EARTH ENVIRONMENTAL & GEOTECHNICAL
A Technics Group Company

Integrated Phase I and GeoEnvironmental Site Investigation Report

Palatine Road

Didsbury

August 2025

On behalf of

Affordable & Stylish Ltd

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PHASE I DESK STUDY & SITE INVESTIGATION REPORT

PALATINE ROAD

DIDSBURY

Report Ref: A6550/25/SI

AUGUST 2025

Prepared on Behalf of:

Affordable and Stylish Ltd

By:

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DISTRIBUTION:

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PHASE I DESK STUDY & GEOENVIRONMENTAL SITE INVESTIGATION REPORT

PALATINE ROAD, DIDSBURY

Report Reference: A6550/25/SI

Version B.1

Date: 29th August 2025

Prepared for: Affordable and Stylish Ltd

Prepared by: Earth Environmental & Geotechnical Ltd
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Definition of Version Code:
D. Applied during initial drafting of the report before it has been reviewed.
C. Applied after the report has been reviewed but before it has been approved by the Project Manager.
B. Applied after the Project Manager has approved the report ready for issue to the client.
A. Applied to reports after external/internal review.

The version number starts at "0" and is raised by "1" at each re-type.

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1.0 EXECUTIVE SUMMARY

Appointment	A Site Investigation has been commissioned by Affordable and Stylish Ltd ('the Client'), to examine ground conditions for a proposed development at 246 Palatine Road, Manchester M20 2WF.
The Investigation	The investigation comprised two window sampling boreholes with follow-up dynamic probing, in-situ testing, and laboratory geotechnical testing, along with subsequent visits to conduct ground gas monitoring.
The Site	The site is located at Palatine Road, approximately 2.7km northeast of East Didsbury train station. The National Grid Reference for the centre of the site is SJ 83481 90855 (X: 383481, Y: 390855), the closest postcode being M20 2UE. According to the British Geological Survey (BGS), the site is underlain by superficial deposits of Alluvium and bedrock deposits of Wilmslow Sandstone Formation.
Site History	Historically, the site comprised a vacant plot of undeveloped land until the mid-1970s when the existing property was developed. Elevation changes have been recorded on site between the early 1900's and the 1950's, however were not noted between the 50s and 70s, suggesting potential levelling of the area. The on site car port is understood to have been constructed prior to 2003. No significant change has been identified since.
Ground Conditions Encountered	The exploratory holes generally encountered made ground to depths of 1.70m in the south of the site and 2.70m in the north of the site. This was overlying superficial deposits of alluvium, comprising very soft to soft clay and loose to very dense sand to a maximum depth of 8.00m bgl. Groundwater was encountered during the site investigation in both exploratory boreholes at 5.00m bgl. Subsequent monitoring visits identified groundwater levels between 4.43m - 4.52m bgl exclusively within WS01 (north of the site).
Geotechnical Assessment	Shallow strip/pad foundations placed in the natural superficial deposits are not considered appropriate for the current proposed development, due to the presence of deep made ground and soft/ loose alluvium (with a medium volume change potential). Foundation loadings will need to be transferred to competent strata by use of driven or bored piles. Pavement Design - preliminary design value = 1% in Made Ground. Design Sulphate Class = DS-1 ACEC Site Classification = AC-1s
Contamination Assessment	No significant sources of contamination identified during the desk study. Gravel layer containing ash and clinker to the rear of the property should be removed during redevelopment of the garden area. No furth visual or olfactory evidence of contamination observed during the ground investigation.
This sheet is intended to provide a summary only of the report. It does not provide a definitive engineering analysis for the purposes of costing or construction and is subject to the limitation of the agreed brief.	

2.0 INTRODUCTION

2.1 Background

A site investigation has been commissioned by Affordable and Stylish Ltd ('the Client'), to examine ground conditions for a proposed development at 246 Palatine Road, Manchester.

2.2 Existing Planning Applications

2.2.1 Planning Application to Manchester City Council, 133426/FO/2022 dated June 2022.

A planning application has been submitted for the site to Manchester City Council and was approved with conditions.

This report aims to address condition 8 of the design notice.

8) a) Before the development hereby approved commences, a report (the Preliminary Risk Assessment) to identify and evaluate all potential sources and impacts of any ground contamination, groundwater contamination and/or ground gas relevant to the site shall be submitted to and approved in writing by the City Council as local planning authority. The Preliminary Risk Assessment shall conform to City Council's current guidance document (Planning Guidance in Relation to Ground Contamination).

In the event of the Preliminary Risk Assessment identifying risks which in the written opinion of the Local Planning Authority require further investigation, the development shall not commence until a scheme for the investigation of the site and the identification of remediation measures (the Site Investigation Proposal) has been submitted to and approved in writing by the City Council as local planning authority. The measures for investigating the site identified in the Site Investigation Proposal shall be carried out, before development commences and a report prepared outlining what measures, if any, are required to remediate the land (the Site Investigation Report and/or Remediation Strategy) which shall be submitted to and approved in writing by the City Council as local planning authority.

b) When the development commences, the development shall be carried out in accordance with the previously agreed Remediation Strategy and prior to occupation a Completion/Verification Report shall be submitted to and approved in writing by the City Council as local planning authority.

In the event that ground contamination, groundwater contamination and/or ground gas, not previously identified, are found to be present on the site at any time before the development in each phase is occupied, then development shall cease and/or the development shall not be occupied until, a report outlining what measures, if any, are required to remediate the land (the Revised Remediation Strategy) is submitted to and approved in writing by the City Council as local planning authority and the development shall be carried out in accordance with the Revised Remediation Strategy, which shall take precedence over any Remediation Strategy or earlier Revised Remediation Strategy.

2.3 Terms of Reference

Earth Environmental and Geotechnical Ltd (EEG) have been commissioned by the Client to undertake a site investigation of the site in accordance with proposal A6550/25 dated 7th May 2025. The objectives of this investigation are as follows:

- *Provide factual information on the work undertaken, including sampling location plan, borehole logs, in-situ testing, and geotechnical testing.*
- *Integrated Phase 1 Environmental Desk Study.*
- *Assessment of ground conditions for foundation design.*

2.4 Report Scope

This report presents a review of the Phase I desk study information, full factual records of the site work carried out, the ground conditions encountered in the exploratory holes, and the in situ and laboratory test results. All information collected has been used to provide an interpretation of the ground conditions, with recommendations on geotechnical design and potential ground contamination risks for the proposed development.

2.5 Limitations of the Study

The report is written in the context of an agreed scope of work and budget and should not be used in a different context. New information, improved practices, or changes in legislation may require a reinterpretation of the report in whole or in part. EEG reserves the right to amend either conclusions or recommendations, considering any further information that may become available. The report is provided for the sole use by the client and is confidential to them. Recommendations within this report are also based on exploratory records and examination of samples and, where applicable, laboratory tests. No liability can be accepted for conditions not revealed by the boreholes, particularly at intervening locations. Whilst every effort is made to ensure accuracy of data supplied, all opinions expressed as to the spatial distribution of strata between sampling locations are for guidance only and no responsibility is accepted as to their accuracy.

3.0 SITE LOCATION & DESCRIPTION

The site (0.09 ha) is located at Palatine Road, approximately 2.7km northeast of East Didsbury train station.

The approximate National Grid Reference for the centre of the site is SJ 83481 90855 (X: 383481, Y: 390855), the closest postcode being M20 2UE.

The site is roughly a rectangular shaped parcel of land with current access via Palatine Road located south of the site.

The site is predominantly occupied by a single residential dwelling with a private driveway, garden space, car port and detached canopy. The central structure is surrounded by mature trees and vegetation. An infestation of Himalayan Balsam has been identified predominantly along the southwest site boundary, along with patches on the north of the plot. The infestation was noted to be present off-site to the southwest of the site.

The site is surrounded by dense woodland and mature trees to the north, west, and east. The south side also contains mature vegetation but includes the primary access point from Palatine Road. The wider surroundings include the Withington Golf Club to the south and River Mersey northwest. Residential properties are situated further along Palatine Road to the east.

The site is bound by wooden fencing north, east and west, with a gated entrance located along the southern boundary facing Palatine Road.

The site location is shown below in Figure 1.

Figure 1: Site Location Plan

Figure 2: General Site Photographs

Photograph viewing northeast showing the front of the existing property

Photograph viewing southeast showing the rear of the existing property

Photograph viewing north showing the pond, north of the existing property

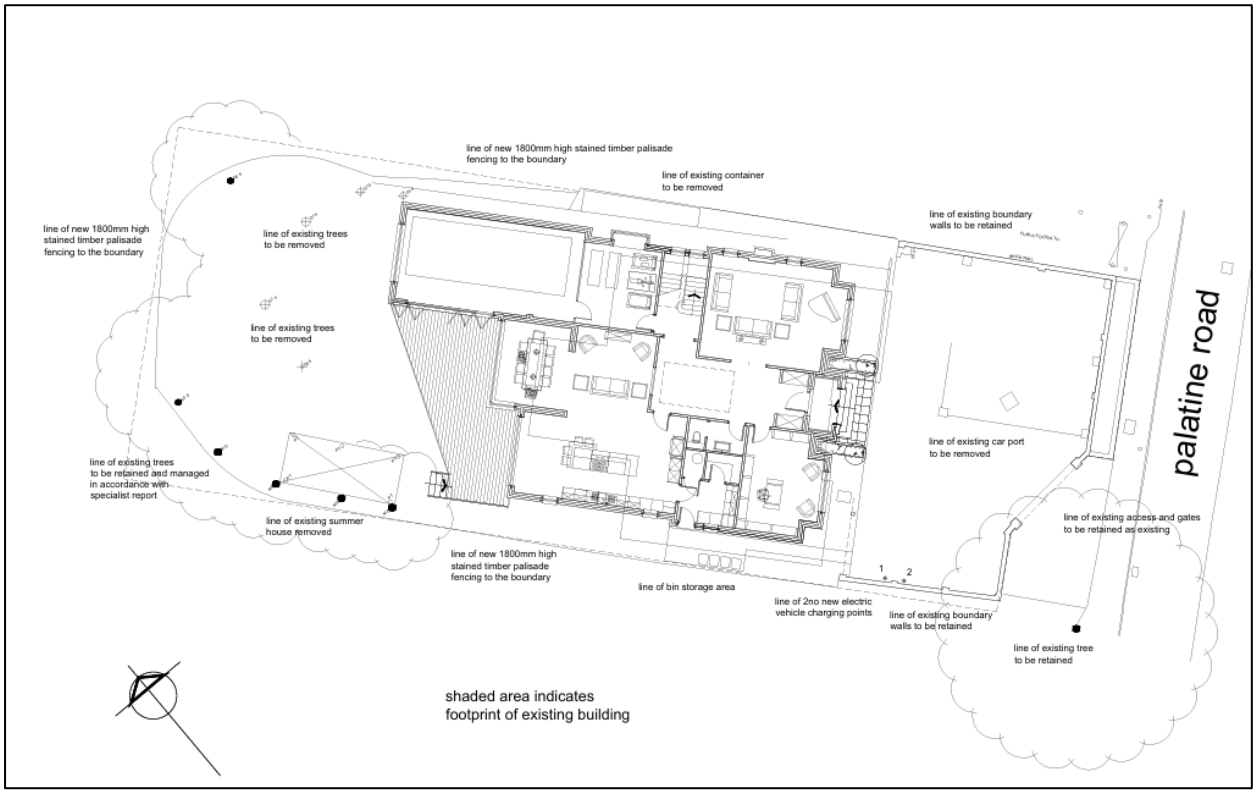
Photograph of representative soils (WS02)

3.1 Proposed Development

It is understood that the Client intends to replace the existing building at Palatine Road, adding new fencing, electric vehicle charging points, removing some trees and outbuildings, and make improvements to the landscape and boundaries.

A proposed development plan is shown in Figure 3 below:

Figure 3: Proposed Development Plan



4.0 REVIEW OF DESK STUDY INFORMATION

4.1 General

The geology of the site is covered by British Geological Survey (BGS) online data and the site specific GroundSure Enviro+Geo Insight report (Appendix 1).

Environmental conditions are covered by Environment Agency (EA) and British Geological Survey (BGS) online data, and the site specific GroundSure Enviro+Geo Insight report (Appendix 1).

4.2 Geology

The BGS states the site is not underlain by artificial deposits or made ground. However, multiple records of made ground are recorded in the surrounding area, particularly along the banks of the River Mersey and to the south of the site (7m south).

The site is recorded to be underlain by superficial deposits of Alluvium, comprising of clay, silt and gravel.

The site is recorded to be underlain by bedrock of the Wilmslow Sandstone Formation, comprising of sandstone.

There are 2no. records of linear features within 500m of the site boundary. The closest record refers to a fault 412m west of the site.

There are no records of landslips within 500m of the site boundary.

There are 7no. borehole records identified within 250m of the site. The closest borehole record is 59m northeast of the site. The records are confidential and are therefore inaccessible. The closest available record refers to a borehole drilled to 17.68m bgl located 228m southwest of the site. The record shows generally soft silty clay to a depth of 5.48m, underlain by loose sand with a single dense gravel band to a depth of 10.67m bgl. This was underlain by dense to very dense sand with gravel and cobbles to a depth of 15.75m bgl. Weakly cemented sandstone rockhead was encountered at a 15.75m bgl. A water strike was recorded at 5.48m bgl at the start of the granular material.

