scope of the ground investigation was designed in general accordance with current UK guidance including LCRM (Ref. 3), BS10175 (Ref. 4), BS5930:2020 (Ref. 5) and BSEN1997-2:2007 Eurocode 7 (Ref. 6).

The scope and rationale are summarised in *Table 3*.

Table 3 – Scope of Works

Exploratory Hole Type	Exploratory Hole Reference	Exploratory Hole Depth (m bgl)	Rationale
Window Sample Boreholes	WS01 WS02 WS03	4.45 3.45 2.50	Confirm shallow ground conditions. Collect soil samples for chemical and geotechnical testing. Undertake in-situ testing. Install boreholes for gas and groundwater monitoring.
Rotary Borehole	RBH01 RBH02 RBH03 RBH04 RBH05 RBH06	14.00 14.00 15.50 4.45 3.85 15.50	Confirm shallow and deep ground conditions. Collect soil samples for chemical and geotechnical testing. Undertake in-situ testing. Install boreholes for gas and groundwater monitoring
Hand Excavated Trial Pits	HP01 HP02 HP03 HP04 HP05 HP06 HP07 HP08 HP09 HP10 HP11 HP12 HP13 HP14 HP15	1.00 1.00 1.00 0.60 1.00 1.00 1.00 0.80 0.85 0.65 1.00 0.30 1.20 1.10 1.20	Confirm shallow ground conditions. Confirm dimensions of existing foundations. Collect soil samples for chemical and geotechnical testing. Carry out TRL DCP Tests in selected locations to derive approximate CBR.
Soakaways in Machine Excavated Trial Pits	SA01 SA02	1.20 1.40	Confirm shallow ground conditions. Facilitate BRE 365 soakaway testing.

Potential sources of on-site contamination are further discussed in *Section 7.0*.

3.1 Soil Logging and Sampling

Exploratory borehole arisings were logged on site by a qualified Engineer. All exploratory holes were logged in accordance with the requirements of BS5930:2015 (Ref. 5) including recording observed visual and olfactory indications of contamination. Exploratory hole logs are provided in *Appendix B*.

3.2 Monitoring Well Installations

Ground gas and groundwater monitoring slotted 50 mm diameter pipes were installed within 8 No. window sample boreholes.

A bentonite seal was placed above and below the screened section of the borehole to minimise potential for downward migration of contaminants and the creation of a preferential migratory pathway. A gravel aggregate surround was installed in the annulus between the sides of the borehole and the slotted sections of pipe. The monitoring wells were primarily designed to assess the potential for ground gas and water monitoring.

The installed response zones are summarised in *Table 4* below.

Table 4 – Monitoring Well Response Zones

Exploratory Hole Ref	Response Zone(s) m bgl (m AOD)	Strata Description
WS01	1.00– 3.00 (35.38 – 32.38)	Made Ground
WS02	2.50 – 3.00 (34.02 – 33.52)	Shirdley Hill Sands
RBH01	0.60 – 1.40 (36.95 – 36.15)	Made Ground
RBH02	5.00 – 9.00 (33.10 – 29.10)	Chester Formation
RBH03	8.00 – 15.50 (30.82 – 23.32)	Chester Formation
RBH04	1.50 – 2.00 (37.95 – 37.45)	Shirdley Hill Sands
RBH05	0.80 – 1.80 (37.82 – 36.82)	Shirdley Hill Sands
RBH06	1.00– 3.50 (37.19 – 34.69)	Made Ground

Copies of borehole logs can be referred to in *Appendix B* of this report.

3.3 Post Investigation Monitoring

3.3.1 Ground Gas and Groundwater Monitoring

Six gas and groundwater level monitoring visits have been undertaken between the 01st of December 2025 and 18th of March 2026 to assess the groundwater and gas conditions as identified in the Preliminary Conceptual Site Model in *Section 2.8*.

4 LABORATORY ANALYSIS

Representative soil samples were selected for laboratory geotechnical and chemical testing, based on field observations, to inform the proposed works.

Selected environmental soil samples were placed in laboratory provided containers and stored in cool boxes prior to being transported to the nominated laboratory under the laboratory's chain of custody documentation. The laboratories selected by Curtins for chemical analysis was Envirolab (UKAS and MCERTS accredited), and for geotechnical analysis was i2 Analytical (UKAS and MCERTS accredited).

Sampling positions were generally located in a non-targeted, systematic array to give adequate and representative coverage of the site's proposed end use and the immediate environmental setting.

4.1 Environmental Chemical Analysis

The contaminants of concern potentially present on the site were considered to include, amongst others; organic matter, fill, hydrocarbons (e.g. fuel/oils) the extent of which is captured by the broad environmental testing suite listed in Table 5.

Table 5 – Environmental Chemistry Analysis Suite: Soils

Suite Ref	Analyte	LOD
Soils Suite A	Asbestos Screen, pH and Soil Organic Matter (SOM)	% w/w, pH, % w/w
	Arsenic, Chromium, Chromium VI, Copper, Lead, Selenium, Zinc, Nickel	1 mg/kg
	Boron (water soluble)	1 mg/kg
	Cadmium	1 mg/kg
	Mercury	0.17 mg/kg
	Cyanide (total)	1 mg/kg
	Phenols (screen)	0.2 mg/kg
	PAHs (USEPA 16)	0.01 to 0.08 mg/kg
	TPH (Aro/Alk Split)	0.01 to 1 mg/kg
	BTEX	0.01 mg/kg
	Water Soluble 2:1 Sulphate	0.01 g/l

A total of fourteen soil samples were obtained during the ground investigation including eleven samples of Made Ground soils and three samples of natural soils.

4.2 Groundwater Analysis

The Preliminary CSM (Ref. 2) has shown a Low risk to controlled waters however made recommendations to undertake supplementary groundwater monitoring to confirm conclusions made by MML.

Groundwater samples were collected from selected boreholes during rounds of groundwater monitoring. Water samples were tested for a suite in line with that identified for soils given the source material identified and strata. These are listed within *Table 6* below.

Table 6 – Environmental Chemistry Analysis Suite: Waters

Suite Ref	Analyte		LOD
Water Suite A	Miscellaneous Contaminants	pH	-
		Cyanide (Total)	0.005 mg/l
		Ammoniacal nitrogen as NH ₄	0.05 mg/l
		Thiocyanate, , Nitrate	0.1 mg/l
		Sulphate, Sulphide, Dissolved Organic Carbon	0.1 – 2 mg/l
	Metals	Arsenic, Calcium, Chromium, Selenium	1 µg/l
		Boron	10 µg/l
		Nickel, Zinc	2 µg/l
		Copper	4 µg/l
		Lead, Mercury	0.1 µg/l
		Cadmium	0.2 µg/l
	PAHs (USEPA16)		0.01 µg/l
	TPH (Aro/Ali Split)		1 – 10 µg/l

A total of two water samples were obtained from monitoring wells. Copies of the environmental chemistry testing certificates are presented in *Appendix D*.

4.3 Geotechnical Analysis

Soil samples for testing were prepared in accordance with BS1377: Part 1:2016 (Ref. 7). The geotechnical testing undertaken is summarised in *Table 7*.

Table 7 – Geotechnical Testing Soils

Test Type	Quantity	Standard
In Situ Testing		
Standard Penetration Test	29	BS 5930: 2015+2020, (Clause 41).
Laboratory Testing		
pH	24	BS1377 1990, Part 3 (Clause 9.4 & 9.5).
Water Soluble Sulphate 2:1 SO ₄	24	BS1377 1990, Part 3 (Clause 5.3 & 5.5).
Moisture Content	9	BS EN ISO 17892-1:2014+A1:2022, BS 1377-2: 2022, (Clause 4.1).

Test Type	Quantity	Standard
Atterberg 4 Point	9	BS EN ISO 17892-12:2018+A2:2022 (Clause 5.3 and 5.5), Fall Cone Method, 4 Pt Test, BS 1377-2:2022, (Clause 5.2 and 6). W by BS EN ISO 17892-1:2014+A1:2022.
Particle Size Distribution	7	BS EN ISO 17892-4:2016, BS 1377-2:2022 (Clause 10).
Point Load Test	44	ISRM 1974-206
Unconfined Compressive Strength Test	6	ISRM 1974-206

The results of the geotechnical testing are summarised in *Section 6.0* of this report. Copies of the geotechnical testing certificates are presented in *Appendix D*.

5 GROUND CONDITIONS

The ground conditions across the site, determined during the Curtins 2025 ground investigation works, generally comprises surface covering of either Topsoil, hardstanding or Made Ground soils. This was generally underlain by granular Made Ground soils with localised cohesive Made Ground. Superficial soils, where encountered, generally comprised of Granular or cohesive Glacial Till with localised Shirdley Hill Sand deposits. Bedrock was confirmed to comprise of sandstone consistent with the Chester Formation.

5.1 General

A summary of the ground conditions encountered during the site investigation works is presented in Table 8, with detailed information presented in the exploratory hole logs included in *Appendix B*.

Table 8 – Summary of Ground Conditions Encountered

Strata	Depth to Top of Strata	Recorded Thickness (m)		Description
	m bgl (m AOD)	Min	Max	
Topsoil	Ground Level (GL) (36.28 – 39.45)	0.10	0.31	Grass cover over brown fine to coarse medium sand with rootlets.
Made Ground	GL – 1.30 (35.22 – 39.33)	0.10	3.70	Greyish brown to dark brown slightly clayey gravelly sand with variable cobble content. And/or Brown to dark brown fine to medium sand. And/or Light to dark brown occasionally black sandy gravelly clay. And/or Concrete or concrete paving slab, tarmac or brick paving.
Shirdley Hill Sands	0.60 – 3.00 (38.02 – 33.38)	0.20	1.45	Light brown to brown slightly gravelly fine to coarse sand. And/or Brown organic clay with fragments of wood and plant matter
Glacial Till	0.40 – 2.15 (36.03 – 37.30)	0.20*	3.20	Reddish brown, grey or brown slightly clayey gravelly sand. And/or Soft to stiff brown or grey sandy slightly gravelly occasionally silty clay.
Chester Formation	2.23 – 5.05 (35.32 – 36.25)	1.25*	11.77*	Very dense reddish brown slightly clayey fine to coarse sand. And/or Weak to medium strong reddish-brown sandstone.

*Base of stratum not encountered.

5.2 Topsoil

Topsoil was encountered in thirteen locations from ground level to maximum depths ranging between 0.10m to 0.31m bgl (38.52m to 36.07m AOD). Topsoil was largely localised in two areas, including the football pitch and associated soft landscaping located in the west of the site and the soft landscaping in the north of the site. Topsoil was generally encountered as a '*brown fine to coarse medium sand with frequent rootlets*'.

5.3 Made Ground

Made Ground soils were encountered in all exploratory hole locations excepting WS03 and generally comprised of granular Made Ground soils with localised cohesive deposits.

5.3.1 Granular Made Ground

Granular Made Ground was encountered either underlying Topsoil or from ground level and was generally recorded maximum depths of 0.30m to 1.55m bgl (37.91m to 37.90m AOD). This deposit typically comprised of a *'greyish brown to dark brown slightly clayey gravelly sand with variable cobble content'* or *'brown to dark brown fine to coarse sand'*.

Greater thicknesses of granular Made Ground were recorded in RBH06 and WS01 in the south of the site.

The deeper Made Ground within WS01 comprises dark brown or light brown slightly clayey gravelly sand, including fragments of brick, concrete and limestone. There is also cohesive Made Ground recorded between 0.31m and 0.80m and 2.45m and 3.00m bgl. WS01 is located within the footprint of a former football pitch, that historic mapping suggests was historically situated at a lower level than the surrounding land.

The deeper Made Ground within RBH06 is attributed to the fact that this location was drilled from the top of an embankment. RBH06 is located slightly east of the proposed building footprint which will be constructed at the lower level. Soils comprise dark brown clayey gravelly sand with fragments of brick, concrete, sandstone and coal from 0.30m to 4.00m bgl (37.98m to 34.19m AOD).

The greatest extent of granular Made Ground soils is present along the sites northeastern and southwestern boundaries. Anthropogenic materials recorded in the granular Made Ground generally comprised of brick, concrete, sandstone, limestone, plastic, pottery and slag.

5.3.2 Cohesive Made Ground

Cohesive Made Ground was encountered in four locations (HP08, WS01, WS02 and RBH04), either underlying or interbedded with granular Made Ground soils. Cohesive Made Ground was encountered from depths ranging between 0.50m to 1.30m bgl (35.93m to 35.22m AOD) with thicknesses of the deposit ranging between 0.10m and 2.20m.

Soils comprise dark brown, light brown or black sandy gravelly clay with fragments of brick, concrete and limestone.

5.3.3 Relic Topsoil

A thin layer of potential relic topsoil was encountered in two locations. These materials were recorded as organic clay, with fragments of wood and plant debris in WS01 (33.38m AOD to 33.18m AOD), and organic sand in RBH04 (37.90m AOD to 37.50m AOD). The soils appear localised to these locations, and were not recorded in shallow excavations across the central area of the site.

5.4 Shirdley Hill Sand

Deposits consistent with the Shirdley Hill Sands were encountered in four boreholes (WS01, WS02, RBH04 and RBH05). This deposit was recorded to be underlying the Made Ground soils and was encountered from depths ranging between 0.60m and 3.00m bgl (38.02m and 33.38m AOD). The thickness of the Shirdley Hill Sands ranged between 0.20m and 1.45m. This deposit was typically described as a *'Light brown to brown slightly gravelly fine to coarse sand'*. *limited thicknesses of brown organic clay with fragments of wood and plant matter were recorded at northern and southern extents of the site, however this may be representative of relic topsoil as described above..*

5.5 Glacial Till

Superficial deposits indicative of Glacial Till was encountered in eleven No. locations, either underlying the Made Ground or Shirdley Hill Sand deposits. Glacial Till was encountered from depths ranging between 0.40m and 2.15m bgl (36.03m to 37.30m AOD).

5.5.1 Cohesive Glacial Till

Glacial Till was largely encountered as a cohesive deposit from depths ranging between 0.84m to 4.00m bgl (35.68m to 34.19m AOD) with thickness of cohesive Glacial Till ranging between 0.30m and 1.47m. This deposit did not appear to be localised and was recorded to be underlying the entirety of the site dipping in a northern to southern direction. This deposit was typically described as a *'Soft to stiff brown or grey sandy, slightly gravelly occasionally silty clay'*.