The following hazards ratings apply to the site and land within 50m and are presented in the Enviro + Geo Insight Report

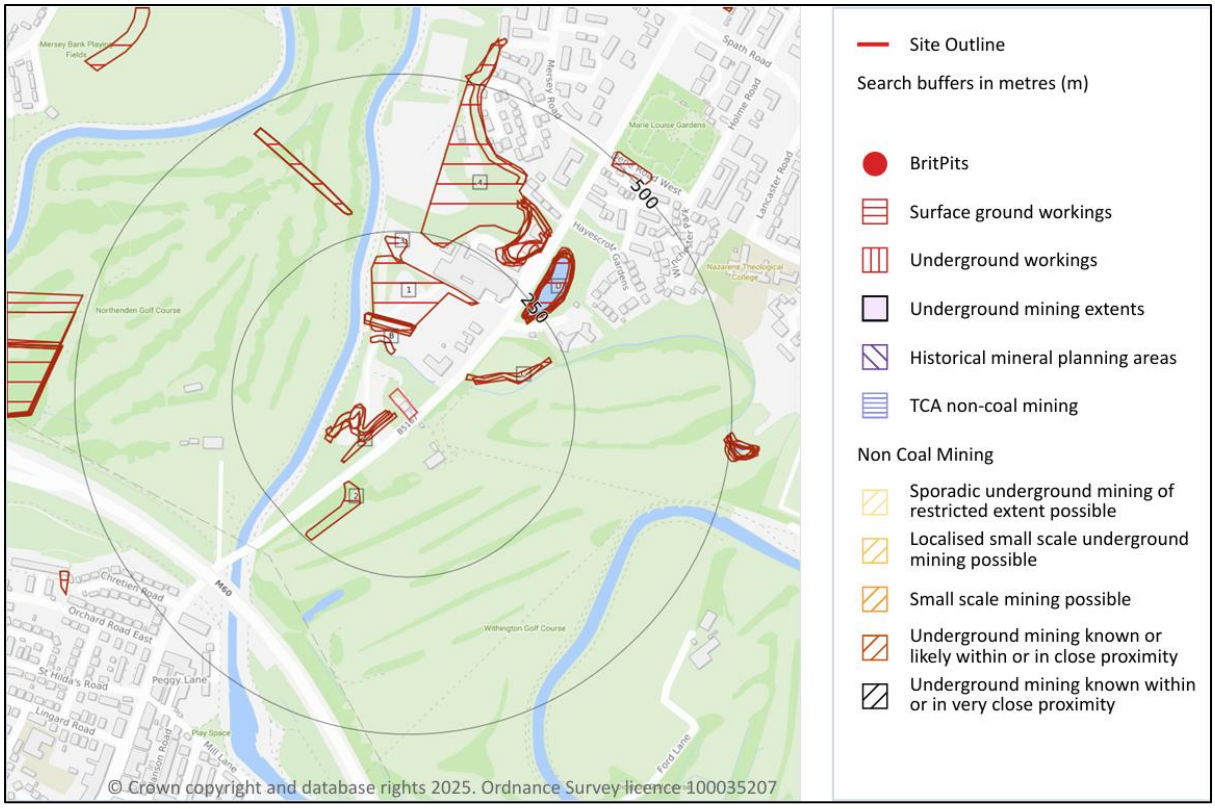
- Shrink / swell clays: Very Low
- Running sands: Low
- Compressible deposits: Moderate
- Collapsible deposits: Negligible
- Landslides: Very Low
- Ground dissolution of soluble rocks: Negligible

4.3 Ground Workings

According to BGS, there are no records of British Pits within 500m of the site.

There are 27no. records of historical surface ground working features identified within 250m of the site boundary. The closest record refers to unspecified ground workings located 11m southwest of the site, mapped in 1923. The remaining records refer to further unspecified ground workings, gravel pit, unspecified pits, unspecified heaps and ponds.

Figure 4: Mining & Ground Workings Map



4.4 Mining and Other Underground Workings

Reference to the Coal Authority shows that the site is not located within an identified coal mining area and is therefore not within a Development High Risk Area.

There are no records for non-coal mining areas located within 1km of the site.

There are no areas of gypsum extraction, brine extraction, tin mining, or clay mining within 1km of the site.

There are no records for non-coal cavities identified within 1km of the site.

There are no records of natural cavities identified within 1km of the site.

There are no records for historical underground working features identified within 1km of the site.

4.5 Radon Potential

The site is not located in a Radon Affected Area as less than 1% of properties above the Action Level. Therefore, radon measures are not required.

4.6 Hydrogeology and Hydrology

The site is recorded to be underlain by superficial deposits of Alluvium, and has been assigned Secondary A aquifer designation with an intergranular flow type and a very low to high permeability. The BGS states the following:

> ***Secondary A*** '*Permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers.'*

The site is recorded to be underlain by bedrock of the Wilmslow Sandstone Formation, and has been assigned a Principal aquifer designation with an intergranular flow type and a high permeability. The BGS states the following.

> ***Principal*** '*Geology of high intergranular and/or fracture permeability, usually providing a high level of water storage and may support water supply/river base flow on a strategic scale. Generally principal aquifers were previously major aquifers.'*

The groundwater vulnerability and soil leaching potential of the site has been classified as high vulnerability for the superficial geology and medium for the bedrock geology vulnerability. The soil leaching potential of the site is classified as high. The BGS states:

> ***'High'*** *Areas able to easily transmit pollution to groundwater. They are likely to be characterised by high leaching soils and the absence of low permeability superficial deposits.*
>
> ***'Medium'*** *Intermediate between high and low vulnerability.*

There are 6no. groundwater abstraction licence records within 2km of the site. The closest record refers to an active licence for spray irrigation- direct, located 581m southeast.

There are 2no. surface water abstraction licence records within 2km of the site. Both records refer to historical licenses for general washing/ process washing and dust suppression, located 823m west of the site.

There are no potable abstraction license records within 2km of the site.

The site is not located within a groundwater Source Protection Zone.

The site is not located within a Source Protection Zone with a confined aquifer.

There are 9no. water network entries within 250m of the site. The closest record refers to Fielden Park Brook, an inland river not influenced by normal tidal action, on the ground surface, located 42m northeast of the site.

There are 4no. surface water features within 250m of the site.

There is 1no. record of a Water Framework Directive (WFD) surface water body catchment located on site. The record refers to the Bollin Dean Mersey Upper operational catchment in the Mersey Upper management catchment.

There is 1no. record of a WFD surface water body located within 500m of the site. The record refers to the River Mersey (upstream of Manchester Ship Canal) located 90m northwest of the site. The water body received a fail chemical rating and a moderate ecological rating in 2019.

There is 1no. record of a WFD groundwater body located on site. The record refers to the Manchester and East Cheshire Permo-Triassic Sandstone Aquifers. The water body received a poor chemical rating in 2019.

4.7 Landfill and Waste Management Activity

There are no records for the current Environment Agency/Natural Resource Wales landfill records within 500m of the site.

There are no records of BGS/DoE non-operational landfill sites within 500m of the site.

There are no records of historical landfill sites from the Local Authority and Historical Mapping Records within 500m of the site.

There is 1no. record of a historic Environment Agency/Natural Resource Wales landfill site within 500m of the site. The record refers to a landfill accepting inert industrial, commercial, household, liquid sludge waste located 445m west.

There are no records of historical waste sites from the Local Authority and Historical Mapping Records within 500m of the site.

There are no records of current Environment Agency/Natural Resources Wales licensed waste sites within 500m of the site.

There are 2no. records of waste treatment, transfer, or disposal sites within 500m of the site. The ten closest records refer to treating waste exemptions and using waste exemptions, non-agricultural waste only, located 295m west of the site.

4.8 Industrial Land Use Information

There are 20no. records of potentially contaminative historical land uses identified within 500m of the site. The closest 3no. records refer to an unspecified ground workings, located 11 - 18m southwest of the site, dated between 1923 - 1981. Other records in the vicinity refer to unspecified heaps and pits, gravel pits, a tunnel, and further unspecified ground workings.

There are 3no. records of historical tanks identified within 500m of the site. All records refer to an unspecified tank located between 336-457m west and northeast, dated 1982-1992.

There is 1no. records of historical energy features identified within 500m of the site. The record refers to an electricity substation located 97m northeast, dated 1989-1992.

There are no records of historical petrol or fuel sites within 500m of the site.

There are 9no. historical garage and motor vehicle repair site records identified within 500m of the site. The closest 3no. records refer to a garage located 288-290m northeast, dated 1964-1994.

There is 1no. record of current potentially contaminative land uses identified within 250m of the site. The record refers to an electricity substation located 104m northeast.

There is 1no. record of a National Geographic Database (NGD) current or recent tank within 250m of the site. The record refers to a roofed storage tank for commercial use, located 105m south of the site, dated 18/04/2014.

There is 1no. record for current petrol or fuel sites within 500m of the site. The record refers to an obsolete petrol station located 475m southwest.

There are no National Grid high voltage underground electricity transmission cables within 500m of the site.

There are no National Grid high-pressure gas transmission pipelines within 500m of the site.

There are no records of historical railway and tunnel features identified within 250m of the site.

There are no historical railway lines identified within 250m of the site.

There are no records of current active railway line records identified within 250m of the site.

There are no underground railway lines or tunnels identified within 250m of the site.

The site is within 500m of the route of the High Speed 2 rail project. The closest record refers to a proposed tunnel located 43m southeast and a proposed tunnel located 172m northwest. These tunnels were part of the original HS2 proposals but are no longer progressing.

The site is not within 500m of the route of the Crossrail 1 rail project.

4.9 Environmental Permits, Incidents and Registers

The Groundsure Report includes records of environmental permits, incidents, and registers within 500m of the site, which are summarised in Table 1 below

Table 1: Environmental Permits, Incidents and Registers within 500m of the site

Permit/Incident/Register	Number	Nearest Record
Sites determined as Contaminated Land (Part 2a Register)	0	N/A
Control of Major Accident Hazards (COMAH)	0	N/A
Regulated explosive sites	0	N/A
Hazardous substance storage/usage	0	N/A
Historical Licensed Industrial Activities (IPC)	0	N/A
Licensed industrial activities (Part A(1)	0	N/A
Licensed pollutant release (Part A(2)/B)	0	N/A
Radioactive Substance Authorisation	0	N/A
Licensed Discharges to controlled waters	1	453m southwest
Pollutant release to surface waters (Red List)	0	N/A
Pollutant release to public sewer	0	N/A
List 1 Dangerous Substances (European Directive E 2006/11/EC)	0	N/A
List 2 Dangerous Substances (European Directive E 2006/11/EC)	0	N/A
Pollution Incidents (EA/NRW)	4	468m northeast
Pollution inventory substances	0	N/A
Pollution inventory waste transfers	0	N/A

Pollution inventory radioactive waste	0	N/A

There is 1no. record of a licensed discharge to controlled waters within 500m of the site. The record refers to a permit surrendered under EPR 2010 for trade discharges- site drainage from the River Mersey, located 453m southwest of the site.

There are 4no. records of pollution incidents (EA/NRW) within 500m of the site. The closest 3no. records refer to a category 3 (minor) land impact caused by inert materials and wastes, located 468m northeast.

There are no further records of Environmental Permits, Incidents and Registers within 500m of the site.

4.10 Environmentally Sensitive Sites

There are no records of a Site of Special Scientific Interest (SSSI) within 2km of the site.

There are 5no. records of Local Nature Reserves (LNR) located within 2km of the site. The closest record refers to Kenworthy Woods located 930m west.

There are 2no. records of Designated Ancient Woodland located within 2km of the site. The closest record refers to the ancient and semi-natural woodland Black Field Wood located 1709m southwest. The second record refers to Round's wood located 1768m southwest.

There are 3no. records of Green Belts located within 2km of the site, including 1no. on-site record. All records refer to the Merseyside and Greater Manchester Green Belt. The 2no. off-site records are located both 1661m southeast and 1767m northwest.

The site is located within an SSSI Impact Risk Zone.

There are no other records of environmentally sensitive sites within 2km of the site.

4.11 Ecology

An ecological assessment of the site falls outside the brief of this report. Where considered necessary, advice should be sought from an ecological specialist in this respect.

However, the site is classified as non-agricultural land. However, the land 5m northeast is classified as urban.

There is 1no. record of open access land within 250m of the site. The record refers to Northenden Golf Club located 68m northwest.

There is 1no. record of a tree felling license located within 250m of the site. The record refers to a selective fell/ thin (unconditional) located 211m west, dated 18/05/2016.

4.12 Archaeology

An archaeological assessment falls outside the brief of this report. Where considered necessary, advice should be sought from an archaeological specialist in this respect.

However, there are no records of World Heritage Sites, Listed Buildings, Conservation Areas, or Scheduled Ancient Monuments within 250m of the site.

4.13 Potential Flood Risks

Detailed assessment of flood risk is outside the scope of this report. However, reference to Environment Agency records indicates that the site lies within a Zone 3 Flood Zone.

There are 12no. records of flooding from rivers and sea (RoFRaS) on site or within 50m of the site. The risk of flooding from rivers and sea (RoFRaS) on site is classified as high.

There are 4no. records of historical flood events within 250m of the site. The closest 2no. records refer to the Mersey (1964) and Didsbury (2021) fluvial floods located on site.

There are 4no. records of flood defences located within 250m of the site. All records are dated 2022 and are located 28 - 99m northeast and northwest.

There is 1no. records of areas benefitting from flood defences within 250m of the site. The record is located 110m northwest of the site.

There is 1no. record of areas used for flood storage located 7m northeast of the site.

The highest risk of surface water flooding occurring on-site for a 1 in 30-year return event is, 0.3m - 1.0m.

The highest risk of groundwater flooding occurring on-site is moderate. The highest risk of groundwater flooding occurring within 50m of the site is high.