5.5.2 Granular Glacial Till

Granular Glacial Till deposits were encountered from depths ranging between 0.50m and 4.70m bgl (36.10m and 33.49m AOD), with proven thicknesses ranging between 0.20m and 1.48m. This deposit was typically described as *'reddish brown, brown or grey slightly clayey, gravelly sand'*.

5.6 Chester Formation

5.6.1 Weathered Bedrock

Granular soils indicative of weathered bedrock of the Chester Formation were encountered within six No. locations immediately underlying the Glacial Till deposits encountered from depths of 2.23m to 5.05m bgl (35.32m to 33.14m AOD), with proven thicknesses ranging between 0.48m and 0.67m.

These soils were typically described completely weathered sandstone recovered as *'very dense reddish brown gravelly coarse sand with occasional bands of grey sand. Gravel is fine to coarse subangular sandstone'*.

5.6.2 Competent Bedrock

Bedrock deposits indicative of the Chester Formation was encountered in five No. locations (RBH01, RBH02, RBH03, RBH04 and RBH06).

This deposit was described as a weak to medium strong reddish-brown sandstone.

5.7 Obstructions Encountered

Two obstructions were encountered during this ground investigation details of which are included below:

- HP08 – Concrete obstruction recorded between 0.79m to 0.80m bgl (35.64m to 35.63m AOD).
- HP12 - Concrete obstruction recorded between 0.29m to 0.30m bgl (37.92m to 37.91m AOD).

The full extent of concrete obstructions was not confirmed during the ground investigation.

5.8 Groundwater

No groundwater strikes were encountered during the ground investigation. It should be noted that rotary boreholes were drilled using water flush preventing the possibility of recording water strikes.

Return groundwater monitoring is ongoing, the results will be presented in a final report.

5.9 Observed Potential Contamination

A slight hydrocarbon / burnt odour was recorded in RBH04 (0.70m – 1.10m bgl) in Made Ground. No further olfactory or visual evidence of contamination was encountered during the ground investigation.

6 GROUND MODEL

6.1 Topsoil & Made Ground

Due to the variable nature of the Topsoil and Made Ground in terms of strength and composition, this layer is not deemed to be a suitable founding stratum. As such, limited geotechnical testing was undertaken on this stratum and characteristic geotechnical design parameters have not been derived.

The Geotechnical test results recorded within the Topsoil/Made Ground are summarised in Table 9 below.

Table 9 – Summary of Geotechnical Test Results – Topsoil/Made Ground

Parameter	No. of Tests	Results	
		Min	Max
In Situ Tests			
SPT N ₆₀	8	4	29
Laboratory Tests – General			
pH ¹	6	7	8.41
Water Soluble Sulphate (mg/l) ¹	6	10	80

(1) Results included from Environmental Testing

6.2 Shirdley Hill Sand

The Geotechnical test results recorded within the Shirdley Hill Sand are summarised in Table 10 below.

Table 10 – Summary of Geotechnical Test Results – Topsoil/Made Ground

Parameter	No. of Tests	Results	
		Min	Max
In Situ Tests			
SPT N ₆₀	1	7	
Laboratory Tests – General			
pH ¹	3	4.6	8.4
Water Soluble Sulphate (mg/l)	3	10.5	364

One SPT test was undertaken within the Shirdley Hill sands which recorded a SPT N₆₀ result of 7 at 2.00m bgl (37.45m AOD). This classifies the granular soil as loose in accordance with BS 5930:2015+A1:2020.

The SPT N₆₀ results have been plotted against elevation in Figures 1.

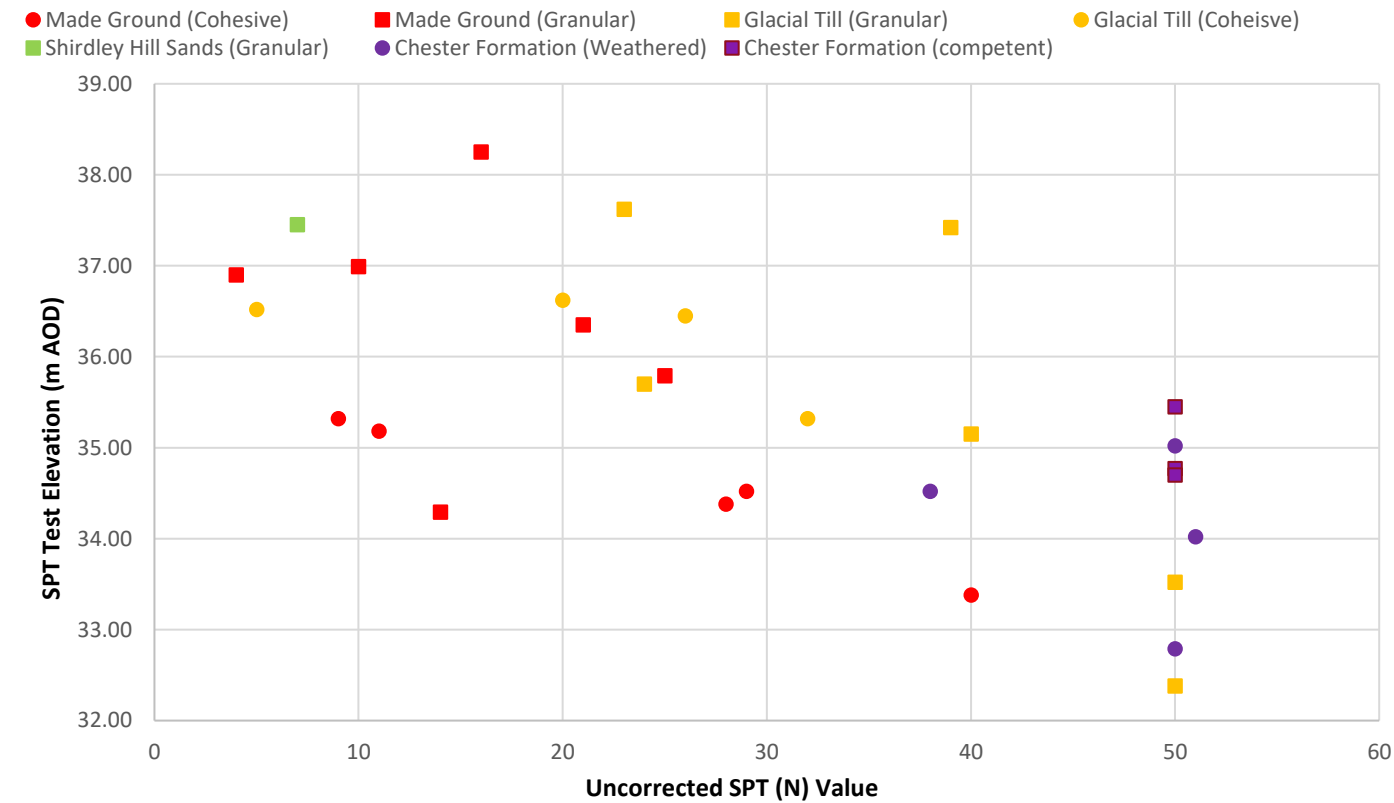


Figure 2 – Uncorrected SPT N versus Elevation (m AOD) Plot (All Stratum)

6.3 Glacial Till Deposits

Superficial deposits indicative of Glacial Till was encountered in 11no. locations from depths ranging between 0.40m and 2.15m bgl (36.03m to 37.30m AOD).

The Geotechnical test results recorded within the Glacial Till deposits are summarised in Table 11 below.

Table 11 – Summary of Geotechnical Test Results – Glacial Till Deposits

Parameter		No. of Tests	Results	
			Min	Max
In Situ Tests				
SPT N ₆₀		10	5	50
Laboratory Tests – General				
Atterberg Tests	Liquid Limit (%)	8	21	35
	Plastic Limit (%)	8	12	15
	Plasticity Index (%)	8	8	21
	Modified Plasticity Index (%)	8	9	20
Water Content (%)		8	12	19
Particle Size Distribution Tests		6	See Figure 1	

Parameter	No. of Tests	Results	
		Min	Max
pH	10	5.6	8.07
Water Soluble Sulphate (mg/l)	10	5.08	51

6.3.1 Granular Glacial Till

The SPT N_{60} results for granular Glacial Till deposits indicate a variable stratum, with N_{60} values ranging between 23 and 40 (discounting 2 No. refusals >50 on suspected cobbles). The SPT N_{60} results are presented on *Figure 2* and suggest a medium dense to dense deposit.

The Angle of Shearing Resistance (ϕ') in granular soils can be determined from SPT N_{60} after Peck, Hanson and Thornburn (1963). Based on this relationship for an SPT N_{60} value of 5 a characteristic ϕ' of 37° is determined.

A characteristic Weight Density (g_k) of 17kN/m^3 is recommended based on a medium dense sand above the groundwater table and 19kN/m^3 below the water table. (BS 8004:2015+A1:2020).

Six Particle Size Distribution tests were undertaken on the granular Glacial Till deposits the results of which are presented in *Figure 3*. The results of the testing generally confirmed that the soils were of a similar nature to those described in the exploratory hole logs.

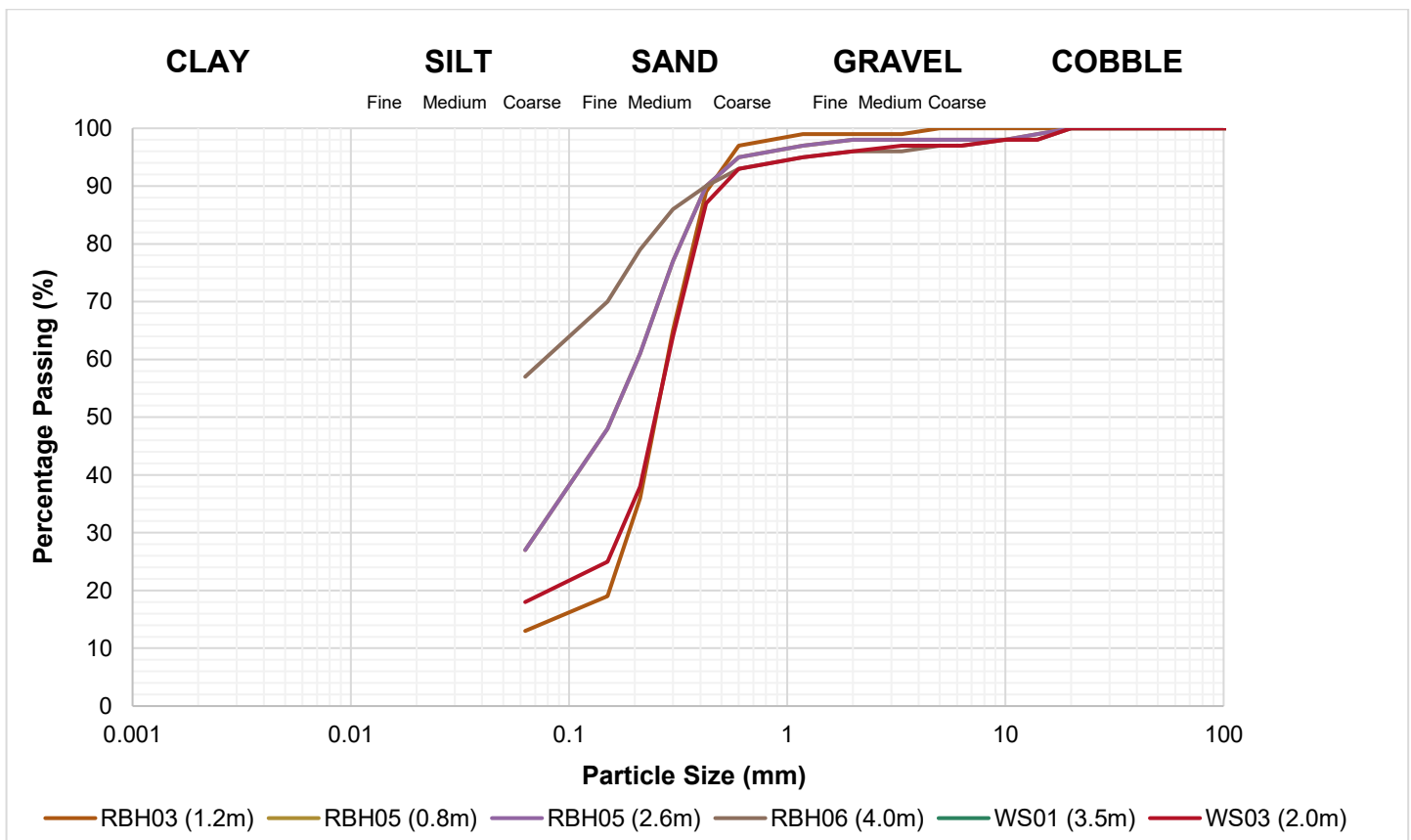


Figure 3 – Particle Size Distribution Chart (Granular Glacial Till)

6.3.2 Cohesive Glacial Till

The SPT N_{60} results for cohesive Glacial Till deposits indicate a variable stratum, with N_{60} values ranging between 5 and 32. The SPT N_{60} results are presented on *Figure 2*.

A total of eight Atterberg Tests were undertaken within the cohesive Glacial Till deposits and the results suggest that the clay is of low plasticity and has a low volume change potential in accordance with guidance from NHBC Standards Chapter 4.2 (Ref. 8). The results of the Atterberg Limits are presented on *Figure 5*.

The undrained shear strength (c_u) of the cohesive Glacial Till has been determined by laboratory testing and estimated through the relationship between SPT N_{60} Values and Plasticity Indices (after Stroud, 1975, Ref. 9) as presented in Equation 1:

$$C_u = SPT N_{60} \cdot f_1 \quad \text{[Equation 1]}$$

Where:

$SPT N_{60}$ is Characteristic Corrected Standard Penetration Test Value

f_1 is the Stroud factor

In the absence of an SPT Energy Ration Certificate, uncorrected SPT N has been used to determine c_u instead of SPT N_{60} .

i

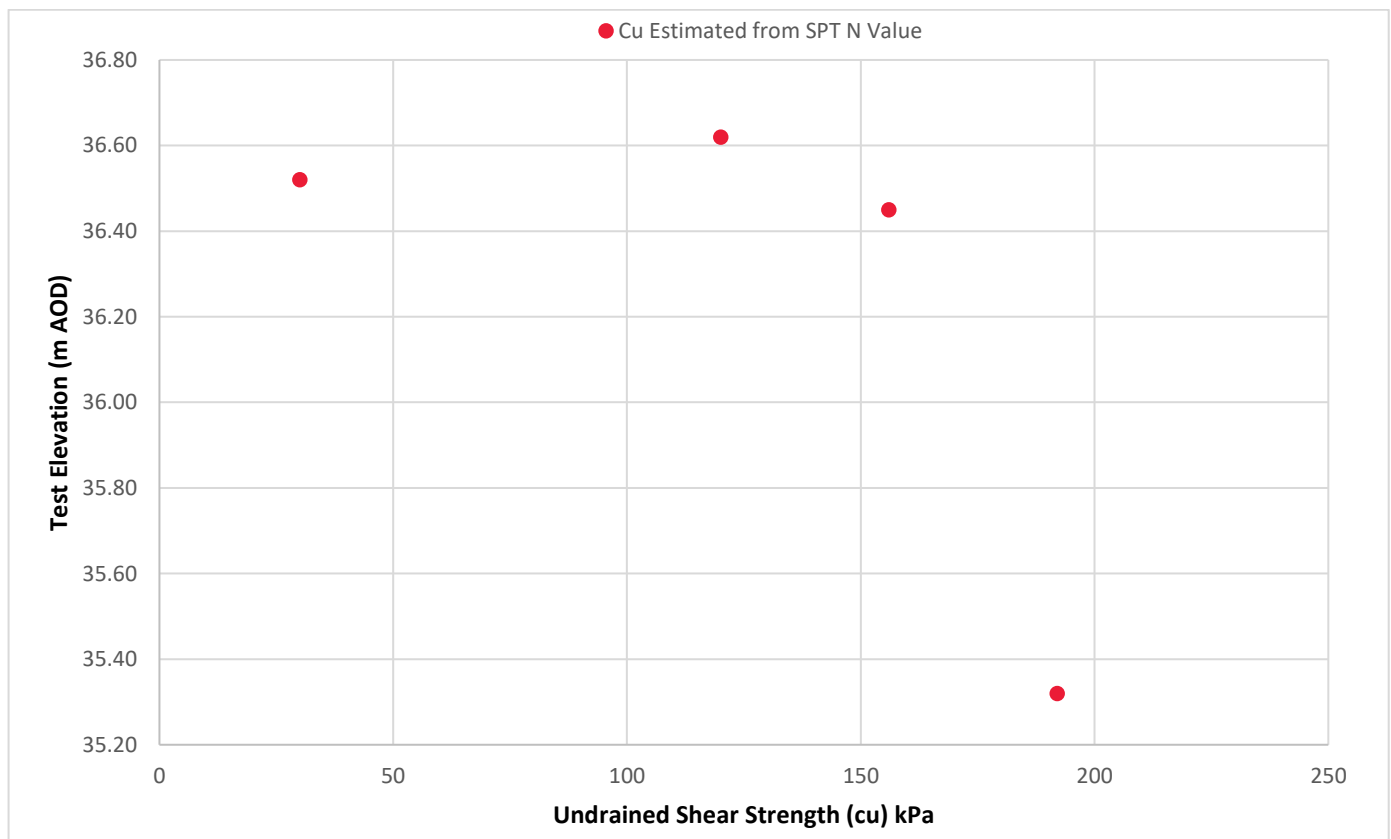


Figure 4 – Estimated Undrained Shear Strength vs Elevation (m AOD) (Cohesive Glacial Till)

Based on the strength of the clay, conservative Weight Densities (g_k) of 17kN/m³ (above the groundwater table) and 18kN/m³ (below the groundwater table) are recommended based on BS 8004:2015+A1:2020.

A characteristic angle of shearing resistance (ϕ') can be estimated from Plasticity Index after Terzaghi, Peck and Mesri, 1996 (Ref. 10). Based on the average Modified Plasticity Index of 11%, a characteristic ϕ' of 29° is recommended for the Cohesive Glacial Till.

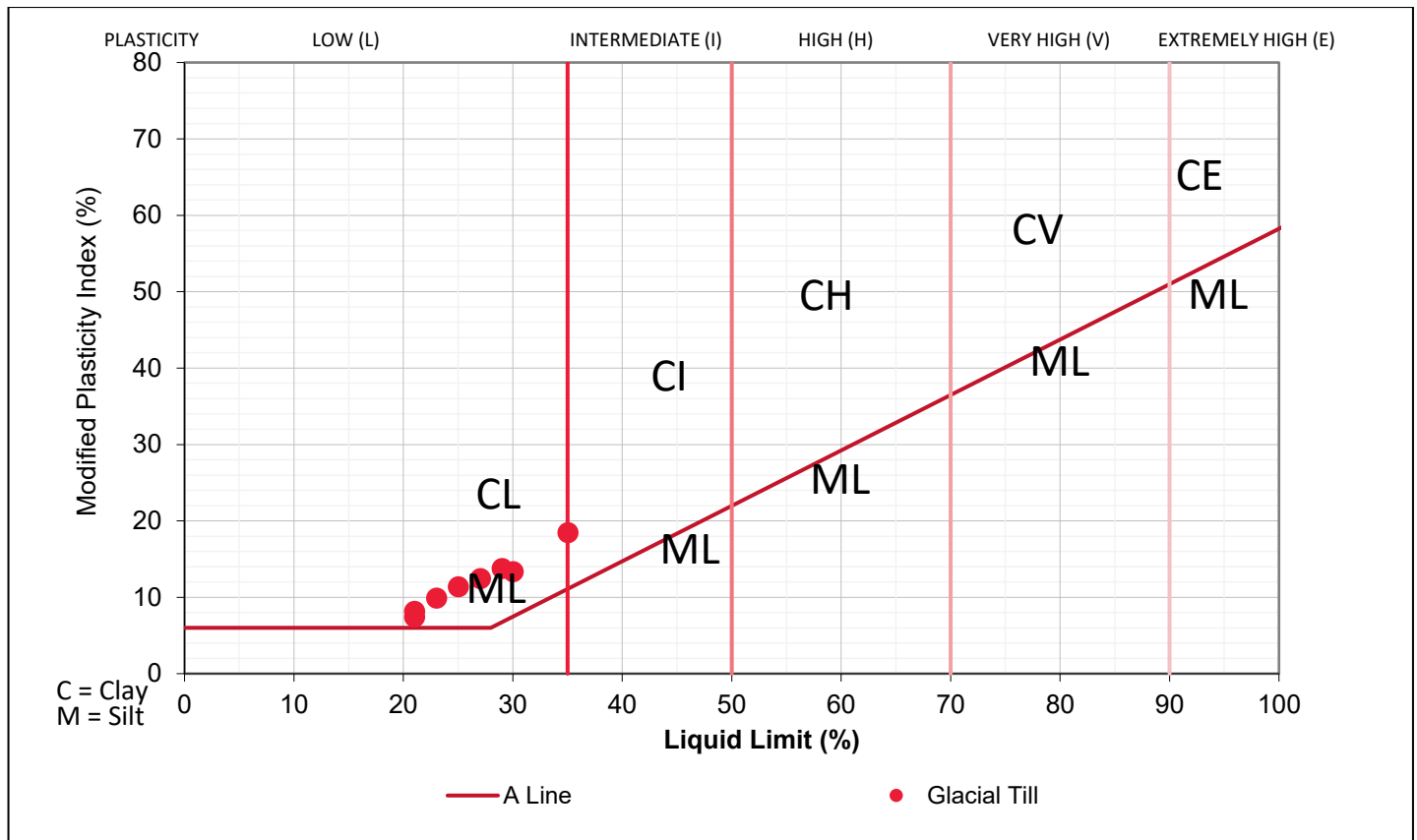


Figure 5 – Casagrande Chart (Cohesive Glacial Till)

6.4 Chester Formation (Sandstone)

Weathered Chester Formation sandstone was encountered from depths ranging between 2.23m to 5.05m bgl (35.93m to 35.22m AOD) with competent bedrock encountered from 2.90m to 5.53m bgl (34.65m to 32.66m AOD).

The geotechnical test results recorded within this stratum are summarised below in *Table 12*.

Table 12 – Summary of Geotechnical Test Results – Chester Formation

Parameter	No. of Tests	Results	
		Min	Max
Laboratory Tests – General			
pH	4	4.5	7.3
Water Soluble Sulphate (mg/l)	4	3.16	33.2
Point Load Test (mPa)	44	0.78	9.23
Unconfined Compressive Strength Test (mPa)	6	11.7	19.9
Particle Size Distribution Tests	1	XXX	

Total Core Recovery (TCR) was ranged between 35% and 100%. Solid Core Recovery (SCR) ranged between 21% and 100%. Rock Quality Designation (RQD) cored samples ranged between 0% and 91%. The RQD indicates a very poor to excellent rock mass quality which generally improved with depth. A summary of the Rock Quality Parameters is presented in Figure 6.

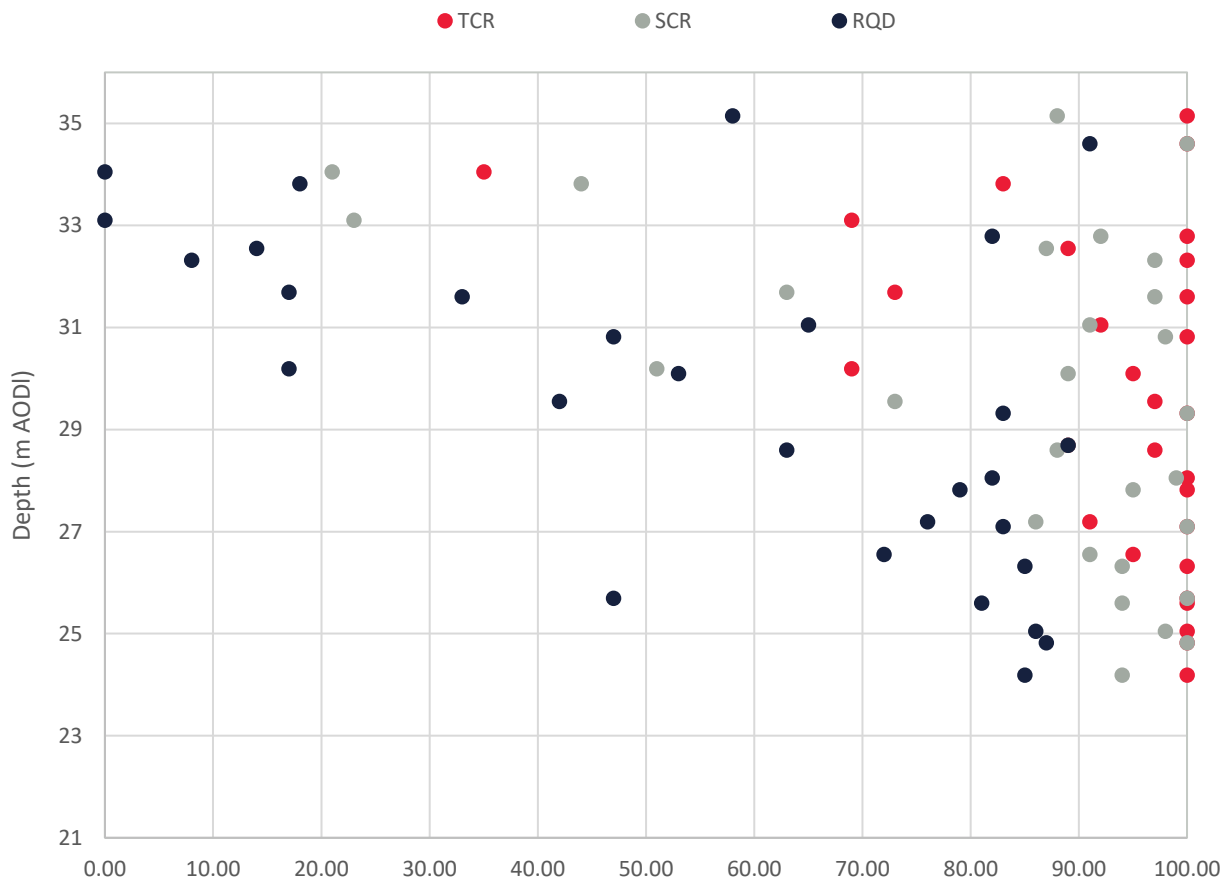


Figure 6 – Summary of Rock Quality Parameters v. Depth

Figure 6 indicates that rock quality generally increased with depth and that the highest quality rock was recorded between 8.00m and 16m bgl. Full details are included in the exploratory hole logs, within *Appendix B*.

44no. point load tests and 6no. uniaxial compressive strength (UCS) tests were undertaken on the Chester Formation bedrock, with the results summarised in *Table 10*.

An approximation of the unconfined compression strength (UCS) of the rock may be derived from the following relationship, described in *Equation 5*: $UCS = PLT\ Is(50) \times f_1$

Equation 5 (Tomlinson)

Where f_1 is derived from the correlation between $PLT\ Is(50)$ and UCS Results

In consideration of the correlation between $Is(50)$ and UCS values reported from laboratory testing and of published literature (ref. 11), a factor of 13 has been considered suitable.

Based on this relationship, estimated UCS values for sandstone range between 0.78 MPa and 9.23 MPa, indicating high variability in the rock strength of the samples tested. Generally, the rock is classified as very weak to moderately weak.

Direct testing results on 6 No. samples ranged between 11.7 MPa (moderately weak) and 19.9 MPa (moderately strong). Test termination reasons were generally recorded as axial cleavage or multiple shear and axial cleavage.

The estimated UCS derived from the correlation between point load tests and UCS generally indicate lower strengths than the direct UCS testing results. This is considered to be due to the inherently stronger nature of rock core samples used for UCS of better rock mass quality, as opposed to smaller samples used for PLTs.

The estimated UCS and UCS values recorded are generally consistent with the field descriptions of weak to moderately strong.

The results of estimated UCS from PLT correlation and UCS testing are shown in *Figure 7*.