4.14 Site History

The historical development of the site has been determined by reference historical plans and Google Earth imagery. The reviewed historical plans comprise only readily available records and may be limited; however, the information available to date indicates that additional searches are unlikely to add to our understanding of the site. The earliest available historical mapping covering the site dates to 1849.

The site history of the site is summarised in Table 2, below, followed by selected extracts from maps and aerial photographs.

Table 2: Summary of Site History

Date	Scale	On-Site History	Surrounding Land Use History
1849	1:10,560	The site comprises a vacant plot of undeveloped, agricultural land. A footpath is recorded to run through the centre of the centre of the site, however this footpath is recorded to be adjacent to the site on subsequent maps, and it is therefore assumed that this map is slightly misaligned.	The site is surrounded by vacant, undeveloped land, with patches of woodland and an orchard to the northeast. The River Mersey is located approximately 90m northwest of the site. The 'onsite' footpath continues to the northwest and southeast. A tunnel is recorded 500m north of the site, assumed to run under the Mersey.
1881	1:2,500	A row of trees are located along the southeast boundary of the site, lining Palatine Road. A small slope is recorded along the southeast boundary which continues for	Palatine Road is located directly south of the site running northeast-southwest. Gravel pit located approximately 150m northeast. Fish pond located approximately 250m northeast. A residential property is located directly east of the site with an associated orchard to the north.

Date	Scale	On-Site History	Surrounding Land Use History
		the length of Palatine Road, suggesting the road is slightly raised.	A brook, running roughly east to west, is located approximately 50m northeast and is assumed to connect to the Mersey approximately 100m northwest of the site. Residential properties are located both approximately 150m northeast and southwest. Northenden Bridge located approximately 300m southwest.
1894	1:2,500	There is no significant change compared to the previous map.	Further residential dwellings are located approximately 80 - 170m northeast.
1905 1907 1910 1907-1911 1916	1:10,560 1:2,500	The land has been separated into two parcels of land by a boundary. The southeast half of the site appears to have been raised to the level of the embanked Palatine Road.	Fielden Park is located approximately 400m northwest of the site. The previously undeveloped land to the south of Palatine Road is now recorded as a golf course. By 1916, the area northwest of the Mersey is recorded as a golf course.
1922 1923	1:2,500 1:10,560	There is no significant change compared to the previous map.	A glasshouse is located approximately 200m southwest of the site.
1934-1938 1935	1:10,560 1:2,500	There is no significant change compared to the previous map.	The open area to the west of the site also appears to have been raised, with a scree mound located approximately 60m west of the site. Open land and nearby golf courses are now marked as areas 'liable to floods'. The glasshouse to the southwest is now recorded as a nursery.
1954-1955 1955 1956	1:10,560 1:1,250 1:2,500	The on site slope/ level change is no longer recorded.	The scree mound to the west of the site is now recorded only as a slope.
1966- 1967	1:10,560	There is no significant change compared to the previous map.	There is no significant change compared to the previous map.
1976-1977 1977-1981	1:1,250 1:10,000	A residential property is now recorded on site.	Slight residential development approximately 250m northeast. A motorway is now located approximately 450m southwest of the site.
1988-1989	1:10,000	There is no significant change compared to the previous map.	The slopes and elevation changes previously marked to the west of the site are no longer recorded. A hotel is located approximately 250m northeast.
1989-1992	1:1,250	There is no significant change compared to the previous map.	An access road has been developed approximately 50m west of the site, which continues north to the now labelled 'Ringway Hotel'. An electrical substation is located 100m northeast of the site.
2001	1:10,000	There is no significant change compared to the previous map.	There is no significant change compared to the previous map.
2010	1:10,000	There is no significant change compared to the previous map.	There is no significant change compared to the previous map.
2025	1:10,000	There is no significant change compared to the previous map.	There is no significant change compared to the previous map.

Table 3: Summary of Site History from Aerial Photographs

Date	On-Site History	Surrounding Land Use History
2000	The area features a mix of hard and soft surfaces. A large house with a paved driveway sits centrally south, with a large car port in the southeast corner of the site. The remainder of the site consists of grassy land with scattered vegetation. Trees line all of the boundaries.	Residential properties lie to the northeast of the site, while the River Mersey is located to the west. To the south, a car park and a club house associated with the adjacent golf course to the southeast are present, with ongoing expansion evident in the parking area. Another golf course is situated across the river to the northwest, accompanied by an additional car park to the north. The surrounding landscape features scattered tree coverage, and a road runs directly south of the site, providing access.
2009	Toward the northwest, there appears to be another smaller structure that looks garden-related possibly a shed.	The expansion of the car park in the southeast corner is now complete.
2015	There is no significant change compared to the previous photograph.	There is no significant change compared to the previous photograph.
2019	There is no significant change compared to the previous photograph.	There is no significant change compared to the previous photograph.
2023	There is no significant change compared to the previous photograph.	The car park previously located to the north appears to in the process of being repurposed.

To summarise, from the start of available historical mapping in 1849, the site was part of a larger undeveloped plot of land until the mid-1970's. During this time, it is recorded that the site underwent elevation changes, with the embankment on which the adjacent Palatine Road was situated extended further north, across the site.

By the mid-1950's, this elevation change was no longer recorded, suggesting the area may have been levelled or the slope made more gradual. The existing property on-site was constructed in the mid 1970's, with aerial imaging suggesting the existing car port was developed prior to 2003. The site boundary is recorded to be surrounded by dense, developed vegetation and trees, with the site undergoing minimal change since its initial development.

The area surrounding the site was historically occupied by undeveloped, agricultural land, with the River Mersey located northwest and a brook connecting to the Mersey to the north.

The land northeast of the site was gradually developed for residential use through the early 1900's, with the land south of Palatine Road developed into a golf course.

During the 1930's, the land directly west of the site underwent elevation changes, similar to the site, with a scree mound recorded between 1934 - 1938.

An access road was developed in the land west of the site in the late 1980's, connecting to the hotel northeast of the site.

Figure 5: Ordnance Survey Map Extract 1881

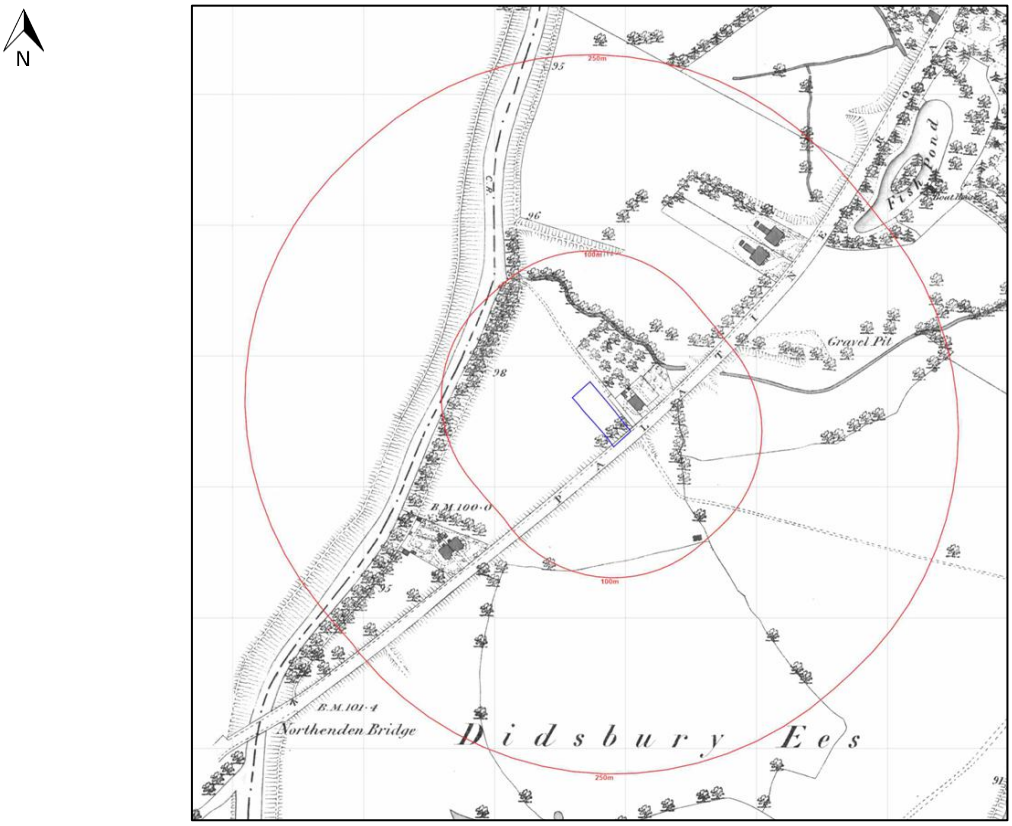


Figure 6: Ordnance Survey Map Extract 1935

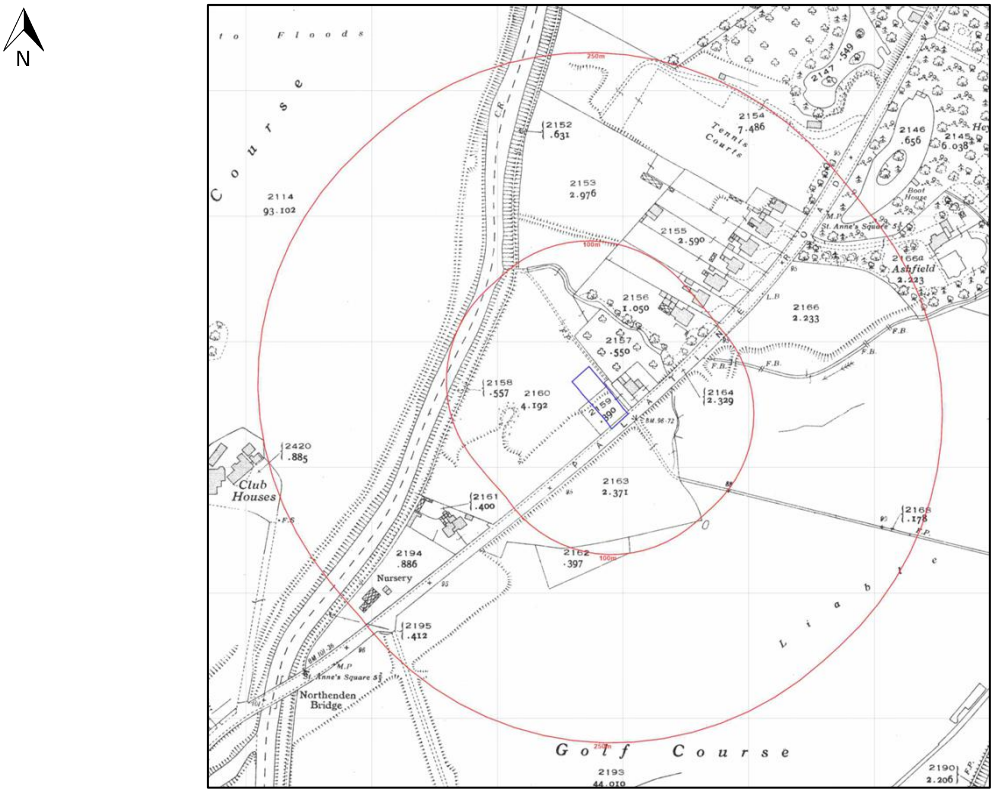


Figure 7: Ordnance Survey Map Extract 1966-1967

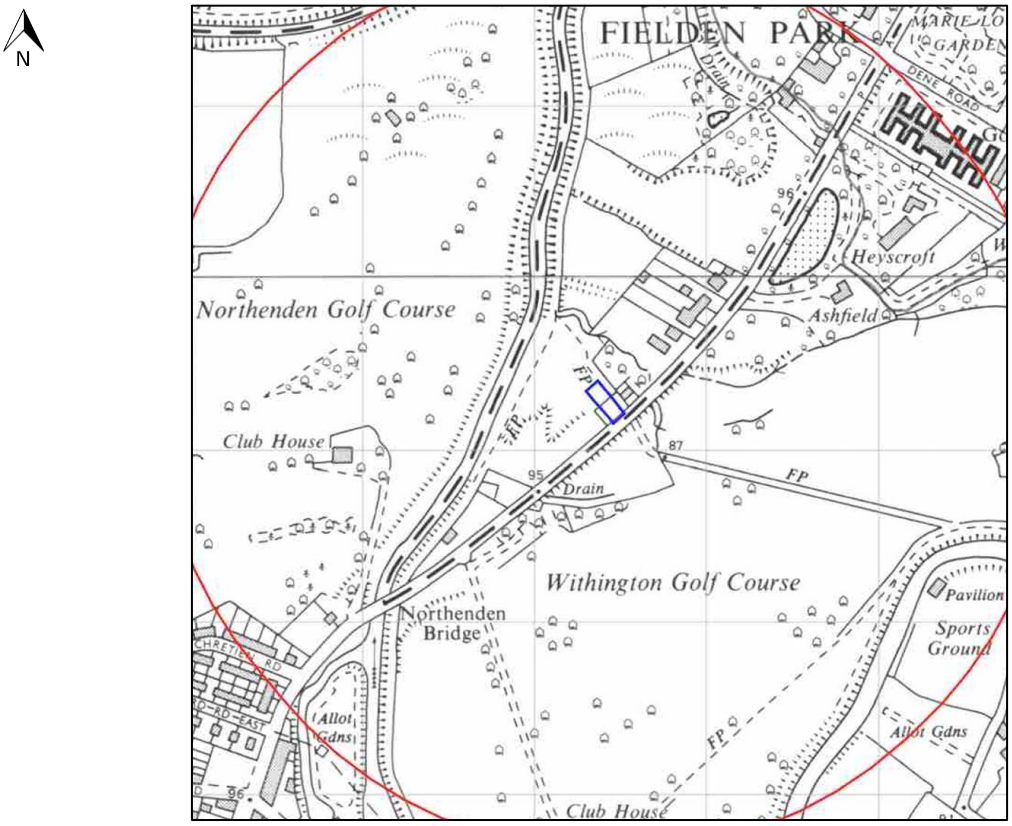


Figure 8: Ordnance Survey Map Extract 1988-1989

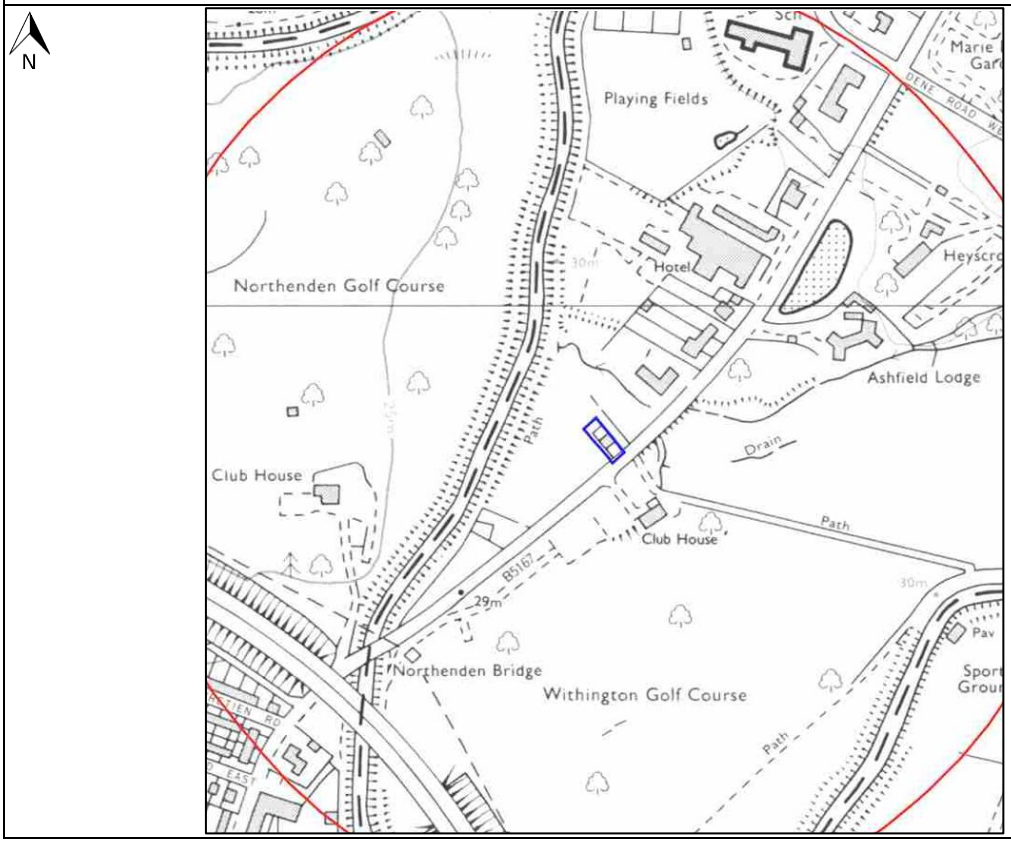


Figure 9: Aerial Photograph 2005

Figure 10: Aerial Photograph 2023

5.0 PRELIMINARY CONTAMINATION RISK ASSESSMENT

5.1 Introduction

The following paragraphs outline a Preliminary Risk Assessment (PRA) for the site based on the above desk study information as defined by Land Contamination Risk Management Environment Agency, July 2023.

Table 6 provides a Preliminary Conceptual Model (PCM) which considers the source-pathway-receptor linkages present alongside the likelihood, severity and risk level as defined within Table 4 and Table 5 below. The assessment of probability, a modified risk table, and certain consequence definitions are based on CIRIA C552 and Land Contamination Risk Management Environment Agency, July 2023.

Table 6 considers whether a pollution linkage is potentially present and provides a preliminary qualitative assessment of risk based on the information currently available. Where a possible linkage is identified, it does not necessarily mean that a significant risk exists but indicates that further information is required through appropriate site investigation to substantiate the conceptual model.

The PCM/PRA is based on a continued residential end use.

Table 4: Consequence, Probability and Risk

Probability	Consequence,	Risk
High Likelihood- There is a pollution linkage and an event either appears very likely in the short term and almost inevitable over the long term, or there is evidence at the receptor of harm or pollution	Very High – acute risk to the human health likely to result in significant harm. Risk of severe or irreversible effect on ground/surface water quality. Catastrophic damage to buildings / property.	Very High – there is a high potential that the source-pathway-receptor scenarios may give rise to harm to human health, or the environment and remedial action is likely to be required.
Likely – there is a pollution linkage, and all the elements are present, which means that it is probable an event will occur. Circumstances are such that an event is not inevitable, but possible in the short term and likely over the long term.	High – Severe or irreversible effect on human health. Temporary severe or irreversible effect on ground/surface water quality. Reduction of water quality rendering groundwater or surface water unfit to drink and/or substantial adverse impact on groundwater dependant environmental receptors.	High – it is likely that the source-pathway-receptor scenarios may give rise to an impact on human health or the environment, which may require remediation and/or control measures to mitigate risks
Low likelihood– there is a pollutant linkage, and circumstances are possible for an event could occur. However, it is by no means certain that even over a longer period such event would take place, and is less likely in the shorter term	Moderate – Long term or short-term moderate effect on human health. Moderate effect on ground/surface water quality, reversible with time. Reduced reliability of a supply at a groundwater or surface water abstraction source	Moderate – it is possible that the source-pathway-receptor scenarios may give rise to an impact on human health or the environment, however it is either relatively unlikely that such would be severe, or if any harm were to occur it is more likely that harm would be mild.
Unlikely – there is a pollution linkage, but circumstances are such that it is doubtful that an event would occur even in the very long term.	Low – Non-permanent health effects to human health (easily prevented by means such as personal protective clothing etc.) Slight effect on ground/surface water quality, reversible with time. Marginal reduced reliability of a supply at a groundwater or surface water abstraction source.	Low – it is possible that harm could arise at the source, however it is likely that this would at worst be mild.
		Very Low – it is unlikely that the source-pathway-receptor scenarios will give rise to an impact on human health or the environment.

Table 5: Estimation of Level of Risk by Comparison of Consequence and Probability

		Consequence			
		High	**Moderate**	**Low**	**Very low**
Probability	**High Likelihood**	Very High	High risk	Moderate risk	Moderate to low risk
	Likely	High risk	Moderate risk	Moderate to low risk	Low risk
	Low Likelihood	Moderate risk	Moderate to low risk	Low risk	Very low risk
	Unlikely	Moderate to low risk	Low risk	Very low risk	Very low risk

5.2 Potential Sources

There is therefore a limited potential for contamination due to the low frequency of on and offsite development.

Due to the age of the main building on-site, there is the potential that asbestos containing materials have been used in its construction, however it should be noted that no ACM was observed during the site walkover.

There is also the possibility of ground gas associated with potentially deep made ground where the elevation of the site has changed over time. However, for the purpose of this assessment, the age of any potential made ground must be considered, as it is likely to have substantially degassed.

5.3 Potential Receptors

The following receptors have been considered for the construction and operational stages of the proposed development.

- Current site users.
- Adjacent land users.
- Future land users.
- Construction workers during site development works.
- Surface water and Groundwater within the underlying aquifer

5.4 Potential Pathways

The following pathways have been considered for the construction and operational stages of the proposed development.

- Dermal contact, ingestion, inhalation pathways of potentially contaminated soils.
- Downward vertical migration of leachate to surface waters and shallow groundwater.
- Vertical or lateral migration of ground gas.

Table 6: Preliminary Conceptual Model and Risk Assessment

Source	Pathway	Receptor	Probability	Consequence	Risk	Comment
Potential soil contamination E.g., Heavy Metals, PAH, and ACM	Dermal contact, ingestion, and inhalation of soils dust	Current Site Users	Unlikely	Moderate	Low	The site currently comprises a vacant property, therefore there is no receptor to be exposed to potentially contaminated soils. The risk rating is assessed as **LOW**.
		Adjacent land users	Low Likelihood	Moderate	Moderate to Low	The site is directly surrounded by undeveloped land with a golf club to the south. Although it is anticipated that made ground will be present below the site, at this stage no significant contamination sources have been identified. The risk is considered **MODERATE to LOW,** until ground conditions confirmed**.** Usual dust control measures should be implemented as part of good site working practices during construction to reduce dust generation.
		Future land users	Low Likelihood	Moderate	Moderate to Low	The proposed development consists of replacing the existing building at Palatine Road on a slightly larger footprint. Again, although it is anticipated that made ground will be present below the site, at this stage no significant contamination sources have been identified. The risk to future site users via direct exposure is considered to be **MODERATE to LOW** until ground conditions confirmed.
		Construction Workers	Unlikely	Moderate	Low	Construction workers may be exposed to potentially contaminated soils during construction works, however exposure duration will be short-term only. The risk to construction workers is considered **LOW.** Appropriate health and safety measures (in line with CDM and other relevant health and safety guidance) should be adhered to.
	Downward vertical migration of leachate to shallow groundwater	Groundwater within the Underlying Aquifer	Unlikely	Moderate	Low	The site is underlain by superficial deposits of alluvium with high groundwater vulnerability and a high soil leaching potential, indicating a capacity for pollution transmission to underlying aquifers. The underlying Wilmslow Sandstone Formation bedrock is classified as a principal aquifer with high permeability. However, no significant contamination sources have been identified on-site, and the historical land use suggests limited potential

Source	Pathway	Receptor	Probability	Consequence	Risk	Comment
						for leachable pollutants. Given these factors, the risk of downward leachate migration to shallow groundwater is assessed as **LOW**.
	Lateral migration in surface waters	Surface water	Unlikely	Moderate	Low	Several surface water features lie close to the site, including a river 42m northeast and the River Mersey 90m northwest. The Mersey is recorded to have a poor water quality. No significant contamination sources have been identified on-site. Given the limited development and absence of leachable pollutants, the risk of lateral migration to nearby surface waters is considered **LOW**.
	Vertical or lateral migration of ground gas	Current Site Users	Unlikely	Moderate	Low	The site is currently a vacant property. The risk is therefore considered to be **LOW.**
		Adjacent land users	Unlikely	Moderate	Low	The site is directly surrounded by undeveloped land, with a golf club located to the south. Due to the absence of significant adjacent receptors, the risk of lateral migration of ground gas to adjacent land users is considered **LOW**.
		Future land users	Likely	Moderate	Moderate	The proposed development consists of replacing the existing building at Palatine Road. The site and surrounding area are recorded to have undergone elevation changes between the early 1900's until the late 1980's in some areas. Both the anticipated made ground associated with elevation changes, and the underlying alluvium deposits have the potential to be ground gas generating. The risk to future site users is **MODERATE,** until ground conditions have been confirmed.
		Construction Workers	Unlikely	Moderate	Low	Construction workers may be exposed to ground gas/depleted oxygen conditions in confined spaces and excavations; however, the duration will be short term. The risk to construction workers from ground gas is considered **LOW.**
Asbestos Containing Material (ACM)		Current Site Users	Unlikely	Moderate	Low	The site is currently a vacant property and asbestos is only harmful when disturbed. Therefore the risk to current site users is considered to be **LOW.**
		Adjacent land users	Low Likelihood	Moderate	Moderate to Low	The site is directly surrounded by undeveloped land, with a golf club located to the south. Due to the age of the property, there is the potential for asbestos to be present within its structure, although no evidence of ACM was identified on site.

Source	Pathway	Receptor	Probability	Consequence	Risk	Comment
						Disturbance of soil during the construction phase may allow any potential fibres to become airborne. Dust control measures (dampening down) should be implemented as part of good site working practices. The risk is to adjacent site users considered **MODERATE to LOW**, until ground conditions are confirmed. A pre-demolition asbestos survey of the property is recommended.
		Future land users	Low Likelihood	Moderate	Moderate to Low	The proposed development consists of replacing the existing building at Palatine Road. Due to the age of the property, there is the potential for asbestos to be present within its structure, although no evidence of ACM was identified on site. The risk to future site users is therefore considered **MODERATE to LOW,** until ground conditions are confirmed.
		Construction Workers	Low Likelihood	Moderate	Moderate to Low	There is a low potential for ACMs to be present in soils at the site. Disturbance of soil during the construction phase may allow fibres to become airborne. The risk is therefore considered **MODERATE to LOW.** Dust control measures (dampening down) should be implemented as part of good site working practices to reduce the risk to **LOW**.

6.0 GEOTECHNICAL HAZARDS ASSOCIATED WITH THE DEVELOPMENT

In addition to the environmental hazards there are also geotechnical hazards associated with the stability of the ground including load bearing capacity, slope stability and effects of ground mining activities.

Local Authorities follow NPPF (2012) which requires that a site be suitable for its new use considering of ground conditions and land instability, including from natural hazards to former activities such as mining.

A summary of the geotechnical considerations is provided below in Table 7.