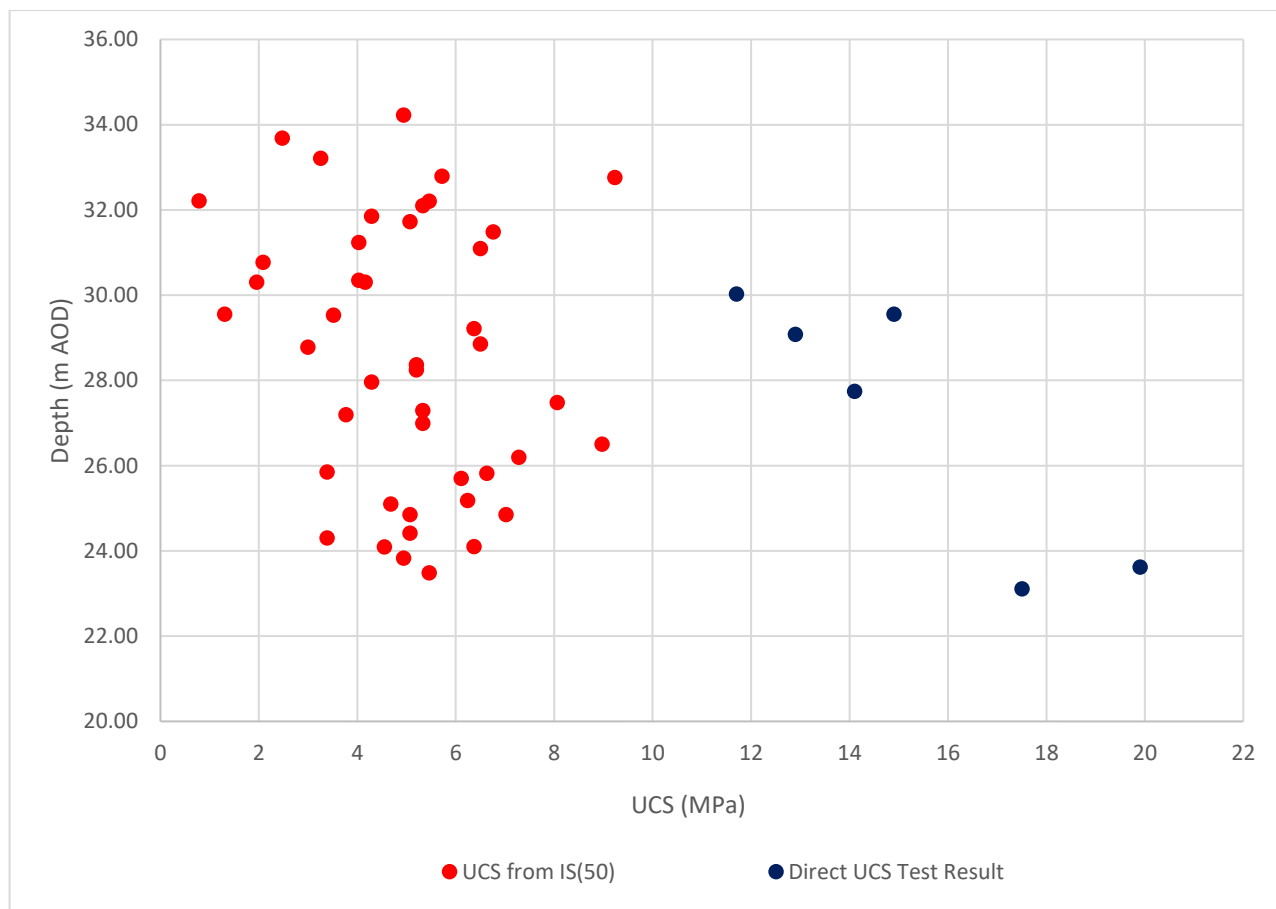


Figure 7 – Estimated UCS and UCS of Chester Formation v. Elevation (m AOD)

6.5 Aggressive Ground Conditions

The classification of the site in terms of concrete in aggressive ground is based on the guidance provided in Table C2 of the Building Research Establishment (BRE) Special Digest 1, 3rd edition of 2005 (Ref. 15). A summary of the results obtained during are summarised in Table 13, and Table 14 details the classification.

Table 13 – Summary of Testing Results

Stratum	Quantity	Range
Topsoil/Made Ground	pH	7 – 8.41
	Water Soluble Sulphate (mg/l)	<10 - 80
Shirdley Hill Sands	pH	4.6 – 8.4
	Water Soluble Sulphate (mg/l)	10.5 – 364
Glacial Till	pH	5.6 – 8.07
	Water Soluble Sulphate (mg/l)	5.08 – 51
Chester Formation	pH	4.5 – 7.3
	Water Soluble Sulphate (mg/l)	3.16 – 33.2

Table 14 – Aggressive Chemical Environment for Concrete (ACEC) Site Classification

Stratum	Design Sulphate Class	ACEC Class ⁽¹⁾
Topsoil/Made Ground	DS-1	AC-1
Shirdley Hill Sands	DS-1	AC-2z
Glacial Till	DS-1	AC-1
Chester Formation	DS-1	AC-2z

(1) ACEC assessment was based on the mobile groundwater condition in a brownfield scheme area.

7 GROUND CONTAMINATION ASSESSMENT

This section of the report includes the assessment of the potential contamination, solid and gas, identified on the subject site which may present a risk to the proposed end users, associated utilities, and the wider environment.

In LCRM guidance published by the Environment Agency (Ref. 3), the risk to human health is determined through an assessment of pollutant linkages between a source of contamination (within the ground either on or off site) and a sensitive receptor such as end users of the site, building materials, edible plants grown in gardens or groundwater abstracted for drinking. This is termed a source-pathway-receptor relationship. The same model is applied to the assessment of risk arising from ground gases as detailed within BS8576:2013 (Ref. 13).

These models have a common approach, which is one of a tiered assessment. At each stage of the assessment further detail can be applied to the conceptual site model to provide a detailed interpretation on a site by site basis. As part of the planning process this approach is adopted to establish either if the site is 'suitable for use' or whether additional work or else remedial work is required for the site to be deemed so.

The sub-sections hereafter therefore incorporate the second Tier (Tier 2) of the approach described in EA guidance, otherwise referred to as the Generic Quantitative Risk Assessment (GQRA). The GQRA builds on the qualitative risk assessment (Tier 1) presented in the Phase 1 PRA Report (Ref. 2), in conjunction with observations made during the ground investigation and is based solely on the results of the chemical and other testing data obtained as part of Curtins ground investigation. The GQRA is used to build/refine the Conceptual Site Model (CSM) for the site as detailed and presented in Section 9.0 of this report.

More detail on Curtins risk assessment methodology, rationale and hierarchy for human health risk assessment is enclosed in Appendix G.

7.1 Human Health GQRA

7.1.1 Adopted Soil Human Health GACs Screening Methodology

The proposed use of the site is most analogous with a '*Commercial*' end use scenario.

The soil organic matter (SOM) content has an influence on the volatilisation of organic contaminants (i.e., the higher the SOM, the lower the volatilisation rate and therefore inhalation exposure risk). Soil organic matter (SOM) values for the site soils ranged from 1.08% to 8.46% for Made Ground soils and 0.29% and 0.97% for natural soils. Consideration of the geometric mean results in a calculated value of 2.32% for Made Ground and 0.60% for natural soils.

As such a comparison against Tier 1 thresholds for a SOM of 1% for all the samples has been adopted for '*Commercial*' end-use.

A review of the chemical analysis results determined that concentrations of benzo(a)pyrene were recorded below the laboratories limit of detection in samples of Made Ground and natural soil, and therefore, it is not possible to assess the genotoxic PAHs using a surrogate marker approach in accordance with Public Health guidance. Rather, samples have been assessed against individual PAH compounds, utilising relevant C4SL or S4UL Generic Assessment Criteria for these soil types.

The adopted GAC's are listed in *Appendix E*.

7.1.2 Generic Assessment Criteria Screening of Soil Laboratory Results

The results of the environmental testing can be referred to in *Appendix C*, with testing undertaken on a total of fourteen soil samples across the site.

With respect to the proposed '*Commercial*' end use, soil chemical analysis results did not record any exceedances when compared against GAC screening thresholds.

All soil samples were screened for asbestos, with one sample being positively identified as containing asbestos. Details of identified asbestos is included in Table 15 below.

Table 15 – Identified Asbestos Fibres

Exploratory Hole ID	Sample Depth (m bgl)	Asbestos Type	Asbestos Matrix	Asbestos Quantification (% w/w)
HP11	0.20 – 0.30	Amosite	Loose Fibres	<0.001

A previous ground investigation undertaken by Mott MacDonald (Ref. 1) also identified asbestos in two samples obtained. This included a sub-sample taken from WS02 at 1.00m bgl from cohesive Made Ground within demolition spoil and RBH01 at 0.50m bgl from granular Made Ground. WS02 was located in the SW corner of the pitch in the south of the site. RBH01 was located in the banked ground in the SE corner of the site. Asbestos quantification was undertaken on the samples by two different tests: gravimetric quantification (GQ) and Phase Contrast Optical Microscopy (PCOM). The quantity of asbestos present in the sample from WS02 was reported as 0.0025% by GQ and <0.001% by PCOM. The quantity in RBH01 was reported as <0.001% in both tests.

7.2 Controlled Waters GQRA

A model for assessing the potential for pollution of controlled waters and for deriving a safe concentration in ground and groundwater is the Environment Agency's publication "Remedial Targets Methodology – Hydrogeological Risk Assessment for Land Contamination" (Ref. 14).

In relation to the standards for controlled waters, there are currently no generic groundwater standards or surface water standards that are necessarily applicable to all sites.

However, dependant on the receptor identified as being at risk, see Section 7.2.1, the UK Drinking Water Standards (UK DWS) (Ref. 15), and/or Water Framework Directive Environmental Quality Standards (WFD EQS) (Ref. 16) can be utilised as primary screening values in a Level 1 assessment. These can also be supplemented by World Health Organisation (WHO) guidelines (Ref. 17), where WFD or DWS water quality standards (WQS) do not exist.

Volatile contaminants in groundwater have been assessed to human health as outlined within The Society of Brownfield Risk Assessment (SoBRA), Development of Generic Assessment Criteria for Assessing Vapour Risks to Human Health from Volatile Contaminants in Groundwater (Ref. 18).

7.2.1 Adopted Controlled Waters Tier 1 Screening Values and Methodology

The results of laboratory analysis of groundwater have been assessed against the UK Drinking Water Standards (DWS) due to the presence of a superficial Secondary A Aquifer (Shirdley Hill Sands deposit only) and bedrock Principal Aquifer (Chester Formation) underlying the site. In the absence of UK DWS, a comparison against WHO standards has been used. The nearest surface water feature is recorded to be an inland river located c. 680m north of the site, as such the groundwater samples have not been compared to Environmental Quality Standards (EQS) due to the distance from site.

The adopted Level 1 Screening Values are listed in *Appendix G*.

7.2.2 Generic Assessment Criteria Screening of Groundwater Laboratory Results

The results of the environmental testing can be referred to in *Appendix D*.

With respect to the underlying aquifers, exceedances are noted within groundwater samples, as detailed in *Table 16* below.

Table 16 – Table of Exceedances Recorded against the respective GACs

Determinant	GAC Screening Value		Locations Exceedances Encountered
	DWS Threshold	World Health Organisation (WHO)	
Boron (µg/l)	1000	0.3	RBH03 (45 µg/l) RBH02 (119 µg/l)
Copper (Dissolved) (µg/l)	2000	1	RBH03 (7 µg/l) RBH02 (16 µg/l)
Nickel (Dissolved) (µg/l)	20	70	RBH03 (35 µg/l)
Benzo(a)pyrene (µg/l)	0.01	0.01	RBH02 (0.04 µg/l)
Sum of benzo(b)fluoranthene, benzo(ghi)perylene, benzo(k)fluoranthene, indeno(1,2,3-c,d)pyrene (µg/kg)	0.1	-	RBH02 (0.11 µg/l)

Recovered groundwater samples show minor exceedances of UK Drinking Water Standards and the World Health Organization Standards in five contaminants including Metals, and PAHs. These exceedances confirm what has been identified previously in other investigations. The of exceedances of heavy metals in groundwaters beneath the site suggests naturally occurring sources rather than point sources associated with former or current land uses. A possible source may be residues from historic agricultural land uses or chemicals used in the maintenance of pitches and grassed areas.

A review of the contaminants and results has shown that risks to controlled waters from site soils are limited in nature and are unlikely to significantly benefit from either further contaminant modelling or remedial action. The results of soil testing identified the generally low-level leachable contaminants across the site within Made Ground Deposits and topsoil with no specific historic or, current point source identified.

8 GROUND GAS ASSESSMENT

The assessment of risk presented by ground gases is assessed with reference to guidance published by CIRIA Assessing Risks Posed by Hazardous Ground Gases to Buildings, C665 (Ref. 19), BSI Publication Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings BS8485:2015 (Ref. 20) and other broadly accepted references such as the Ground Gas Handbook 2009 (Ref. 21).

The ground gas risk assessment adopts a tiered approach. In the first instance this involves a re-evaluation of the Conceptual Site Model described within the Phase 1 PRA Report (Ref. 1) and thereafter validating this conceptual model with the ground gas data, the semi-quantitative risk assessment.

8.1 Encountered Geology

Made Ground was typically encountered either underlying the Topsoil or from ground level to basal depths of between 0.30m and 4.00m bgl. The greatest thickness of Made Ground soils was recorded in RBH06, located in the southwest of the site. It is considered likely that the localised deep granular Made Ground soils encountered within RBH06 are associated with an embankment (recorded from 1968 OS mapping records) and is not representative of Made Ground soils across much of the site and beneath the proposed development footprint.

Made Ground constituents were typically recorded to comprise of non-putrescible construction type materials inclusive of brick, concrete, sandstone, limestone, pottery and slag. No other visual evidence of contamination was recorded in soils or groundwater during the investigation.

A thin layer of what is thought to represent relic topsoil was encountered in WS01 (33.38m AOD to 33.18m AOD) and RBH04 (37.90m AOD to 37.55m AOD).

The Shirdley Hill Sands generally comprise light brown or brown slightly gravelly sand, with limited visual evidence of organic matter or contamination.

The Glacial Till deposits and Chester Formation were not recorded to be rich in organic materials.

Chemical laboratory testing was undertaken as part of the ground investigations of the chemical laboratory testing undertaken, fourteen soil samples were submitted for soil organic matter testing. A summary of the recorded soil organic matter (SOM) has been presented in Tables 17 below. SOM results have been converted to total organic carbon (TOC) in Tables 17, using the following conversion:

$$\text{Total Organic Carbon} = \frac{\text{Soil Organic Matter (SOM)}}{1.72}$$

Table 17 – Summary of Estimated Total Organic Carbon Concentrations

Exploratory Hole Location	Depth of Sample (m bgl)	Stratum	SOM (%w/w)	Estimated TOC (%w/w)
RBH05	0.40 – 0.50	Made Ground	3.05	1.77
RBH03	0.60 – 0.70	Made Ground	2.57	1.49
HP02	0.50 – 0.60	Made Ground	1.93	1.12
HP01	0.70 - 0.80	Made Ground	3.25	1.89
HP07	0.40 – 0.50	Glacial Till	0.29	0.17
HP08	0.50 – 0.60	Glacial Till	0.80	0.47

Exploratory Hole Location	Depth of Sample (m bgl)	Stratum	SOM (% ^w / _w)	Estimated TOC (% ^w / _w)
HP11	0.20 – 0.30	Made Ground	1.67	0.97
WS02	2.90 – 3.00	Shirdley Hill Sand	0.97	0.56
RBH01	0.90 – 1.00	Made Ground	8.46	4.91
RBH02	0.55	Made Ground	1.11	0.64
WS01	0.70	Made Ground	1.08	0.63
WS04	1.00	Made Ground	1.77	1.03
RBH06	0.50	Made Ground	2.76	1.60
RBH06	3.50	Made Ground	2.62	1.52

8.2 Potential Ground Gas Source Assessment

The magnitude of the generation potential of each of the identified sources has been identified using the framework outlined in Clause 8.7 of BS8576:2013, Figure 6 (Figure 2).

The Preliminary Conceptual Site Model (PCSM) presented within the Phase 1 PRA (Ref. 2) identified Made Ground as a potential source of ground gas generation. Noxious and asphyxiate gases were attributed to include, but not limited to, carbon dioxide, carbon monoxide, methane, and hydrogen sulphide. The PCSM identified a **Low Risk**.

From guidance available in the NHBC NF96 document, there are 6 key factors that should be considered when assessing the risks associated with the ground gas emissions of a potential source. Commentary on these factors is provided below:

- **Organic content** – As outlined above, no substantial quantities of organic content or materials have been recorded. Made Ground soils generally comprise non-putrescible type materials. The greatest estimated concentration of organic matter content was reported in RBH01 at 0.90m – 1.00m bgl (TOC of 4.91 %^w/_w). All other estimated TOC concentrations were reported to be <2 %^w/_w. Natural Soils (Shirdley Hill Sand and Glacial Till) reported estimated TOC concentrations of 0.56 %^w/_w between 0.17 %^w/_w – 0.47 %^w/_w, respectively.
- **Available biodegradable material** – The key indicator of a high gas generation potential is the presence of vegetable matter or food waste. The exploratory hole logs do not indicate the presence of such putrescible materials, including in the limited thickness of relic topsoil materials encountered in WS01 or slightly organic sand in RBH04. Relic topsoil is not likely to present a credible source of ground gas emissions (Ref. 22).
- **Nature of the fill material** – Made Ground deposits were found across the site either underlying the Topsoil or from ground level. Beneath the building proposed building footprints, the base of the Made Ground was recorded to depths of between 0.30m bgl and 3.00m bgl. The Made Ground generally comprises granular soils with localised cohesive soils recorded in 4 No. locations, as described in Section 5.3. Shallow Made Ground with inclusions of gravels typical of construction and demolition waste is not a credible gas generation source (Ref. 22).
- **Age of the materials** – Historic mapping records indicate the site was historically occupied by a farm (until the early 1960s), including a farm house in the centre of the site. The farm buildings were demolished and the site was redeveloped, including construction of a football ground in the south of the site, including embankments surrounding the pitch, and a stand off-site. The remainder of the site was vacant. The stadium was demolished by the mid-1990s, and the site was redeveloped to its current setting, or similar, by 2001. Made Ground may be sourced from demolition materials from the historic farm buildings (1960s), or the

demolition and subsequent levelling of the previous football stadium (1990s). The Made Ground is likely to be more than 25 years old and the nature of the materials does not indicate a potential gas generation.

- **Distance from the receptor** – The proposed development is situated either directly above or adjacent to Made Ground soils. The greatest thicknesses of Made Ground were reported in WS01 (3.00m) and WS02 (2.35m), indicating the greatest thicknesses are localised to the south of the site, likely associated with infill of the historic football pitch in this area. All other Made Ground was reported to be up to a maximum of 1.55m in thickness.
- **Presence of preferential pathways** – Made Ground soils beneath the site are typically granular in nature, with some cohesive materials. Given the granular nature of the soils, it is unlikely that preferential pathways are present, and that advective flow (air pressure) is likely to be the main gas migration pathway.

8.3 Gas Monitoring

The ground conditions indicate a low potential for ground gas generation within site soils.. Notwithstanding, and to further support this assertion, a program of ground gas monitoring has been completed to obtain supplementary data to inform ground gas risk assessment.

The appropriate monitoring frequency and duration was determined with consideration of the preliminary conceptual site model and ground conditions encountered during the ground investigation, using the frameworks defined in BS8576:2013 (Ref 13).

The overall gas generation potential from soil sources is considered to be very low (BS8576:2013). Figure 6 provides further guidance on monitoring frequencies, an extract of this figure is included as Figure 8. This suggests weekly monitoring over a period of two months would be appropriate.

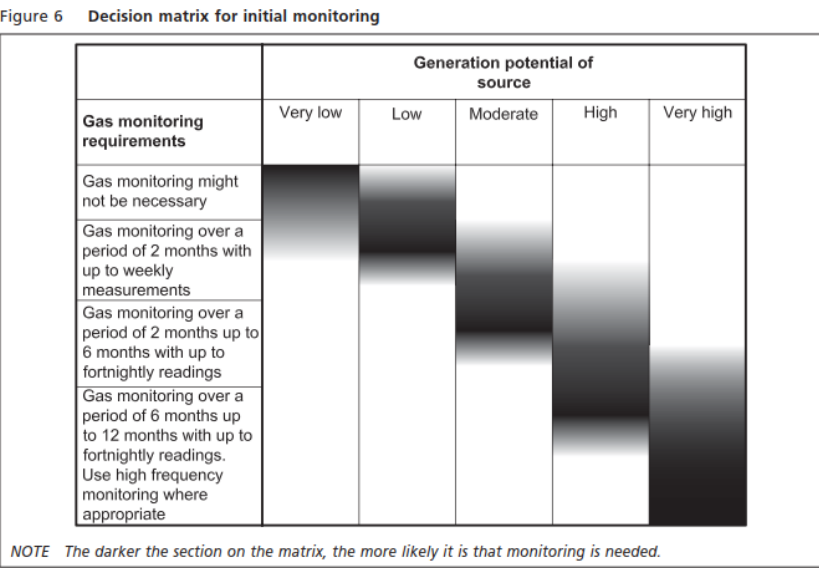


Figure 8 – BS8576:2013 Figure 6 – Decision Matrix for initial monitoring

To characterise the site’s ground gas regime and validate the qualitative assessment of ground gas risk described in Section 2.8, ground gas monitoring wells were installed within 8 No. boreholes as detailed in Section 3.2.

8.3.1 Ground Gas Monitoring Results

A total of six ground gas monitoring visits have been undertaken between the 1st December 2025 and 18th March 2026, with barometric pressure recorded between 987mb and 1015mb. Rising barometric pressures were recorded on the first, third and sixth visits, with falling barometric pressure recorded on the second, fourth and fifth visits. The results log sheets are contained within *Appendix D* and summarised in *Table 18*.

Table 18 – Summary of Ground Gas Monitoring Results

Exploratory Hole ID	Number of Monitoring Events	Maximum Methane Concentration (%)	Maximum Carbon Dioxide Concentration (%)	Minimum Steady Oxygen Concentration (%)	Maximum Gas Flow (l/hr)	
					Maximum	Steady State
RBH01	5	<0.1	4.4	4.1	0.5	<0.1
RBH02	6	<0.1	4.7	19.1	3	<0.1
RBH03	6	<0.1	6.9	17.2	37.6	-2.5
RBH04	6	<0.1	11.3	<0.1	0.4	<0.1
RBH05	6	<0.1	1.8	17.7	<0.1	<0.1
RBH06	4	25.8	11	<0.1	-18.2	<0.1
WS01	5	2.2	7.4	<0.1	<0.1	<0.1
WS02	6	0.3	7.6	0.3	<0.1	<0.1

During the ground gas monitoring programme methane was recorded at below the limit of detection of the monitoring instrument (<0.1% v/v) in the majority of boreholes during the monitoring visit excepting:

- RBH06 (Made Ground embankment in the southwest of the site) on the second, third, fifth and sixth visits,
- WS01 (Made Ground in the south of the site) on the second, fifth and sixth visit, and
- WS02 (Shirdley Hill Sand) on the first visit.

Maximum Carbon Dioxide concentrations recorded during the monitoring visit ranged between 1.8 % v/v and 11.3% v/v.

Carbon Monoxide and Hydrogen Sulphide were recorded below the limit of detection (<1 ppm) in the majority of boreholes throughout the monitoring period. Within RBH06 carbon monoxide concentrations ranged between 170 ppm and 182ppm on the second and third visits, respectively, and hydrogen sulphide concentrations were 50ppm on the second and third visits.

Peak air flow rates were recorded at 37.6 l/hr within RBH03 on the fifth visit, before returning to a steady state of <0.1 l/hr. Peak negative air flow rates of -18.2l/hr were recorded in RBH06 on the third visit, before returning to a steady state of <0.1 l/hr. Steady state airflow rates were recorded as <0.1 l/hr in all borehole positions throughout the monitoring period, excepting RBH03 on the sixth monitoring visit which recorded a steady state flow of -2.5 l/hr.

8.3.2 Non-Representative Data

Elevated air flow rates were recorded in RBH03 during the monitoring programme; however, the monitoring well was flooded throughout the monitoring period. The air flow rate recorded is attributed to increased headspace pressure where the water within the monitoring well has compressed the air above it (i.e. known as the 'piston effect'). With consideration of the wider dataset, it has been deemed that these airflow rates are not representative of the natural gas regime at the site and have been discounted when determining the gas screening value for the site.

Elevated carbon dioxide (>5% v/v) were recorded in RBH03 (installed within the Chester Formation Sandstone) on the 10th March and 18th March. The response zone of this borehole was flooded for the duration of the monitoring programme. A flooded response zone means that any gas in the well is trapped gas that is simply in equilibrium with the dissolved gas in the groundwater. Any gas recorded from the monitoring will not be representative of the ground gas regime in the unsaturated zone. This is because in the surrounding ground the equilibrium in the well headspace

is not reflected in the unsaturated zone because of oxygen ingress from the ground surface and potentially oxidation of methane. As such, RBH03 data has been disregarded for the purpose of the assessment.

RBH06 was undertaken within an embankment. The primary reason for undertaking this exploratory hole was to determine and characterise the natural soils and bedrock and groundwater conditions in the southwest of the site. The borehole was undertaken at the top of the embankment due to access constraints associated with working on/adjacent to the training pitch. The exploratory hole was undertaken on ground situated outside of the building footprint. The monitoring well was installed within the embankment to determine groundwater levels, gas monitoring was also undertaken. Given the location of the monitoring well, and the variation in ground conditions between the embankment and the proposed building footprint, it is considered that the monitoring data from this location is not representative of ground conditions for the proposed development, and therefore this data has been discounted from the assessment.

8.4 Ground Gas Evaluation

Based on the monitoring data, gas screening values (GSV) have been calculated for all boreholes where response zones provide meaningful data when considered with current ground gas monitoring guidelines (Ref. 20, Ref. 22) and the context of the conceptual site model.

It is considered that a comprehensive dataset has been obtained, and that steady state air flow rates are suitable for use in deriving the GSV with consideration of the conceptual site model.

Steady state air flow rates <0.1 l/hr were reported throughout the monitoring period where representative monitoring data was obtained. The Q_{hg} for the representative and worse case scenarios is taken as 0.0022 l/hr for methane and 0.0113 l/hr for carbon dioxide. The GSV is taken as 0.0113 l/hr, corresponding with a Characteristic Situation 1 (CS-1) classification.

In light of the above, further consideration to upgrading to CS2 has only been given to locations where carbon dioxide is greater than 5% v/v or methane is greater than 1% v/v . *Table 19* summarises the representative monitoring data where such occurrences have been recorded.

Table 19 – Representative Monitoring Data Where $CO_2 > 5\% v/v$ and/or $CH_4 > 1\% v/v$

Exploratory Hole ID	Response Zone Strata	Date Recorded	Steady State Flow (l/hr)	Maximum CH_4 Concentration (% v/v)	Maximum CO_2 Concentration (% v/v)
RBH04	Relic Topsoil / Shirdley Hill Sands	01/12/2025	<0.1	<0.1	10.7
RBH04		11/03/2026	<0.1	<0.1	11.3
RBH04		10/03/2026	<0.1	<0.1	5.5
RBH04		18/03/2026	<0.1	<0.1	10.0
WS01	Made Ground (Infilled Ground with relic topsoil at base)	11/03/2026	<0.1	1.2	7.4
WS01		10/03/2026	<0.1	2.2	7.3
WS01		18/03/2026	<0.1	1.3	7.3
WS02	Shirdley Hill Sands	01/12/2025	<0.1	0.3	7.6
WS02		16/12/2025	<0.1	<0.1	7.3

Clause 6.4 of BS8485 (Ref. 20) states that an assessor should consider increasing (in full cognisance of the conceptual site model) from CS1 to CS2 where methane is recorded >1% v/v or where carbon dioxide is recorded >5% v/v . However, there is no explicit requirement to increase a sites CS classification, and a view should be taken based upon a line of evidence approach. The NHBC NF94 document provides further detail on the lines of evidence to be considered.

In line with this guidance, a ternary plot of the data points in *Table 19* is presented as *Figure 9*.

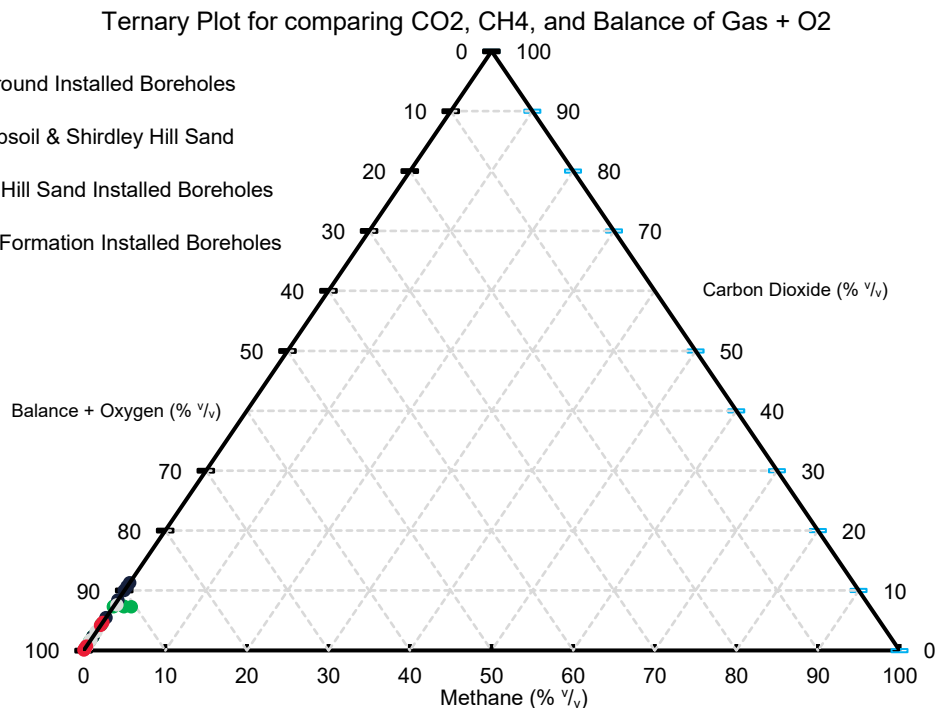


Figure 9 – Ternary Plot showing gas monitoring data.