Table 7: Summary of Geotechnical Hazards

Geohazards:	
Highly Compressible Ground	Moderate risk
Collapsible Soils	Negligible risk
Swelling Clay	Very low risk
Running Sand	Low risk
Ground Dissolution	Negligible risk
Landslip	Very low risk
Mining & Quarrying	The site is not located within an identified coal mining area and is therefore not within a Development High Risk Area. There are no records of underground mining or quarrying within 250m of the site.
Geotechnical Design Considerations	
Site Clearance	Prior to any development on-site, the Himalayan Balsam identified across the site would require removal. Aside from the removal of the existing structures and hardstanding (patio) to the rear of the property, no significant site clearance is likely to be required.
Trees	Mature trees are present along the northern site boundaries.
Existing Buildings/Obstructions	A large residential property is situated in the central southern portion of the site. An additional structure (car port) is located in the southeastern corner. The garden area contains another structure to the northwest and features a pond.
Foundations	The depth and type of proposed foundations would depend on the ground conditions present on site. An intrusive ground investigation is recommended prior to any construction works taking place to discover the most suitable foundation options for the site.

Geotechnical Design Considerations	
Floor Slabs	An intrusive geotechnical investigation is recommended prior to any construction works to discover the most suitable floor slab design for the on-site ground conditions.
Groundwater	Exact groundwater conditions are not known at this stage. However, records indicate that the site is underlain by superficial deposits of Alluvium, comprising clay, silt, and gravel, which form a Secondary Undifferentiated Aquifer. Beneath this, the bedrock consists of the Wilmslow Sandstone Formation, classified as a Principal Aquifer. The highest risk of groundwater flooding on site is recorded as moderate, with flooding risk increasing to high within 50m of the site.
Earthworks	The proposed development area is generally flat and level. Significant earthworks are not likely to be required at the site.
Slopes	The site has a generally flat and level, however the surrounding area is noted to slope away from the site.
Retaining Walls	There are no retaining walls present on site.
Chemically aggressive ground conditions	Chemically aggressive grounds are not anticipated beneath the site. Again, an intrusive investigation is recommended.

7.0 SITE INVESTIGATION

7.1 Exploratory Fieldwork

The fieldwork was carried out by EEG on the 3rd and 4th July 2025 which comprised:

- Two window sample boreholes (designated WS01 & WS02) were each sunk to a maximum depth of 8.00m existing ground level. Both boreholes were drilled with the intention of reaching 10.00m bgl, however were terminated early due to borehole collapse between 7.00m - 8.00m bgl.
- Window sampler boring is carried out with a small, track-mounted rig, which uses a chain-driven trip hammer to drive sampling tubes or penetrometers into the ground. These tools are coupled to the anvil of the hammer by solid drill rods. Sampling tubes comprise "windowless samplers," which are plain sampler tubes in which a continuous disturbed sample is recovered within a semi-rigid plastic liner. To reduce friction within the borehole, sampling tubes of progressively smaller diameter are used as the borehole depth increases. Sampler diameters generally range from between approximately 90mm to 50mm. Standard Penetration Tests (SPTs) were undertaken in the boreholes in accordance with BS EN ISO 22476-3. Groundwater observations were noted where possible. These observations relate to the time of the investigation only, and do not necessarily reflect seasonal fluctuations. Exploratory hole logs are included in Appendix 2.
- Upon completion, following dynamic probe testing was conducted to a maximum depth of 10.00m bgl. Results of the tests are presented in Appendix 3.

Exploratory hole locations were selected prior to the investigation by an EEG engineer based on the proposed development layout and avoiding known services. Each exploratory location was scanned using a Cable Avoidance Tool (CAT) in order to locate unrecorded underground services, and the exploratory locations were repositioned if necessary.

On completion, samples recovered from the site were taken to specialist laboratories for geotechnical testing.

All site investigation work was supervised full time by a representative of EEG. The logging of soils and rocks has been carried out in accordance with BS5930(2015+A1:2020) except where superseded by the soil and rock description methodology in BS EN14688-1(2002), BS EN 14688-2(2004) and BS EN 14689-1(2003).

All sampling locations were surveyed by use of a hand-held Trimble GeoXH GPS instrument that is capable of surveying to an accuracy of less than 10mm depending on satellite coverage, proximity to trees and building structures.

The descriptive terminologies such as firm, etc formerly used within older versions of BS5930 to describe strength now solely relate to consistency. Shear strength is now defined related to results obtained in the field (using a hand vane for example) or in the laboratory (from triaxial tests), as detailed in Table 8 below.

Table 8: Shear Strength Definitions

Term based on measurement	Undrained Strength (c_u) definition in kN/m² (from BS EN ISO 14688-2: 2004, 5.3, Table 5)
Extremely Low Strength	<10
Very Low Strength	10 to 20
Low Strength	20 to 40
Medium Strength	40 to 75
High Strength	75 to 150
Very High Strength	150 to 300
Extremely High Strength	300 to 600

An Exploratory Hole Location Plan is presented as Figure 11 below.

Figure 11: Exploratory Hole Location Plan

A summary of exploratory holes undertaken during the investigation are presented in Table 9 below.

Table 9: Summary of Exploratory Holes Undertaken

Hole	Type*	Depth (m)	Date Started	Date Finished	Easting (m)	Northing (m)	Backfill Details**
WS01	WS	8.00	03/07/2025	03/07/2025	383477	390864	MW
WS02	WS	8.00	04/07/2025	04/07/2025	383493	390849	MW
*WS = Window Sample Borehole **MW = Monitoring Well							

7.2 Laboratory Testing

7.2.1 *Geotechnical Testing*

A programme of laboratory testing was carried out on samples taken from the various strata to assist in classification and determine the engineering properties of the materials underlying the site. The tests were scheduled by EEG and carried out by Murray Rix and Envirolab (BRE Suite). The test procedures used were generally in accordance with the methods described in BS1377:1990. Details of the specific tests used in each case are given below:

Table 10: Summary of Laboratory Geotechnical Tests Undertaken

TEST	STANDARD	No.
Moisture Content	BS1377:1990 Part 2, Clause 3.2	4
Liquid Limit, Plastic Limit, Plasticity Index	BS1377:1990 Part 2, Clause 4/5	4
Particle size distribution (wet)	BS1377:1990 Part 2, Clause 9.2	2
BRE SD1	BS1377:1990 Part 3, Clause 5	4
pH value	BS1377:1990 Part 3, Clause 9	4

The results of the laboratory geotechnical tests are discussed in Section 9 and included in Appendix 4.

8.0 GROUND CONDITIONS ENCOUNTERED

8.1 Soil Profile Encountered

The BGS states the site is not underlain by artificial deposits or made ground. The site is recorded to be underlain by superficial deposits of Alluvium, comprising of clay silt and gravel. The site is recorded to be underlain by bedrock of the Wilmslow Sandstone Formation, comprising of sandstone. The sequence of strata encountered beneath the site was as follows:

- **Made Ground** was encountered in all exploratory hole locations from ground level to a maximum depth of 2.70m bgl, comprising:
  - Dark brown fine to coarse SAND with varying quantities of clay and gravel of red brick, sandstone and mudstone, and frequent rootlets (TOPSOIL).
  - Black, angular to subangular, fine to coarse GRAVEL of clinker, coal and ash.
  - Reddish brown fine to coarse SAND with gravel of red brick, sandstone, mudstone and coal.
  - Dark brown CLAY with varying quantities of sand and gravel of red brick, sandstone and mudstone

- **Superficial Deposits,** interpreted as Alluvium, were encountered in all exploratory hole locations to a minimum depth of 8.00m bgl, comprising:
  - Very soft to soft CLAY, with varying quantities of silt, sand and gravel of sandstone, mudstone, siltstone, and coal.
  - Loose to very dense SAND, with varying quantities of silt and gravel of sandstone, mudstone, coal, quartz and rare granite.

The depths of the various materials encountered in the exploratory holes are summarised in Table 11 below.

Table 11: Summary of Ground Conditions Encountered

Borehole Location	Depth to Stratum (m bgl)				Groundwater Strike (m bgl)
	Made Ground		Superficial Deposits		
	Granular	Cohesive	Clay	Sand	
WS01	GL - 1.60 1.70 - 2.70	1.60 - 2.70	2.70 - 4.80	4.80 - 8.00	5.00
WS02	GL - 0.60 0.90 - 1.70	0.60 - 0.90	1.70 - 2.10 2.70 - 5.00	2.10 - 2.70 5.00 - 8.00	5.00

8.2 Observable Indications of Contamination

No visual or olfactory signs of contamination were encountered during the fieldwork.

8.3 Obstructions

No man-made obstructions were observed during the fieldwork.

8.4 Groundwater

Groundwater was encountered in all windowless sample boreholes during the fieldwork at a depth of 5.00m bgl within alluvial sands. During the subsequent monitoring visits, groundwater was observed in one of the installed boreholes, between 4.43m - 4.52m bgl (WS01).

9.0 ENGINEERING PROPERTIES OF SOILS ENCOUNTERED

9.1 General

The following sections discuss the engineering properties of the strata encountered, based on results of in situ and laboratory testing obtained during this investigation.

The results of laboratory geotechnical testing are summarised in the following table.

Table 12: Summary of Laboratory Geotechnical Test Results

Location	Depth (m)	Strata*	CLASSIFICATION									STRENGTH	CHEMICAL	
			Moisture Content (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Modified Plasticity Index (%)	PSD Gravel (%)	PSD Sand (%)	PSD Silt (%)	PSD Clay (%)	Shear Strength (kN/m²)	pH Value	Water Soluble Sulphate SO_4 (mg/l)
WS01	0.70	MG	-	-	-	-	-	-	-	-	-	-	8.18	<10
WS01	2.00	MG	-	-	-	-	-	-	-	-	-	-	8.42	<10
WS01	3.20	CLAY	33.9	41	17	24	24	-	-	-	-	-	-	-
WS01	4.00 – 4.45	CLAY	27.4	37	15	22	21	-	-	-	-	-	-	-
WS01	6.50	SAND	-	-	-	-	-	40	56	4		-	-	-
WS02	0.50	MG	-	-	-	-	-	-	-	-	-	-	7.09	<10
WS02	1.50	MG	-	-	-	-	-	-	-	-	-	-	8.12	16
WS02	1.80	CLAY	22.9	43	16	27	27	-	-	-	-	-	-	-
WS02	3.00	CLAY	36.3	43	16	27	27	-	-	-	-	-	-	-
WS02	4.50	CLAY	-	-	-	-	-	0	29	55	16	-	-	-

9.2 Made Ground

Made Ground was encountered in both exploratory boreholes between ground level and a maximum depth of 2.70m bgl in WS01 and 1.70m bgl in WS02.

SPT tests carried out in the made ground resulted in **SPT N values** between 11 and 15, as shown on the SPT v Depth Plot in Figure 12 (overleaf).

The **water-soluble sulphate** content of four made ground samples, tested as part of the BRE Suite, ranged from <10mg/l to 16mg/l SO_4, together with **pH values** of 7.09 to 8.42.

9.3 Superficial Deposits

As discussed in Section 8, superficial material was encountered as variable CLAY and SAND in both exploratory hole locations.

9.3.1 Clay

Clay was encountered in both exploratory hole locations, below the made ground, to a maximum depth of 5.00m bgl.

SPT tests carried out in the clay resulted in **SPT N values** between 2 and 7, as shown on the SPT v Depth Plot in Figure 12 (overleaf). This result suggests the clay is very soft to soft.

Atterberg Limit tests were carried out on four samples of the clay. Results of the test reported **liquid limit** values in the range of 37% to 43% and **plastic limit** values in the range of 15% to 17%, resulting in values of **plasticity index** in the range of 22% to 27%. These results suggest the clay to be of **intermediate plasticity**. Results are shown on the Plasticity Chart in Figure 13, overleaf.

Recommended N values and derived design values for the cohesive soils are summarised in Table 13, below.

Table 13: Summary of Design Parameters (Clay)

Depth	SPT N Value Range	Design N Value*	Equivalent Shear Strength** (kN/m^2)	Coefficient of Volume Compressibility** (mv)
3.00	4 - 7	4.75	23 (Low Strength)	0.43 (High Compressibility)
4.00	2 - 5	2.75	13 (Very Low Strength)	0.74 (High Compressibility)
*Based on lower quartile N value and correlations by Peck Hanson and Thornburn(1974) **Based on correlation by Stroud & Butler (1975)				

It is recommended that for assessing ultimate bearing capacities, where the lower values are critical, the lower quartile value of N values is used. Based on the N Values in the above table, the equivalent shear strength values were between 13 kN/m^2 - 23 kN/m^2.

For design purposes, a value of plasticity index = 27% is recommended, based on the upper quartile value of the results.

The **coefficient of volume compressibility (mv)** has been estimated using the following correlation by Stroud and Butler (1975): for a clay with a plasticity index of 27%, mv = 1 / (0.490 x N value). This correlation gives a value of coefficient of volume compressibility of 0.43 to 0.74m^2/MN, as shown in Table 13, above. The results suggest the clay has a **high compressibility**.

In accordance with NHBC Chapter 4.2 Building Near Trees (2003) soils can be classified in terms of volume change potential, using the relationship:

$$I'_p = I_p \times \frac{\%\ \text{less than } 425\mu m}{100\%}$$

I'_p = modified plasticity index,
I_p = plasticity index.

Based on the laboratory test results, the above relationship and Table 1 of NHBC Chapter 4.2, the samples of clay are shown to have **a medium volume change potential**.

The **Natural Moisture Content** (NMC) and **Liquid Limit** (LL) of the soil can be used to give an indication of **soil desiccation**, i.e., where the NMC is less than 40% of the LL, the soil is inferred to be desiccated, as summarised in Table 14, overleaf.

Table 14: Soil Desiccation Indicators in the Clay

Location	Depth (m)	Liquid Limit (%)	40% Liquid Limit (%)	Natural Moisture Content (%)	Desiccation
WS01	3.20	41	16	33.9	No
WS01	4.00 - 4.45	37	15	27.4	No
WS02	1.80	43	17	22.9	No
WS02	3.00	43	17	36.3	No

The results in the above table show that none of the clay samples tested show evidence of desiccation.