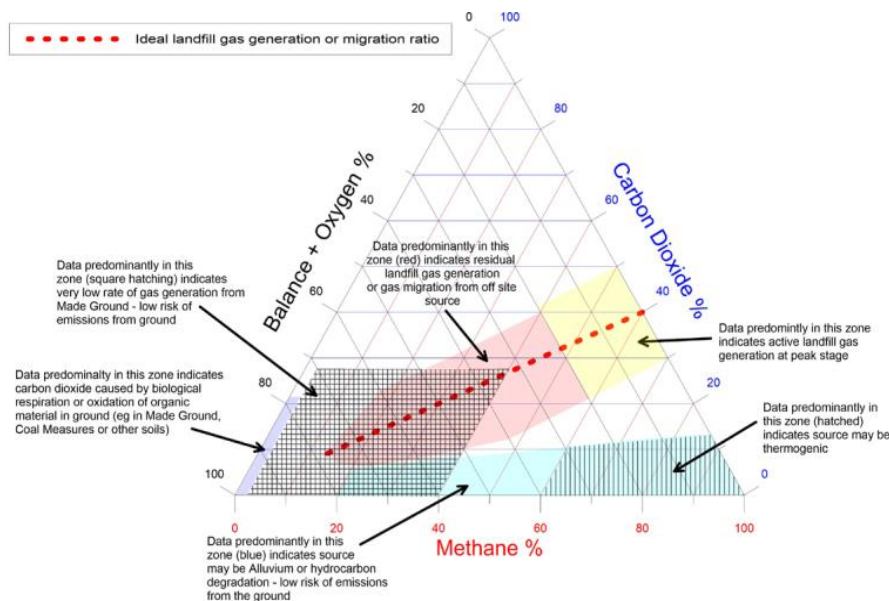


Figure 10 – Ternary Plot with zones indicating the potential gas sources (NHBC NF94, Ref 22).

A review of the ground gas monitoring results ternary plot, and anticipated ground gas generating sources outlined in Figure 10 suggests that the gas generating sources outlined below may be prevalent. Further commentary on each potential source is included, with consideration of exploratory hole locations and monitoring data points where representative data was obtained:

- **Low rates of gas generation Made Ground**

Made Ground soils were encountered in all exploratory hole locations. Monitoring wells were installed within Made Ground in WS01 and RBH01.

The monitoring well installed in WS01 was installed within Made Ground between 1.00m bgl and 3.00m bgl in the south of the site, the source of the Made Ground is likely to be associated with demolition materials during levelling out historic embankments around the former football pitch.

The monitoring well installed in RBH01 was also installed within Made Ground between 0.60m and 1.40m bgl in the centre of the site. The screened materials comprise dark grey slightly gravelly fine to coarse sand, with fragments of brick. The total organic carbon recorded in this sample was estimated to be 4.91 % w/w. No specific source of ground gas generation was identified during the ground investigation. This is reflected in the ground gas monitoring results, where results are consistently <5% v/v in this borehole.

With consideration of the above, it is not considered that low rates of gas generation sourced from Made Ground require an increase in characteristic situation to CS-2.

- **Biological respiration or oxidation of organic material in Made Ground**

Ground gas monitoring results indicate elevated carbon dioxide concentrations (>5% v/v) were recorded within:

Made Ground: WS01

Relic Topsoil / Shirdley Hill Sand: RBH04

Shirdley Hill Sand: WS02

Ground gas monitoring results indicate elevated methane concentrations (>1% v/v) were recorded within:

Made Ground: WS01

No elevated concentrations of methane were recorded in any other locations or strata.

In absence, or low concentrations, of methane, it is considered that elevated concentrations of carbon dioxide are likely associated with biological respiration naturally occurring within Relic Topsoil and the Shirdley Hill Sand. This is a naturally occurring process and does not pose a risk of hazardous gas emissions. As such, it is considered that increasing the characteristic situation to CS-2 due to marginally elevated carbon dioxide concentrations sourced from biological respiration is not required.

Marginally elevated concentrations of methane were recorded within Made Ground from WS01. Although unlikely to be associated with biological respiration, methane concentrations recorded in WS01 are unlikely to present a risk to site end users. The main risk driver of elevated methane sourced from ground gas generation is the risk associated with explosive atmospheres. The monitoring data shows that methane concentrations ranging from <0.1 % v/v to 2.2 % v/v, with corresponding oxygen concentrations ranging between <0.1% v/v and 0.9 % v/v. Figure X1.2 of ASTM International Standard Guide for Evaluating Potential Hazard as a Result of Methane in the Vadose Zone, included as Figure 11, indicates that these concentrations would lie in the zone where the atmosphere is not capable of forming explosive mixtures with air. As such, it is considered that increasing the characteristic situation to CS-2 due to marginally elevated methane concentration is not required.

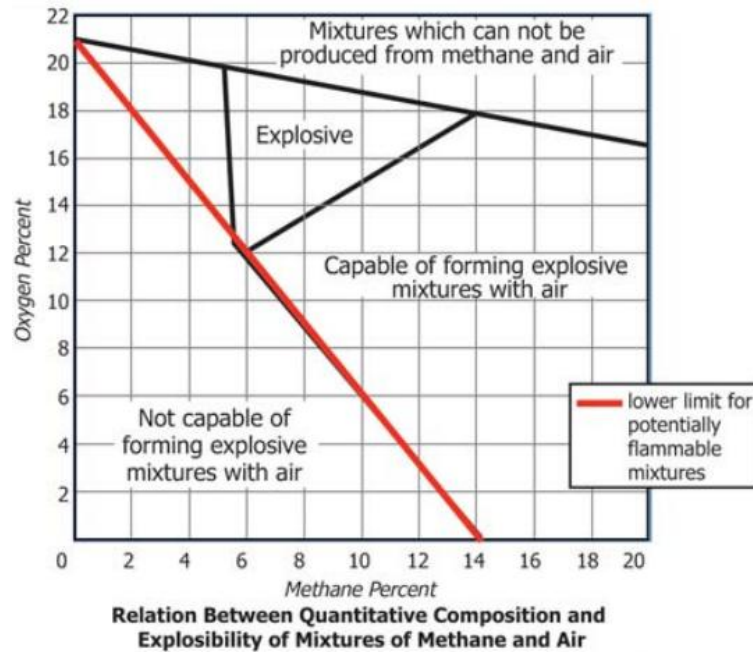


Figure 11 - Extract of Figure X1.2 from ASTM International Standard Guide for Evaluating Potential Hazard as a Result of Methane in the Vadose Zone

8.5 Summary

The gas screening value for the site is taken as 0.0113 l/hr for carbon dioxide, corresponding with a CS-1 classification, not requiring gas protection measures. Steady state gas flow rates are typically <0.1 l/hr which indicates there is no active gassing source.

It is noted that elevated concentrations of carbon dioxide were recorded in several boreholes, including WS01 (Made Ground), RBH04 (relic topsoil and Shirdley Hill Sand) and WS02 (Shirdley Hill Sand). Elevated carbon dioxide concentrations are attributed to biological respiration, which is a naturally occurring process and does not pose a risk of hazardous gas emissions. As such, it is considered that increasing the characteristic situation to CS-2 due to marginally elevated carbon dioxide concentrations sourced from biological respiration is not required.

Marginally elevated concentrations of methane were recorded within Made Ground from WS01. Although unlikely to be associated with biological respiration, methane concentrations recorded in WS01 are unlikely to present a risk to site end users. The main risk driver of elevated methane sourced from ground gas generation is the risk associated with explosive atmospheres. The monitoring data shows that methane concentrations ranging from <0.1 % v/v to 2.2 % v/v , with corresponding oxygen concentrations ranging between <0.1% v/v and 0.9 % v/v . Figure X1.2 of ASTM International Standard Guide for Evaluating Potential Hazard as a Result of Methane in the Vadose Zone, indicates that these concentrations would lie in the zone where the atmosphere is not capable of forming explosive mixtures with air. Coupled with steady state air flow rates of <0.1 l/hr throughout the monitoring period, it is considered that increasing the characteristic situation to CS-2 due to marginally elevated methane concentration is not required.

It's further noted that the new indoor pitch building affords some inherent protection through large internal airspaces and provision of intake louvres and extract fans at gable ends of the building.

Overall, it is considered that CS-1 is appropriate for the site, and that no ground gas protection measures are required for the proposed development.

This assessment is in line with previous assessments for the site by other consultants.

9 REVISED CONCEPTUAL SITE MODEL

The Preliminary Conceptual Site Model (PCSM) presented in the Phase 1 PRA Report (Ref. 2) and discussed in *Section 2.8* of this report has been revised following the GQRA in *Section 7.0* above. The Revised Conceptual Site Model (CSM) is summarised in the table overleaf.

The CSM details the source-pathway-receptor linkages or potential pollutant linkages (PPL) that have been identified as relevant for the site. The GQRA details the associated level of risk relating to these potential pollutant linkages.

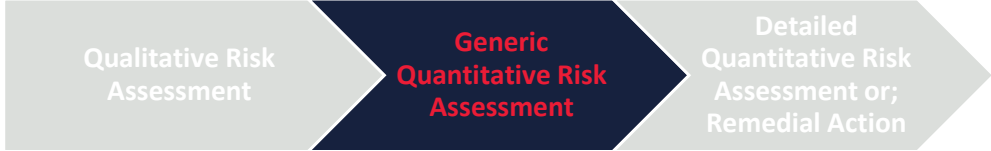
The CSM follows the framework outlined within CIRIA C552 (Ref. 23) which is summarised within *Appendix G*.

The 'risk rating' within the CSM refers to the risk that the source, pathway, receptor linkage or PPL is complete. Unless specifically stated it does not necessarily refer to an immediate risk and is intended to be used as a tool to assess the necessity for further assessment/investigation.

Risks presented by Mining are discussed and assessed within *Section 2.3.4*.

Risks presented by Unexploded Ordnance are discussed and assessed in *Section 2.7*.

Under current health and safety legislation, employers are required to carry out their own appropriate risk assessments and mitigation to protect themselves and their employees, other human receptors, and the environment from potential contamination. Such risks must be adequately mitigated by law, specifically the Construction Design Management (CDM) Regulations, 2015 (Ref. 24) which require that potential risks to human health and the environment from construction activities are appropriately identified and all necessary steps taken to eliminate / manage that risk. It has been assumed that any future construction works on site will be undertaken in compliance with these requirements. Reference should be given to the environmental testing results discussed within *Section 7.0* and presented within *Appendix C*.



- The table below represents the Second stage in the land quality risk assessment process; the Revised Conceptual Site Model following the Quantitative Risk Assessment.
- For a development site to be deemed 'suitable for use' the level of risk needs to be brought down to acceptable levels, i.e. low to very low risk. The purpose of each stage of risk assessment is ultimately to establish if there is a requirement for additional levels of assessment to be made to have sufficient confidence to support a risk characterisation or management decision, e.g., remedial action.

Conceptual Site Model			Qualitative Risk Assessment			Recommended Actions	Actions			
Source	Pathway(s)	Receptor(s)	Consequence	Likelihood of Occurrence	Risk Rating					
Potential for uncontrolled deposition of Made Ground associated with local construction works. Potential for Localised fuel spills and leakages associated with hard standing carparks and roads located onsite. Potential for Localised polychlorinated biphenyls (PCBs) associated with historic electric substation.	Direct contact and dermal uptake, soil and dust ingestion, dust & migration inhalation Vertical and horizontal migration through the superficial deposits (soils).	End user of site	Medium Chronic health risk.	Low	Moderate/Low	No exceedances above commercial General Assessment Criteria were identified. Asbestos positively identified during MML ground investigation including WS01 at 1m bgl (0.0025% ^{w/w}) and RBH01 at 0.5m bgl (<0.001% ^{w/w}). Asbestos also positively identified during Curtins ground investigations in HP11 at 0.3m bgl (<0.001% ^{w/w}).	Construction workers to be provided with appropriate PPE and sanitary facilities. Asbestos management plan during groundworks and construction works, Actions to be detailed in a Remediation Strategy. Installation of clean cover system may be required for some areas of soft landscaping or else further assessment works may need to be considered (JIWG assessment). Details to be specified in a Remediation Strategy.			
		Construction Workers		Low	Moderate/Low					
	Horizontal migration over and through the superficial deposits (soils).	Controlled Waters (groundwater)		Medium Pollution of classified groundwater.	Low			Moderate/Low	Minor exceedances of UK Drinking Water Standards and the World Health Organization Standards in five contaminants including Metals, and PAHs from 2 groundwater sampling locations. Risks to controlled waters from site soils are limited in nature and are unlikely to significantly benefit from either further contaminant modelling or remedial action. The results of soil testing identified the generally low-level leachable contaminants across the site within Made Ground Deposits and topsoil with no specific historic or, current point source identified.	No further action.
		Direct contact and dermal uptake, soil and dust ingestion, dust & migration inhalation								
	Inland river located 680m north									

Conceptual Site Model			Qualitative Risk Assessment			Recommended Actions	Actions
Source	Pathway(s)	Receptor(s)	Consequence	Likelihood of Occurrence	Risk Rating		
Organic matter, Made Ground and/or contamination as source material for the generation of ground gas.	Vertical and horizontal migration through Made Ground.	End users of site	Medium Chronic health risk.	Unlikely	Low	A CS-1 situation has been assigned to the site, the development does not require any ground gas protection measures. See Section 9 for further commentary and discussion.	No further action required.