9.3.2 Sand

Variable sand deposits were encountered in both exploratory hole locations, below the clay deposits, between 1.70m and a maximum depth of 5.00m below ground level.

SPT tests carried out in the granular material resulted in **SPT N values** between 4 and 44, as shown on the SPT v Depth Plot in Figure 12 (overleaf). This result suggests the granular material is loose to dense.

Recommended N values and derived design values for the granular soils are summarised in Table 15, below.

Table 15: Summary of Design Parameters (Sand)

Depth	SPT N Value Range	Average N Value	Design N Value*	Equivalent Soil Density	Angle of Internal Friction (degrees)**
2.00	4	4	4	Loose	27.9°
5.00	5 - 21	13	9	Loose	29.6°
6.00	27 - 28	28	27	Medium Dense	35.2°
7.00	34 - 44	39	37	Dense	37.9°
8.00	35 - 42	39	37	Dense	37.9°
*Based on lower quartile N value **Based on the correlation by Peck, Hanson and Thornburn(1974)					

For assessing settlements average ground conditions will give a more realistic value of settlements, and the average of N values should be used.

Figure 12: SPT N v Depth Plot

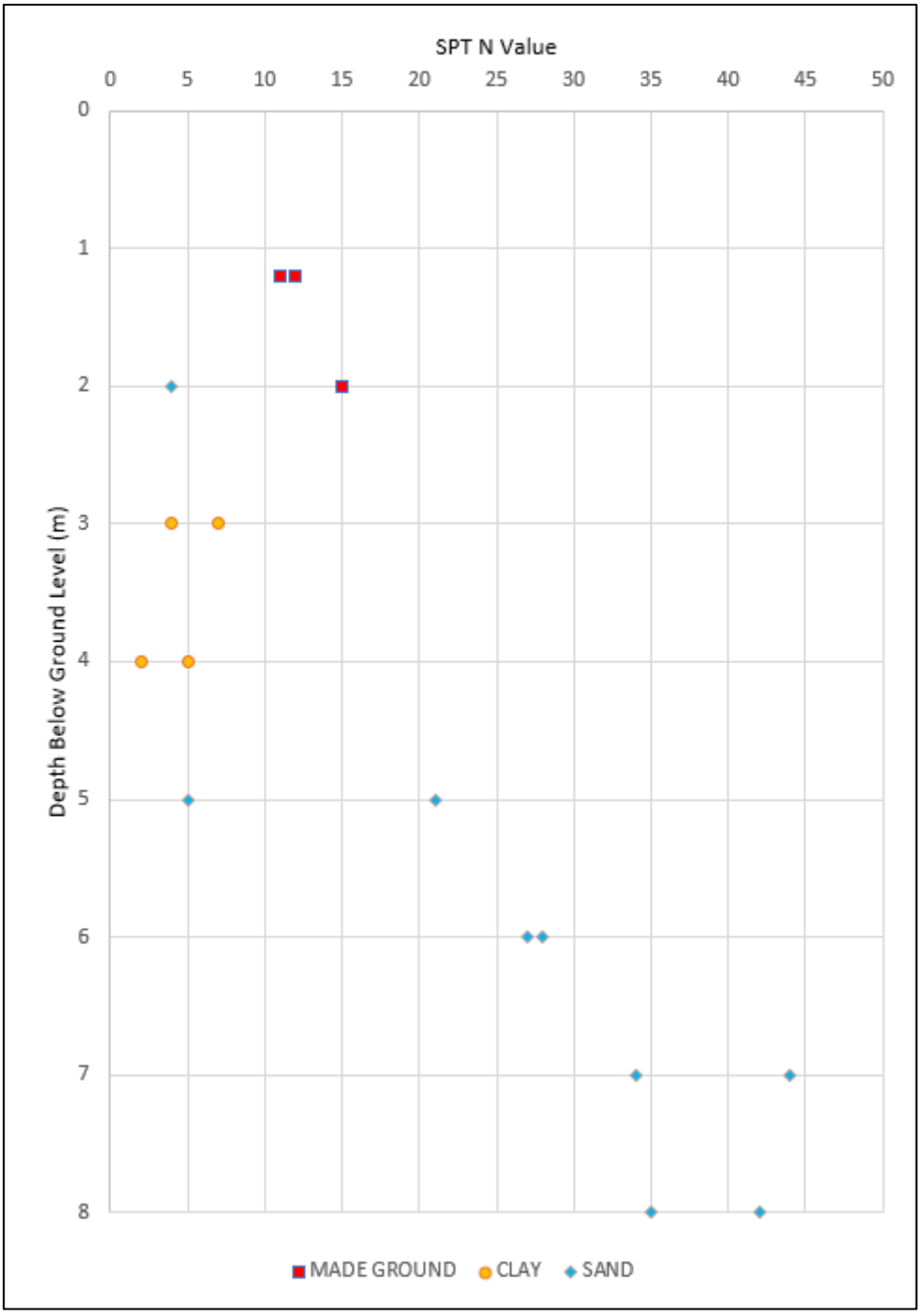
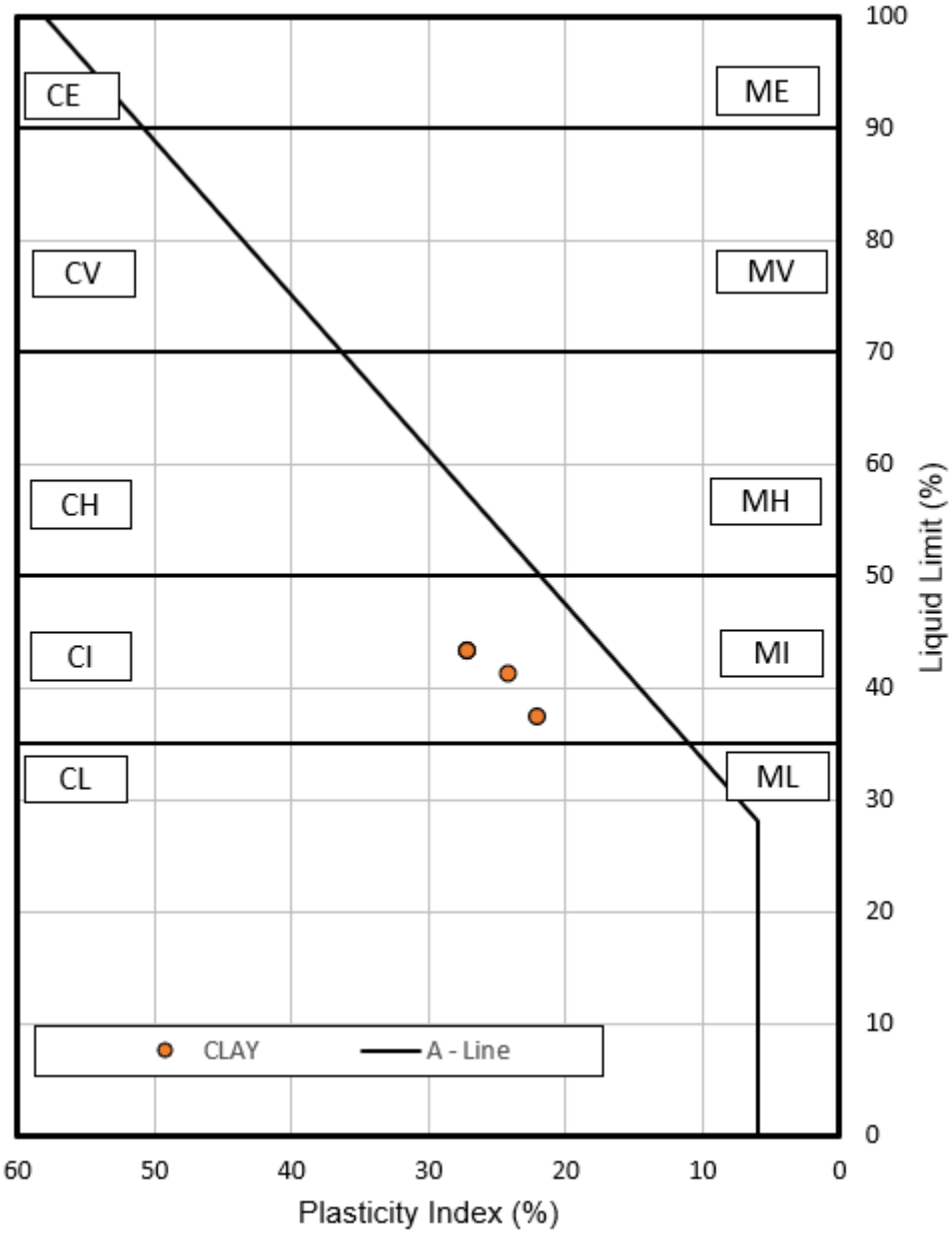


Figure 13: Plasticity Chart



10.0 GEOTECHNICAL ASSESSMENT

10.1 Proposed Development

It is understood that the Client intends to demolish all existing structures on-site and construct a new residential property on a similar footprint.

Detailed information regarding structural loadings and proposed foundation type was not available at the time of authoring this report.

10.2 Ground Conditions Encountered

The exploratory holes generally encountered made ground (up to 2.70m bgl) overlying superficial deposits of clay and sand to a maximum depth of 8.00m bgl.

Groundwater was encountered during the site investigation in both exploratory boreholes at a depth of 5.00m bgl, within the alluvial sands.

Subsequent monitoring visits identified groundwater levels between 4.43m - 4.52m bgl in one of the installed boreholes (WS01).

10.3 Foundation Considerations

Based on the ground conditions encountered, conventional foundations (strip/pad), placed in the superficial deposits, are not considered suitable for the proposed development, due to the variable depth of made ground on-site, as well as the deep, soft alluvial superficial deposits underlying the made ground.

Therefore, foundation loadings should be transferred to competent strata by use of driven or bored piles.

10.3.1 *Piled Foundations*

Due to the deep and variable made ground and soft superficial driven or bored piles should be adopted. Driven piles would have the advantage of minimising the spoil that is generated, however, the noise and vibration associated with the installation of driven piles may prevent this type of pile from being selected. It should also be noted that driven piles can also potentially create preferential pollutant pathways.

Short bored (cast in-situ) piles installed using continuous flight auger (CFA) techniques may therefore be more appropriate but given the various advantages and limitations of each pile type, and the cost implications, advice should be sought from specialist piling contractors to determine the most suitable and cost-effective type.

They should also be able to give recommended pile diameters and depths and likely pile capacities, with guaranteed performance. It is recommended a pile test be carried out to confirm pile capacities. In assessing the pile capacities, contractors should make an allowance for the effects of negative skin friction, particularly in any Made Ground.

There may be differential settlement between piled structures and the surrounding ground level. Provision should, therefore, be made to make up ground levels at threshold positions, vehicle access doorways, etc. Alternatively, these materials should be removed and replaced in a controlled manner by suitable existing materials or imported engineered fill.

It is essential the advice of a specialist piling contractor is sought and that positive assurances are provided by the piling contractor that their proprietary system is capable of providing the required working loads in the ground conditions encountered.

Floor slabs should be designed as suspended if the piled solution is used.

Bored cast in-place piles would be suitable, and large diameters are achievable and can be quickly installed.

The excavation of bored piles within the soft soils may require temporary or permanent casings or linings to prevent bulging, from grout or concrete injected under pressure.

10.5 Pavement Design

The exploratory boreholes generally encountered Made Ground at a subgrade level. Based on the recommendations for design CBR values provided in Interim advice note 73/06, Revision 1 (2009), a conservative design CBR value of 1% should be adopted in areas where Made Ground is encountered at a subgrade level.

Consideration should be given to the potential differing ground conditions near surface, which could cause pavements to be constructed on variable made ground. In this context a flexible pavement design may be required.

Consideration should also be given to the use of geotextiles to allow reduction of capping thickness. For examples biaxial geogrids such as Tensar SSLA20 and SSLA30 are often used to reduce capping thickness. The advice of a suitable contractor should be sought as to the most appropriate type of geotextile to use in the ground conditions encountered at this site. For guidance, the following table gives a comparison of granular layer thickness with and without the use of a geotextile, in accordance with the requirement of HA25/94 Part 2.

It should be noted the type of construction will depend on proposed finished pavement levels across the site and it is recommended the pavement design is reviewed once these levels are known. In this context, it is essential further in situ CBR testing is carried out once formation levels are known to confirm design CBR values.

Table 16: Comparison of Capping Thickness with and without Geotextile

CBR	Unreinforced			Reinforced with Tensar Geogrid				
	Sub-base	Capping	Total	Sub-base	Capping	No. of grids	Total	Thickness saving
0.5%	Design not suitable			200mm	400mm	2	600mm	-
1.0%	150mm	600mm	750mm	400mm	0	1	400mm	350mm
1.5%	150mm	600mm	750mm	310mm	0	1	310mm	440mm
2.0%	150mm	600mm	750mm	260mm	0	1	260mm	490mm
3.0%	150mm	350mm	500mm	210mm	0	1	210mm	290mm
4.0%	150mm	300mm	450mm	175mm	0	1	175mm	275mm
5.0%	150mm	250mm	400mm	160mm	0	1	160mm	240mm
These figures are suitable for light access roads and car parks, based on 1000 standard axles. For heavier loaded pavements, the advice of specialist contractor should be sought.								