10 SUMMARY OF POTENTIAL POLLUTANT LINKAGES

A **Moderate/Low** risk rating is identified to site end-users and construction workers from contamination in Made Ground soils from direct contact, dermal uptake, soil and dust ingestion and inhalation. There were no exceedances of *Commercial* GACs; however, asbestos fibres in soils were identified during both the MML and Curtins ground investigation. Contractors must prepare suitable risk assessments and methods statements, and mitigation measures which may not be limited to the use of suitable PPE and provision of suitable welfare and sanitary facilities during works. Clean capping may be required in any new nearby soft landscaped areas or else further assessment works considered with respect to proposed development plan.

A **Moderate/Low** risk rating is identified to controlled waters (Groundwater), and a **Low** risk rating is identified to controlled waters (Surface Waters) as the ground investigation encountered no olfactory, visual or gross contamination.

A **Low** risk rating is identified to site end users from ground gases following the monitoring visits, with a CS-1 assigned to the site, the development requires no ground protection measures.

11 ENGINEERING ASSESSMENT AND RECOMMENDATIONS

11.1 Introduction

This section will assess the relevant geotechnical issues for the proposed development comprising of a new indoor pitch, new show pitch with spectator stand, extension of the existing carpark, extension and refurbishment of the existing Academy Building, all with associated hard and soft landscaping.

The engineering assessment considers foundation design, bearing capacity, settlement, excavations, and ground floor slabs for the site. It is understood that structural loadings up to 850kN are required for the development. It should be noted that detail may change in the development of designs beyond the issue of this Phase 2 Report and the Construction Designer should satisfy themselves regarding the adequacy of their design and proposed approach to construction by reference to the on-going project design proposals, the site investigation information, and their own examination of the site.

No recommendations are provided herein for the indoor pitch design which is considered specialist design.

11.2 Summary of Ground Conditions

The ground conditions at the site generally comprised of surface covering of either Topsoil, hardstanding or Made Ground soils. This was generally underlain by granular Made Ground soils with localised cohesive Made Ground. Superficial soils, where encountered, generally comprised of Granular or cohesive Glacial Till with localised Shirdley Hill Sand deposits. Bedrock was confirmed to comprise of sandstone consistent with the Chester Formation.

Characteristic geotechnical parameters suggested for use in preliminary geotechnical designs are discussed in *Section 5.0* and *Section 6.0*.

11.3 Excavations

Based on observations on site, together with the results of in-situ and laboratory tests, it is considered that excavations to <1.20m bgl should stand unsupported in the short term at suitable batters. Side support for safety purposes should of course be provided to all excavations which appear unstable, and those >1.20m deep, in accordance with Health and Safety Regulations.

Suitable side slope batters may be required. These must be designed by a suitably qualified temporary works contractor for any excavations.

It is anticipated that excavations with conventional plant through the Made Ground, superficial soils and weathered bedrock will be attainable, however, a breaker may be required where bedrock becomes stronger.

Groundwater was encountered during the ground investigation and during post-investigation monitoring and appeared to be largely located within the weathered Chester Formation deposit. Groundwater may be encountered as seepages in shallow excavations for foundations or services as perched water. It is considered that groundwater inflows, if encountered, may be controlled by pumping from sumps.

All excavation temporary works shall be designed by a suitably qualified temporary works contractor for any excavations.

11.4 Earthworks

It is known that earthworks will be required to facilitate the scheme. It is anticipated that a Cut and Fill will be required for the site, prior to construction of the up to of the construction of a new indoor pitch, new show pitch with spectator stand, extension of the existing carpark, extension and refurbishment of the existing Academy Building, all with associated hard and soft landscaping.

It is important that the earthworks are undertaken under an Earthworks Specification in accordance with CC 601 Earthworks to capture the geotechnical acceptability criteria for the re-use of site won and imported materials as engineered fill and the compaction requirements.

11.5 Soakaways

2 No. soakaways were undertaken as part of the ground investigation.

The Infiltration Rate for both soakaway tests (SA01 and SA02) were determined as N/A, due to the water level remaining the same throughout the length of the test. As such, soakaways are unlikely to be considered to be a suitable drainage strategy for the proposed development.

11.6 Foundation Design

It is understood that the proposed development is for the construction of a new indoor pitch, new show pitch with spectator stand, extension of the existing carpark, extension and refurbishment of the existing Academy Building, all with associated hard and soft landscaping. It is understood that structural loadings up to 850kN are required for the development.

Based on the required loadings and the ground conditions encountered during Curtins intrusive ground investigation shallow foundations are unlikely to be considered suitable for the proposed development. Alternatively, a piled foundation solution is likely to be feasible, to transfer loads to more competent sandstone bedrock. End bearing piles socketing into the Chester Formation sandstone are likely to be a suitable foundation solution for high loads. The type, diameter and depth of the piles should be determined by a specialist whose design should be warranted. Deep mass trench fill may be deemed an option, however specific geotechnical assessment would be required to determine the feasibility.

11.7 Ground Floor Slabs

Based on the findings of the ground investigation it is recommended that consideration is given to constructing suspended ground floor slabs, bearing on pile caps and supported by a network of beams.

11.8 Volume Change Potential in Cohesive Glacial Till

Based on the laboratory testing results discussed in Section 6.2.2, the cohesive Glacial Till encountered on site has a low volume change potential in accordance with guidance from the NHBC Standards Chapter 4.2.

11.9 Chemical Attack on Buried Concrete

The site has been classified in accordance with BRE Special Digest (Ref. 12) and laboratory testing undertaken accordingly in *Section 6.5*.

Based on the laboratory test results, DS-1 and AC-2z is considered appropriate for this development. This is based on lower pH levels recorded in the Shirdley Hill Sands and Chester Formation deposits.

12 CONCLUSION AND RECOMMENDATIONS

12.1 Ground Contamination

A revised tabulated revised Conceptual Site Model has been derived following the findings on the Generic Quantitative Risk Assessment risk assessment and is presented in Section 8.0.

12.1.1 Ground Contamination

A **Moderate/Low** risk rating is identified to site end-users and construction workers from contamination in Made Ground soils from direct contact, dermal uptake, soil and dust ingestion and inhalation. There were no exceedances of Commercial GACs; however, asbestos fibres in soils were identified during both the MML and Curtins ground investigation. Containing materials have been encountered. Contractors must prepare suitable risk assessments risk assessments and methods statements, and mitigation measures which may not be limited to the use of suitable PPE and provision of suitable welfare and sanitary facilities during works. Clean capping may be required in any new nearby soft landscaped areas.

A **Low** risk rating is identified to controlled waters (Groundwater and Surface Waters) as the ground investigation encountered no olfactory, visual or gross contamination. This assessment should be reviewed and updated following receipt of groundwater samples.

A **Low** risk rating is identified to site end users from ground gases following the monitoring visits, with a CS-1 assigned to the site, the development requires no ground protection measures.

12.2 Recommendations

Based on the findings of the ground investigation, the following recommendations are made:

1. Construction workers to be provided with appropriate PPE and sanitary facilities with reference to environmental testing certificates appended herein.
2. Adopt an Asbestos Management Plan during groundworks and construction works.
3. A clean capping layer may be required in some areas of new soft landscaping, or else further assessment of risk recommended with respect to proposed development plans.
4. It is recommended that a Remediation Strategy is produced to detail the above requirements.
5. It is recommended that an Earthworks Specification is undertaken once final cut and fill volumes have been finalised.
6. It is recommended that a specialist piling contractor is consulted to assess the suitability of a piled foundation solution for the proposed development.

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APPENDICES

Appendix A – Drawings

Appendix B – Exploratory Hole Logs

Appendix C – Chemical Laboratory Test Results

Appendix D – Geotechnical Laboratory Test Results

Appendix D – Ground Gas Monitoring Results

Appendix E – GAC Screening Thresholds

Appendix F – Risk Assessment Methodology

Appendix A – Drawings



Legend

Exploratory Holes

- Hand Pit
- Foundation Pit
- Soak Away Trial Pit
- Dynamic Sample Borehole
- Rotary Cored Borehole
- Window Sample Borehole
- Red line boundary

0 25 50 m

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Status				
INFORMATION				
Project:				
Liverpool FC Academy				
Drg Title:				
Exploratory Hole Location Plan				
Scale:	Size:	Issue Date:	Drawn:	Checked:
See Scale	A3	28/11/2025	JP	NF
Drg No:				Rev:
088269-CUR-00-XX-DR-GE-80002				P01

1.2 PROPOSED MASTERPLAN

PROPOSED SITE PLAN

SUMMARY OF DEVELOPMENT

The masterplan proposals consist of:

- Extending and refurbishing the academy building
- A new full-size artificial indoor pitch
- A new full-size show pitch
- A 499 (maximum) seat spectator stand and associated accommodation such as changing rooms, officials rooms and spectator facilities.
- Replacement of lost parking spaces and some additional parking spaces with coach and mini-bus parking.
- Landscaping, pitch access, and replacement trees.

— SITE BOUNDARY



Appendix B – Exploratory Hole Logs







Project Name: LFC Academy

Project No.
088269

Co-ords: 342317.64 - 398463.44

Level: 36.58

Date

12/11/2025

Location: Liverpool FC Academy, Liverpool, L33 7ED

Dimensions
(m):

0.33

Scale

1:25

Client: Liverpool FC

Depth
0.60

0.33

Logged
JP

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
				0.30	36.28		MADE GROUND: Grass cover over brown fine to medium sand.	
				0.60	35.98		MADE GROUND: Greyish brown slightly gravelly clayey fine to coarse sand with a low cobble content. Gravel is fine to coarse, angular to subangular of brick. Cobbles are subangular of brick.	
						From 0.45m to 1.0m bgl: TRL CBR test undertaken.		
						End of pit at 0.60 m		
							1	
							2	
							3	
							4	
							5	

Remarks:	Hand excavated trial pit to 0.6m bgl with DCP test undertaken at 0.45m bgl. Position was GPR cleared and CAT scanned by Avoim Maa and a Curtins Engineer. No water strikes were encountered during excavation.
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Stability: Stable



Curtins				Trial Pit Log			Trialpit No HP06 Sheet 1 of 1		
Project Name: LFC Academy				Project No. 088269		Co-ords: 342277.67 - 398412.65		Date 12/11/2025	
Location: Liverpool FC Academy, Liverpool, L33 7ED				Dimensions (m):		0.3		Scale 1:25	
Client: Liverpool FC				Depth 1.00		0.3		Logged JP	
Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
	Depth	Type	Results						
				0.30	35.98		MADE GROUND: Grass cover over brown fine to medium sand.		
				0.60	35.68		MADE GROUND: Greyish brown slightly gravelly clayey fine to coarse sand with a low cobble content. Gravel is fine to coarse, angular to subangular of brick, wood and slag. Cobbles are subangular of brick. <i>From 0.35m to 1.0m bgl: TRL CBR test undertaken.</i>		
				1.00	35.28		MADE GROUND: Greyish brown slightly gravelly clayey fine to coarse sand with a low cobble content. Gravel is fine to coarse, angular to subangular of brick, wood and slag. Cobbles are subangular of brick. <i>From 0.35m to 1.0m bgl: TRL CBR test undertaken.</i> End of pit at 1.00 m		
								1	
							2		
							3		
							4		
							5		
Remarks: Hand excavated trial pit to 1.0m bgl with DCP test undertaken at 0.35m bgl. Position was GPR cleared and CAT scanned by Avoin Maa and a Curtins Engineer. No water strikes were encountered during excavation.									
Stability: Stable									
AGS									

Project Name: LFC Academy

Project No.
088269

Co-ords: 342343.99 - 398468.02

Level:	36.44
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Date

12/11/2025

Location: Liverpool FC Academy, Liverpool, L33 7ED

Dimensions
(m):

0.4

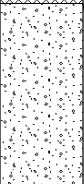
Client: Liverpool FC

Depth
1.00

0.4

Scale
1:25

Logged
JP

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.40 - 0.50	ES		0.30	36.14		MADE GROUND: Grass over light brown fine to medium sand.
				0.40	36.03		MADE GROUND: Greyish brown slightly gravelly clayey fine to coarse sand. Gravel is fine to coarse, subangular of sandstone.
							From 0.32m to 1.0m bgl: TRL CBR test undertaken. Brown gravelly fine to coarse SAND. Gravel is fine to coarse, subangular of sandstone and mudstone.
				1.00	35.44		End of pit at 1.00 m
							1
							2
							3
							4
							5

Remarks:	Hand excavated trial pit to 1.0m bgl with DCP test undertaken at 0.32m bgl. Position was GPR cleared and CAT scanned by Avoim Maa and a Curtins Engineer. No water strikes were encountered during excavation.
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Stability: Stable



Curtins				Trial Pit Log			Trialpit No HP08 Sheet 1 of 1			
Project Name: LFC Academy				Project No. 088269		Co-ords: 342294.07 - 398524.01 Level: 36.43		Date 12/11/2025		
Location: Liverpool FC Academy, Liverpool, L33 7ED						Dimensions (m): 0.3		Scale 1:25		
Client: Liverpool FC						Depth 0.80		Logged JP		
Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description			
	Depth	Type	Results							
	0.50 - 0.60	ES		0.30	36.13		MADE GROUND: Grass cover of light brown fine to medium sand.			
				0.50	35.93		MADE GROUND: Brown fine to medium sand. <i>From 0.34m to 0.80m bgl: TRL CBR test undertaken until refusal at 0.80m bgl.</i>			
				0.60	35.83		Firm dark grey very sandy clay. Sand is fine to coarse.			
				0.79	35.64		Dark brown slightly gravelly fine to medium SAND. Gravel is fine to medium, subangular of sandstone.			
				0.80	35.63		Grey CONCRETE.			
							End of pit at 0.80 m			
Remarks: Hand excavated trial pit to 0.8m bgl with DCP test undertaken at 0.34m bgl. Position was GPR cleared and CAT scanned by Avoin Maa and a Curtins Engineer. No water strikes were encountered during excavation. Stability: Stable									AGS	