All formation excavations should be examined by a suitably experienced engineer or inspector to check for soft or unsuitable material, which should be removed and replaced with compacted granular fill. Also, to ensure good compaction and remove unevenness, the formation should be compacted with equipment suitable for use in the ground conditions encountered. Careful inspection of this work will also help identify any soft spots at or just below formation level.

10.6 Chemical Attack on Buried Concrete

Chemical tests (see Appendices) show low levels of water-soluble sulphates and near neutral conditions. Based on these conditions, it is recommended that for concrete placed in natural strata the Design Sulphate Class for the site, as defined in BRE Special Digest 1[(2005)], be taken as DS-1, and the Aggressive Chemical Environment for Concrete (ACEC) site classification be taken as AC-1s. The recommendations of BRE Special Digest 1 should be followed for concrete foundations and ground bearing floor slabs.

10.7 Suitability of Excavated Materials

Acceptability criteria and testing, and methods of compaction/placement will depend on the type of contract and specification used for the construction of the proposed development and it is recommended that earthworks specifications are reviewed by a suitably qualified engineer once these have been prepared by the relevant parties.

Granular Made Ground could be suitable for re-use as structural fill, providing it is not contaminated and does not contain excessive amounts of clay and providing moisture contents are controlled during placement. The control of moisture contents will be important as the cohesive content of this stratum is likely to be sensitive to moisture content changes.

10.8 Temporary Works

Formations will be susceptible to damage both by weather and trafficking, and should be protected immediately on exposure, particularly in areas where construction plant will access the site.

Excavations in Made Ground are likely to be unstable and should be battered back to an angle of 1 in 2, or a system of close sheeting and shoring adopted to ensure stability, and where personnel are required to enter excavations. All excavations should be adequately supported where personnel are required to enter.

Groundwater seepages could be encountered near surface within excavations, particularly during the wetter months of the year. Pumping of excavations from a suitable located sump is likely to be required to keep excavations dry.

All natural materials on site should be capable of being excavated using conventional excavating machinery.

11.0 GROUND GAS AND RADON GAS CONTAMINATION RISK ASSESSMENT

11.1 Radon Gas

The site is not located within a Radon Affected Area as defined by the Health Protection Agency and therefore radon protection measures are not necessary.

11.2 Analyses of Monitoring Results

The potential risk associated with gases being generated in the ground (whether from natural or man-made sources) depends on the concentrations of gas and its flow rate to the surface. These factors are assessed by monitoring the gas installations in the boreholes. The variable nature of gas generation and the effect of barometric pressure on gas flow means that the volume of gas potentially reaching the ground surface is usually inconsistent over time.

Two monitoring visits were conducted on the 27th July and 4th August 2025. The results recorded methane (CH_4) levels of 0.0% v/v with carbon dioxide (CO_2) levels of 0.2% to 7.8% v/v. Oxygen concentrations of between 9.6% and 16.9% v/v were also recorded. Groundwater was encountered in exclusively in WS01 during both visits at depths between 4.43m and 4.52m bgl.

Generally, an absence of flow rates was detected during the monitoring period, however a maximum flow rate of 0.9 litres/hour was detected within WS01 during the second visit. As the steady flow rate during both visits was 0.0 litres/hour, for assessment purposes, a steady flow rate of 0.1 litres/hour has been used based on the limit of detection of the flow meter.

Atmospheric pressure was recorded to be between 1009mb and 1020mb, with the first visit conducted during a falling pressure event (1020 - 1018 over 7 hours).

Full results of the monitoring are presented in Appendix 5.

Table 17 overleaf, adapted from Table 8.5 of CIRIA C665, assessing risks posed by hazardous ground gases to buildings, by Wilson et al. 2007, shows a summary of the current UK practice with respect to appropriate gas protection measures based upon a Gas Screening Value (GSV). A GSV for the site has been obtained by multiplying the maximum concentration of gas by the steady flow rate of 0.1l/h adopted for assessment purposes.

- Carbon dioxide: Steady flow rate = 0.1 l/hr, max concentration = 7.8%
- Methane: Steady flow rate = 0.1 l/hr, max concentration = 0.0%.

Based on the above figures, the GSV is calculated as:

- **Carbon Dioxide**: GSV = 0.1 x 7.8 / 100 = **0.0078 litres/hour**
- **Methane**: GSV = 0.1 x 0.0 / 100 = **0.0 litres/hour**

The CIRIA guidance document notes that '...the GSV is a guideline value and not an absolute threshold.'

The above results suggest the site can be given a Characteristic Situation 1, i.e. 'Very Low Risk' in accordance with Table 17 overleaf, however this would ordinarily be raised to CS2 due to the presence of elevated carbon dioxide (>5%).

Table 17: Characteristic Situation (Wilson et al 2006/2007 modified from Wilson and Card, 1999)

Characteristic Situation	*Risk Classification*	*Gas Screening Value CH_4 or CO_2 (l/hr)*	*Additional Factors*	*Typical source of generation*
1	Very Low	<0.07	Typically, < 1% methane Typically, < 5% carbon dioxide	Typical made ground
2	Low	<0.7	Borehole air flow rate to not exceed 70l/hr otherwise consider increase to Characteristic Situation 3	Typical made ground
3	Moderate	<3.5		Old landfill, inert waste, flooded mine workings
4	Moderate to High	<15	Quantitative risk assessment	Mine workings susceptible to flooding, completed landfill
5	High Risk	<70		Mineworking unflooded inactive with shallow workings near surface
6	Very High Risk	>70		Recent landfill site

Detailed Assessment

EEG have made reference to *Ground Gas Information Sheet No.1, Using Ternary Plots for Interpretation of Ground Gas Monitoring Results (July 2018),* which reports that carbon dioxide is widespread in the sub-surface environment at concentrations of up to 21% and is generated by microbial and geochemical processes. Elevated carbon dioxide concentrations are commonly elevated in Glacial Till, Chalk, River Terrace Gravel, Thanet Sand, Lambeth Group and Made Ground.

It is reported that when monitoring wells are installed in these materials, small volumes of organic material are exposed to oxygen, which results in biological respiration or oxidation of the material, resulting in the production of carbon dioxide. Weathering of pyrites and subsequent reactions of acidic pore water with carbonate material can also cause increased concentrations of carbon dioxide in the monitoring well headspace.

Organic material in Made Ground can also degrade to produce carbon dioxide and or methane, in which case the carbon dioxide may be generated so slowly that it will not be emitted from the ground surface in quantities or at a rate that is sufficient to pose a risk to overlying development.

Based on the above information, the gas monitoring data from this investigation has been analysed with respect to methane, carbon dioxide, oxygen, and nitrogen gas ratios to deduce the potential source of the ground gas, as shown in Figures 14 to 16 overleaf.

Figure 14: Gas Ratio Ternary Plot

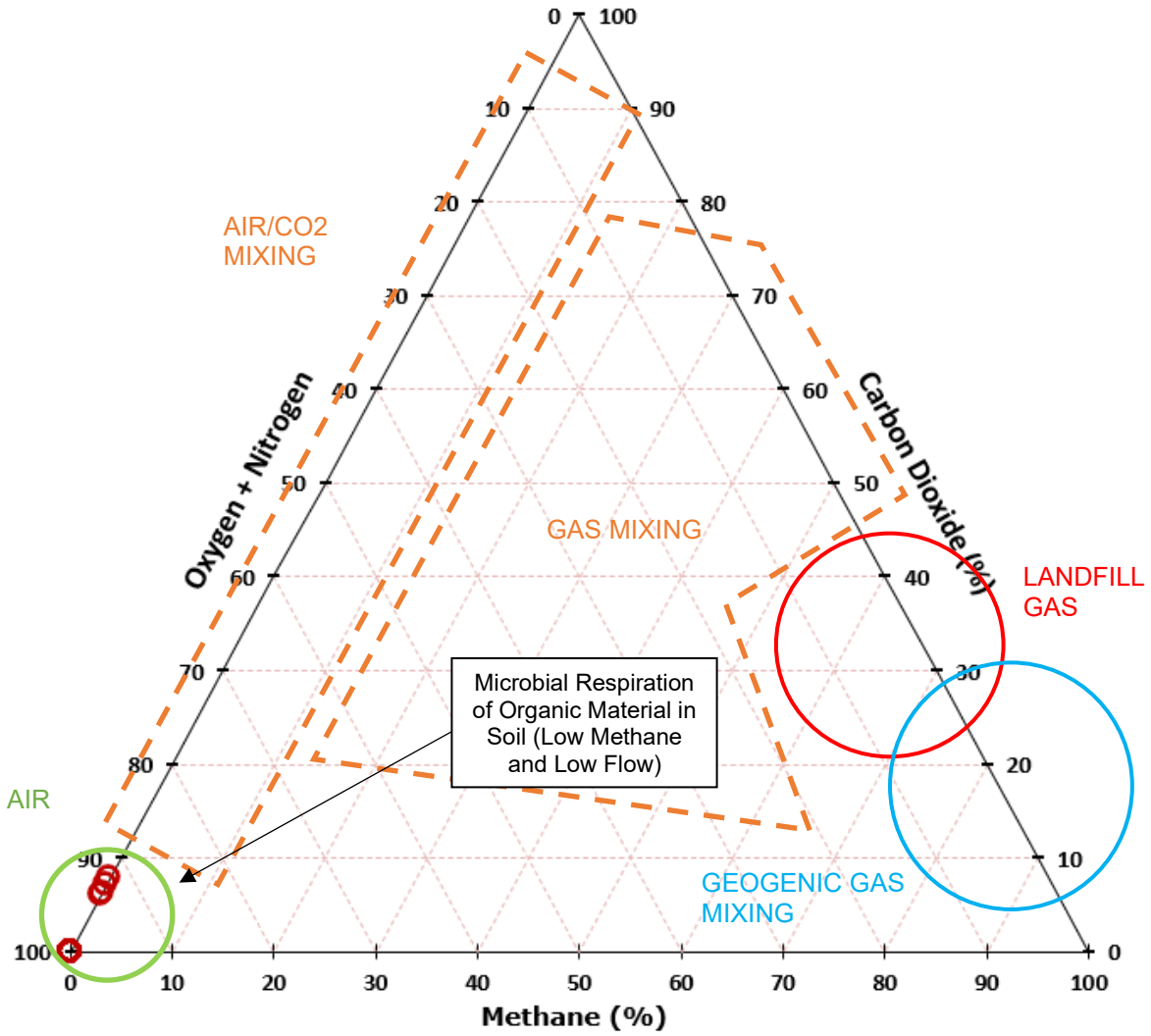


Figure 14 shows the ground gas monitoring results from this site investigation plotted with the gas composition from different sources, adapted from Teasdale et al. 2015. The results show that the gas composition within the monitoring wells at the site is unlikely to be landfill gas.

The results generally correspond to air on the gas ratios ternary plot.

Figure 15: Carbon Dioxide: Oxygen Ratio Plot

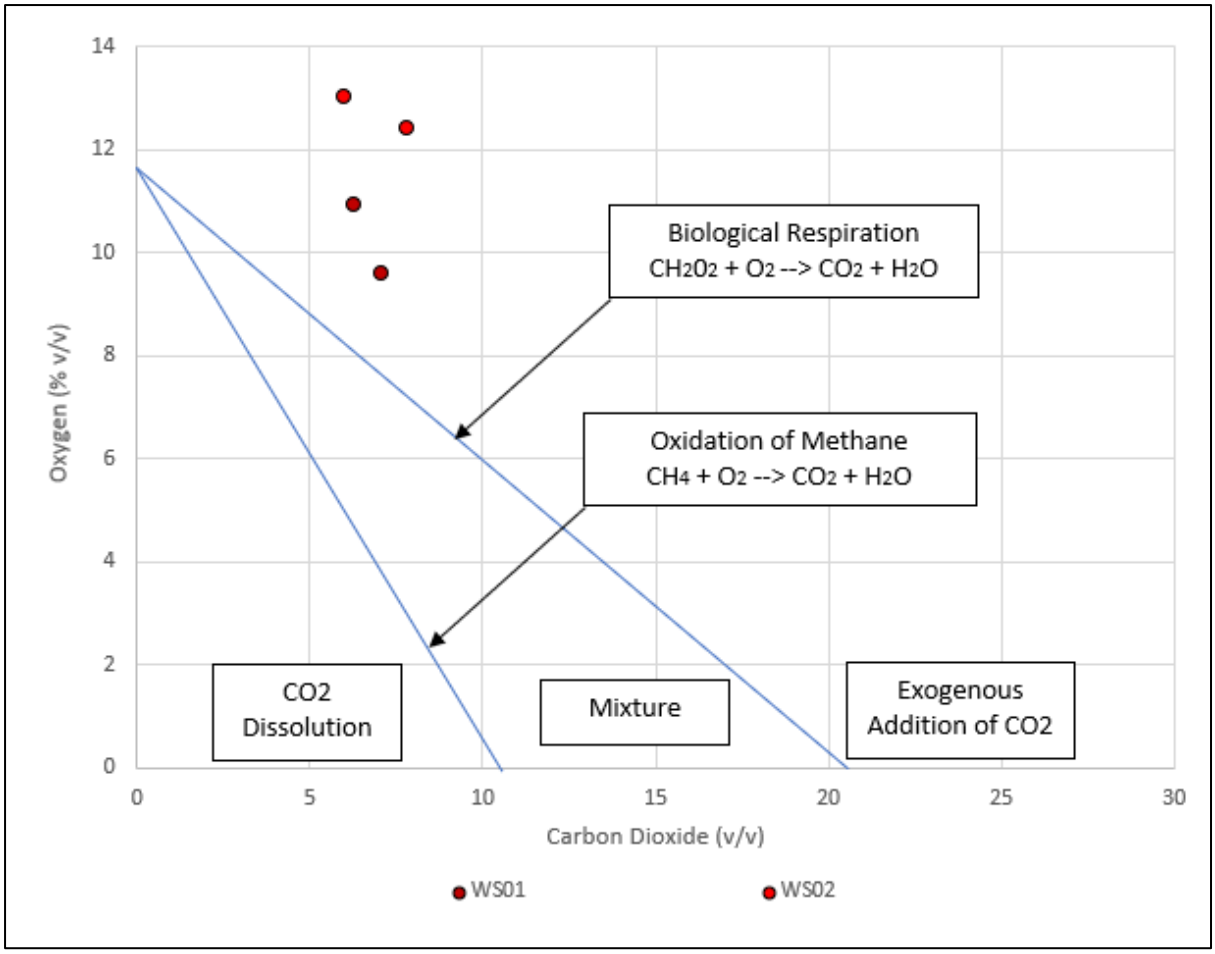


Figure 15 shows that the points that plot to the left of the biological respiration and oxidation of methane lines are caused by dissolution of gas from the ground (or pore) water and from the reaction of rainwater with soil. The points to the right of the biological respiration line are caused by biological respiration (i.e., oxidation of organic material in the soil).