Curtins				Trial Pit Log			Trialpit No HP09 Sheet 1 of 1		
Project Name: LFC Academy				Project No. 088269		Co-ords: 342456.65 - 398572.28		Date 11/11/2025	
Location: Liverpool FC Academy, Liverpool, L33 7ED				Dimensions (m):		0.6		Scale 1:25	
Client: Liverpool FC				Depth 0.85		0.45		Logged JP	
Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
	Depth	Type	Results						
				0.07	38.58		Grey CONCRETE paving slab. <i>From ground level to 0.70m bgl: Brick wall foundations.</i>		
				MADE GROUND: Light brown fine to coarse sand.					
				0.30	38.35		MADE GROUND: Brown slightly clayey sandy gravel with a high cobble content. Gravel is fine to coarse, angular to subangular of brick and concrete. Cobbles are subangular of brick and cobbles.		
				0.65	38.00			Brown fine to coarse SAND. <i>From 0.70m to 0.85m bgl: Concrete foundation steps out 0.15m, with a raised ridge noted extending a further 0.15m. The concrete then extends down to the final excavated depth.</i>	
				0.85	37.80	<i>End of pit at 0.85 m</i>			
Remarks: Hand excavated foundation pit to 0.85m bgl. Position was GPR cleared and CAT scanned by Avoin Maa and a Curtins Engineer. No water strikes encountered during excavation. For more information refer to cross section drawings. Ground level estimated from topographic survey. Co-ordinates estimated from GIS mapping tool.				1 2 3 4 5					
Stability: Stable									



Curtins				Trial Pit Log			Trialpit No HP10 Sheet 1 of 1		
Project Name: LFC Academy				Project No. 088269		Co-ords: 342449.32 - 398581.88 Level: 38.59		Date 12/11/2025	
Location: Liverpool FC Academy, Liverpool, L33 7ED				Dimensions (m): Depth 0.65		0.5 0.45		Scale 1:25 Logged JP	
Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
	Depth	Type	Results						
				0.10	38.49		Grey CONCRETE paving slab. <i>From ground level to 0.33m bgl: Brick wall foundations.</i>		
				0.65	37.94		MADE GROUND: Greyish brown gravelly fine to coarse sand with cobbles. Gravel is fine to coarse, angular to subangular of brick, concrete and slag. Cobbles are subangular of brick, concrete and slag. <i>From 0.33 to 0.43m bgl: Concrete foundation extends 0.2m from wall with a thickness of 0.1m.</i> <i>From 0.33 to 0.45m bgl: Concrete slab noted on the opposite side of the foundation pit with a thickness of 0.1m.</i> End of pit at 0.65 m		
							1		
							2		
							3		
							4		
							5		
Remarks:				Hand excavated foundation pit to 0.65m bgl. Position was GPR cleared and CAT scanned by Avoin Maa and a Curtins Engineer. No water strikes encountered during excavation. For more information refer to cross section drawings. Ground level estimated from topographic survey. Co-ordinates estimated from GIS mapping tool.					
Stability:				Stable					

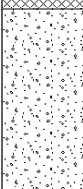
AGS

Curtins				Trial Pit Log			Trialpit No HP11 Sheet 1 of 1					
Project Name: LFC Academy				Project No. 088269		Co-ords: 342356.69 - 398413.99 Level: 38.16		Date 12/11/2025				
Location: Liverpool FC Academy, Liverpool, L33 7ED						Dimensions (m): Depth 1.00		0.35 		Scale 1:25 Logged JP		
Client: Liverpool FC												
Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description					
	Depth	Type	Results									
	0.20 - 0.30	ES					MADE GROUND: Grass cover over brown sligthyl clayey slightly gravelly fine to coarse sand with occasional rootlets. Gravel is fine to coarse, subangular of brick.					
							From 0.32m to 1.0m bgl: TRL CBR test undertaken.					
				0.70	37.46		MADE GROUND: Brown sandy GRAVEL. Sand is fine to coarse. Gravel is fine to coarse, subangular of concrete.					
				1.00	37.16		End of pit at 1.00 m					
											1	
											2	
											3	
											4	
											5	
Remarks: Hand excavated trial pit to 1.0m bgl with DCP test undertaken at 0.32m bgl. Position was GPR cleared and CAT scanned by Avoin Maa and a Curtins Engineer. No water strikes were encountered during excavation.											AGS	
Stability: Stable												

Curtins				Trial Pit Log			Trialpit No HP13 Sheet 1 of 1		
Project Name: LFC Academy				Project No. 088269		Co-ords: 342338.12 - 398536.05		Date 14/11/2025	
Location: Liverpool FC Academy, Liverpool, L33 7ED				Dimensions (m):		1.35		Scale 1:25	
Client: Liverpool FC				Depth 1.20		0.45		Logged JP	
Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
	Depth	Type	Results						
				0.07	38.12		Grey CONCRETE paving slab.		
				0.11	38.08		From ground level to 0.07m bgl: Brick wall foundations.		
							MADE GROUND: Brown fine to coarse sand.		
							From 0.07m to 0.55m bgl: Sandstone block foundations with a blue membrane surrounding the blocks.		
				0.30	37.89		MADE GROUND: Light grey gravelly fine to coarse sand. Gravel is fine to coarse, angular to subangular of sandstone.		
							MADE GROUND: Greyish brown sandy gravel with a medium cobble content. Sand is fine to coarse. Gravel is fine to coarse, angular to subangular of brick, concrete and sandstone. Cobbles are subangular of brick, concrete and sandstone.		
				0.90	37.29		From 0.55m to 1.20m bgl: Concrete step extending 0.83m from the wall and extends past excavatable depth.		
					MADE GROUND: Greyish brown sandy gravel with a medium cobble content. Sand is fine to coarse. Gravel is fine to coarse, angular to subangular of brick, concrete and sandstone. Cobbles are subangular of brick, concrete and sandstone.				
				1.20	36.99		From 0.55m to 1.20m bgl: Concrete step extending 0.83m from the wall and extends past excavatable depth.		
							End of pit at 1.20 m		
Remarks: Hand excavated foundation pit to 1.2m bgl. Position was CAT scanned by a Curtins Engineer. No water strikes encountered during excavation. For more information refer to cross section drawings. Ground level estimated from topographic survey. Co-ordinates estimated from GIS mapping tool.									
Stability: Stable				AGS					

Curtins				Trial Pit Log			Trialpit No HP14 Sheet 1 of 1		
Project Name: LFC Academy				Project No. 088269		Co-ords: 342344.08 - 398529.30		Date 14/11/2025	
Location: Liverpool FC Academy, Liverpool, L33 7ED				Dimensions (m):		0.82		Scale 1:25	
Client: Liverpool FC				Depth 1.10		0.8		Logged LW	
Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
	Depth	Type	Results						
				0.06	38.15		Grey CONCRETE paving slab.		
				0.15	38.06		From ground level to 0.10m bgl: Brick wall foundations.		
							MADE GROUND: Light brown fine to coarse sand.		
				0.30	37.91		From 0.07m to 0.55m bgl: Sandstone block foundations with a blue membrane surrounding the blocks.		
							MADE GROUND: Light grey sandy gravel. Sand is fine to coarse. Gravel is fine to coarse, subangular of sandstone.		
							MADE GROUND: Dark brown slightly clayey gravelly fine to coarse sand with cobbles. Gravel is fine to coarse, subangular of brick and concrete. Cobbles are subangular of brick and concrete.		
					From 0.55m to 1.20m bgl: Concrete step extending 0.10m from the wall and extends down 0.15m to a second concrete step.				
			1.10	37.11	From 0.55m to 1.10m bgl: Second concrete step extending 0.60m and extends past excavatable depth.				
							End of pit at 1.10 m		
Remarks: Hand excavated foundation pit to 1.1m bgl. Position was CAT scanned by a Curtins Engineer. No water strikes encountered during excavation. For more information refer to cross section drawings. Ground level estimated from topographic survey. Co-ordinates estimated from GIS mapping tool.									
Stability: Stable				AGS					

Curtins				Trial Pit Log			Trialpit No HP15 Sheet 1 of 1		
Project Name: LFC Academy				Project No. 088269		Co-ords: 342358.86 - 398509.77		Date 14/11/2025	
Location: Liverpool FC Academy, Liverpool, L33 7ED				Dimensions (m):		0.93		Scale 1:25	
Client: Liverpool FC				Depth 1.20		0.47		Logged LW	
Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
	Depth	Type	Results						
				0.06	38.15		BRICK surface cover.		
				0.15	38.06		From ground level to 0.06m bgl: Brick wall foundations.		
				0.30	37.91		MADE GROUND: Light brown fine to coarse sand.		
							From 0.07m to 0.55m bgl: Concrete step extending 0.40m from the wall and extends down 0.09m.		
							MADE GROUND: Light grey sandy gravel. Sand is fine to coarse. Gravel is fine to coarse, subangular of sandstone.		
			1.20	37.01	From 0.15m to 0.60m bgl: Sandstone block foundations with a blue membrane surrounding the blocks.				
					MADE GROUND: Dark brown gravelly fine to coarse sand with cobbles. Gravel is fine to coarse, subangular of brick and concrete. Cobbles are subangular of brick and concrete.				
					At 0.60m bgl: Foundations along stairwell end at 0.60m bgl below the sandstone block foundations.				
						From 0.0.60m to 1.12m bgl: Concrete step extending 0.60m and extends past excavatable depth.			
						End of pit at 1.20 m			
Remarks: Hand excavated foundation pit to 1.2m bgl. Position was CAT scanned by a Curtins Engineer. No water strikes encountered during excavation. For more information refer to cross section drawings. Ground level estimated from topographic survey. Co-ordinates estimated from GIS mapping tool.									
Stability: Stable				AGS					

Curtins				Trial Pit Log			Trialpit No SA01 Sheet 1 of 1			
Project Name: LFC Academy				Project No. 088269		Co-ords: 342305.59 - 398526.64 Level: 36.50		Date 11/11/2025		
Location: Liverpool FC Academy, Liverpool, L33 7ED						Dimensions (m): 1.5 0.7		Scale 1:25		
Client: Liverpool FC						Depth 1.20		Logged JP		
Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description			
	Depth	Type	Results							
				0.30	36.20		MADE GROUND: Grass cover over light brown fine to medium sand.			
				0.60	35.90		MADE GROUND: Dark brown fine to medium sand.			
				1.20	35.30		Light brown mottled light grey slightly gravelly fine to coarse SAND with a low cobble and boulder content. Gravel is fine to coarse subangular of sandstone and mudstone. Cobbles and boulders are subangular of sandstone and mudstone.			
							----- End of pit at 1.20 m -----			
									1	
									2	
									3	
									4	
									5	
Remarks: Machine Excavated Trial Pit to 1.2m bgl with BRE Soakaway testing undertaken at 0.70m to 1.20m bgl. Soakaway test failed to infiltrate strata after 180 minutes. Position was GPR cleared and CAT scanned by Avoin Maa and a Curtins Engineer. No water strikes were encountered during excavation. Stability: Stable										



Project Name: LFC Academy

Project No.
088269

Co-ords: 342223.89 - 398452.98

Hole Type
WS

Location: Liverpool FC Academy, Liverpool, L33 7ED

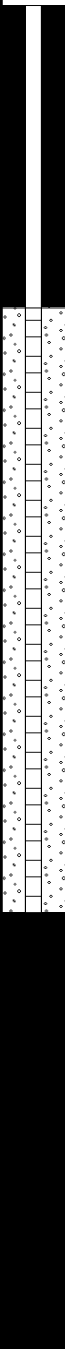
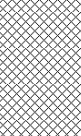
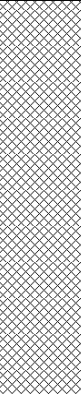
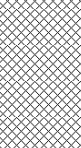
Level: 36.38

Scale
1:25

Client: Liverpool FC

Dates: 14/11/2025 - 14/11/2025

Logged By
LW

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.31	36.07		Grass over TOPSOIL: Light brown sand with frequent rootlets. Sand is fine to medium.	
		0.70	ES		0.80	35.58		MADE GROUND: Dark brown slightly clayey gravelly sand. Sand is fine to coarse. Gravel is fine to coarse, subangular to angular of brick, concrete, limestone, copper wire, charcoal and wood.	
		1.20		N=11 (2,2/2,2,4,3)				MADE GROUND: Dark brown sandy gravelly clay. Sand is fine to coarse. Gravel is fine to coarse, subangular to angular of brick, limestone and concrete.	1
		2.00		N=28 (3,3/4,7,9,8)	2.15	34.23		MADE GROUND: Light brown sandy gravelly clay. Sand is fine to coarse. Gravel is fine to coarse, subangular to angular of brick, limestone and concrete.	2
					2.45	33.93		MADE GROUND: Black/dark brown sandy gravelly clay. Sand is fine to coarse. Gravel is fine to coarse, subangular to angular of brick, limestone and concrete.	
		3.00		N=40 (5,5/8,8,12,12)	3.00	33.38		Brown organic CLAY. Fragments of wood and plant matter.	3
		3.00 - 3.20	D		3.20	33.18		From 3.00m TO 3.20m bgl: Material has an organic odour. Light brown and cream slightly clayey slightly gravelly SAND. Sand is fine to medium. Gravel is fine to medium, subrounded of sandstone.	
		3.50 - 4.00	B						
		4.00 4.00	D	N=50 (6,6/50 for 280mm)					4
					4.45	31.93		End of borehole at 4.45 m	5

Remarks

Window Sample Borehole to 4.45m bgl. Position was GPR cleared and CAT scanned by Avoin Maa and a Curtins Engineer. No water strikes were encountered during excavation.

Project Name: LFC Academy

Project No.
088269

Co-ords: 342249.69 - 398423.18

Hole Type
WS

Location: Liverpool FC Academy, Liverpool, L33 7ED

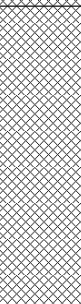
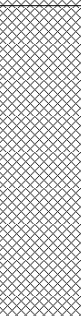
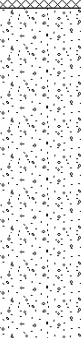
Level: 36.52

Scale
1:25

Client: Liverpool FC

Dates: 13/11/2025 - 13/11/2025

Logged By
JP

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.30			0.30	36.22		MADE GROUND: Grass cover over light brown fine to medium sand.	1
		1.20		N=9 (2,1/2,2,2,3)	1.30	35.22		MADE GROUND: Dark greyish brown clayey slightly gravelly fine to coarse sand. Gravel is fine to coarse, angular to subangular of brick, concrete and sandstone.	
		1.80 - 1.90 2.00	ES	N=29 (4,7/9,8,6,6)	2.35	34.17		MADE GROUND: Greyish brown sandy gravelly clay. Sand is fine to coarse. Gravel is fine to coarse, subangular of brick, concrete and sandstone.	2
		2.90 - 3.00 3.00	D	50 (4,7/50 for 200mm)	3.45	33.07		Dense light brown slightly gravelly fine to coarse SAND. Gravel is fine to coarse, subangular of quartzite and sandstone.	3
								End of borehole at 3.45 m	4
									5

Remarks

Window Sample Borehole to 3.30m bgl. Position was GPR cleared and CAT scanned by Avoin Maa and a Curtins Engineer. No water strikes were encountered during excavation.