All of the data plots to the right side of the biological respiration line. This indicates that the source of carbon dioxide is likely to be from the oxidation of organic material in the soil.

Figure 16: Nitrogen/Oxygen: Carbon Dioxide Ratio Plot

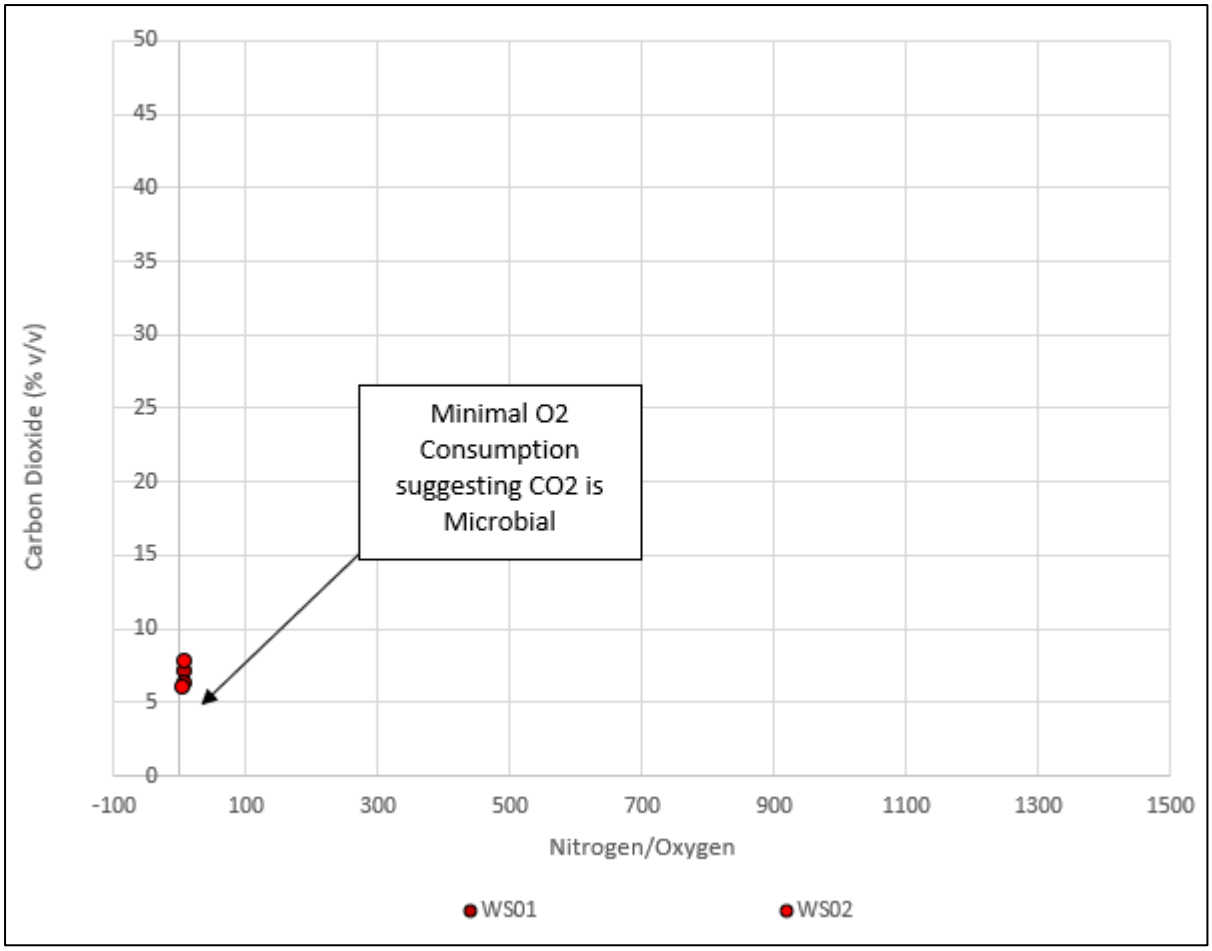


Figure 16 presents an assessment of the nitrogen/oxygen and carbon dioxide ratios. The figure shows all the monitoring results plotted on the left side of the graph, which represents minimal oxygen consumption. There is no data plotting towards the right side of this figure, which would suggest methane oxidation.

The above results and assessment suggest the site can be given a Characteristic Situation 1, i.e., 'very low risk', in accordance with Table 17.

Therefore, ground gas protection measures are not considered necessary at the site.

12.0 CONCLUSIONS & RECOMMENDATIONS

12.1 Soil Contamination

No significant sources of contamination have been identified during the desk study phase of this investigation, with a tentative **MODERATE to LOW** risk to future end users until ground conditions were confirmed. Although made ground to a depth of up to 2.70m bgl was identified during the site investigation phase, no significant sources of contamination were identified.

A made ground gravel layer, containing ash and clinker, was encountered in the borehole in the north of the site (WS01).

Ash and clinker contain metals and hydrocarbons in a crystalline form, and is therefore unlikely to pose a significant leachable risk.

However, it is recommended this layer is removed during the redevelopment of the rear garden area, to remove the likelihood of dermal contact with future end users.

No additional visual or olfactory evidence of contamination was observed during the site investigation.

12.2 Foundation Recommendations

Shallow strip/pad foundations placed in the superficial deposits are not considered appropriate for the current proposed development, due to the variable thickness of the deep made ground, and the soft underlying alluvial deposits.

Foundation loadings should be transferred to competent strata by use of driven or bored piles. Based on the results of the dynamic probe testing, competent ground has been identified between 9.50m - 101.0m bgl.

Due to the medium volume change potential of clay deposits and significant developed trees and vegetation, heave protection measures will be required in the foundation design.

It recommended that for foundations and ground floor slabs in contact with the superficial deposits, the Design Sulphate Class should be taken as DS-1, and the Aggressive Chemical Environment for Concrete (ACEC) site classification be taken as AC-1.

12.3 Hazardous Ground Gas

The site has been initially classified as CS2 due to marginally elevated concentrations of dioxide (>5%) encountered within the window sample boreholes during both monitoring visits.

However, after a detailed assessment of the data, with specific reference to gas ratios, it is evident that the ground gas composition resembles air, rather than landfill or harmful gases. No oxidation of methane is occurring at the site. The source is likely to be biological respiration (i.e., the oxidation of organic material in the soil) that has been disturbed and released during the drilling process.

Based on this analysis and the low steady flow rates recorded in the window sample boreholes, the risk of ground gas can be considered “very low” with a characteristic situation of CS1, and ground gas protection measures are therefore not necessary at the site.

12.4 Pavement Design

Based on the findings of the site investigation, the soil type at subgrade level was typically made ground. Based on the recommendations for design CBR values provided in Interim advice note 73/06, Revision 1 (2009).

A conservative design CBR value of 1% should be adopted in areas where made ground is encountered at subgrade level.

12.5 Site Personnel

As with all construction sites, personnel working on the site during the construction period should be encouraged to maintain a high standard of personal hygiene and on-site washing facilities should be available.

12.6 Other Matters

Due diligence is required during the construction period, and should any further evidence of contamination be found, appropriate investigation and / or action should be taken. The significance of any contamination not discovered by this investigation is outside the scope of this report.

APPENDIX 1

GROUNDSURE REPORT

APPENDIX 2

EXPLORATORY HOLE LOGS

APPENDIX 3

DYNAMIC PROBE TESTING RESULTS

APPENDIX 4

GEOTECHNICAL TESTING RESULTS

APPENDIX 5

GROUND GAS MONITORING RESULTS

APPENDIX 6

REPORT LIMITATIONS

REPORT LIMITATIONS

This contract was completed by Earth Environmental & Geotechnical Ltd based on a defined programme and scope of works and terms and conditions agreed with the client. This report was compiled with all reasonable skill, and care, bearing in mind the project objectives, the agreed scope of works, the prevailing site conditions, the budget, and staff resources allocated to the project.

Other than that, expressly contained in the above paragraph, Earth Environmental & Geotechnical Ltd provides no other representation or warranty whether express or implied, is made in relation to the services. Unless otherwise agreed this report has been prepared exclusively for the use and reliance of the client in accordance with generally accepted consulting practices and for the intended purposes as stated in the agreement under which this work was completed. This report may not be relied upon, or transferred to, by any other party without the written agreement of a Director of Earth Environmental & Geotechnical Ltd.

If a third party relies on this report, it does so wholly at its own and sole risk and Earth Environmental & Geotechnical Ltd disclaims any liability to such parties.

It is Earth Environmental & Geotechnical Ltd understanding that this report is to be used for the purpose described in the introduction to the report. That purpose was an important factor in determining the scope and level of the services. Should the purpose for which the report is used, or the proposed use of the site change, this report will no longer be valid and any further use of, or reliance upon the report in those circumstances by the client without Earth Environmental & Geotechnical Ltd review and advice shall be at the client's sole and own risk.

The report was written in 2025 and should be read considering any subsequent changes in legislation, statutory requirements, and industry best practices. Ground conditions can also change over time and further investigations, or assessment should be made if there is any significant delay in acting on the findings of this report. The passage of time may result in changes in site conditions, regulatory or other legal provisions, technology or economic conditions which could render the report inaccurate or unreliable. The information and conclusions contained in this report should not be relied upon in the future without the written advice of Earth Environmental & Geotechnical Ltd. In the absence of such written advice of Earth Environmental & Geotechnical Ltd, reliance on the report in the future shall be at the client's own and sole risk. Should Earth Environmental & Geotechnical Ltd be requested to review the report in the future, Earth Environmental & Geotechnical Ltd shall be entitled to additional payment at the then existing rate or such other terms as may be agreed between Earth Environmental & Geotechnical Ltd and the client.

The observations and conclusions described in this report are based solely upon the services that were provided pursuant to the agreement between the client and Earth Environmental & Geotechnical Ltd. Earth Environmental & Geotechnical Ltd has not performed any observations, investigations, studies or testing not specifically set out or mentioned within this report.

Earth Environmental & Geotechnical Ltd is not liable for the existence of any condition, the discovery of which would require performance of services not otherwise contained in the services. For the avoidance of doubt, unless otherwise expressly referred to in the introduction to this report, Earth Environmental & Geotechnical Ltd did not seek to evaluate the presence on or off the site of electromagnetic fields, lead paint, radon gas or other radioactive materials.

The services are based upon Earth Environmental & Geotechnical Ltd observations of existing physical conditions at the site gained from a walkover survey of the site together with Earth

Environmental & Geotechnical Ltd interpretation of information including documentation, obtained from third parties and from the client on the history and usage of the site. The findings and recommendations contained in this report are based in part upon information provided by third parties, and whilst Earth Environmental & Geotechnical Ltd have no reason to doubt the accuracy and that it has been provided in full of those it was requested from, the items relied on have not been verified.

No responsibility can be accepted for errors within third party items presented in this report. Further Earth Environmental & Geotechnical Ltd was not authorised and did not attempt to independently verify the accuracy or completeness of information, documentation or materials received from the client or third parties, including laboratories and information services, during the performance of the services. Earth Environmental & Geotechnical Ltd is not liable for any inaccurate information, misrepresentation of data or conclusions, the discovery of which inaccuracies required the doing of any act including the gathering of any information which was not reasonably available to Earth Environmental & Geotechnical Ltd and including the doing of any independent investigation of the information provided to Earth Environmental & Geotechnical Ltd save as otherwise provided in the terms of the contract between the client and Earth Environmental & Geotechnical Ltd.

Where field investigations have been carried out these have been restricted to a level of detail required to achieve the stated objectives of the work. Ground conditions can also be variable and as investigation excavations only allow examination of the ground at discrete locations. The potential exists for ground conditions to be encountered which are different to those considered in this report. The extent of the limited area depends on the soil and groundwater conditions, together with the position of any current structures and underground facilities and natural and other activities on site. In addition, chemical analysis was carried out for a limited number of parameters [as stipulated in the contract between the client and Earth Environmental & Geotechnical Ltd] based on an understanding of the available operational and historical information, and it should not be inferred that other chemical species are not present.

The groundwater conditions entered on the exploratory hole records are those observed at the time of investigation. The normal speed of investigation usually does not permit the recording of an equilibrium water level for any one water strike. Moreover, groundwater levels are subject to seasonal variation or changes in local drainage conditions and higher groundwater levels may occur at other times of the year than were recorded during this investigation.

Any site drawing(s) provided in this report is (are) not meant to be an accurate base plan but is (are) used to present the general relative locations of features on, and surrounding, the site.