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CIVIL • STRUCTURAL

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PROPOSED RESIDENTIAL DEVELOPMENT

LIVERPOOL ROAD,
HUTTON, PRESTON

FOR

LANCASHIRE COUNTY COUNCIL

FEBRUARY 2025

GEO-ENVIRONMENTAL INVESTIGATION REPORT

24182/GEIR/01

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EXECUTIVE SUMMARY

Site	The site is irregular in shape and extends to an area of approximately 5.807 hectares, located north of Liverpool Road, Hutton, Preston.
NGR	SD 49535 26731
Site History	Careful appraisal of the historical maps show that the site has remained a parcel of farmland until the present day. Several ponds of varying sizes have been noted throughout the sites recorded historical, with the final pond being lost from the survey in the early 1990's. Schoolhouse Farm was situated on the southern tip of the development site for around 100 years, being demolished around the early 1990's. The remainder of the site has experienced minimal change, with development consisting primarily of residential properties and Hutton Grammar School to the south of Liverpool Road.
Investigations	The investigations have extended to: - • Walkover survey • Desk study • Extensive intrusive investigations by window sample boreholes and mechanically excavated trial pits • Chemical and geotechnical analyses of soil samples
Ground Conditions	The ground investigation has identified relatively uniform ground conditions comprising of topsoil overlying predominantly cohesive clay deposits, with a silt bed noted only within WS01 from 4.90m bgl. Bedrock has not been encountered within any of the exploratory hole locations during these investigations.
Groundwater	These intrusive investigations have not identified any groundwater ingress within any of the exploratory hole positions. This suggests that the groundwater table lies at a significant depth below the site, possibly within the bedrock strata. Groundwater is not considered to represent an important hazard to the development of the site but waster entries into excavations cannot and should not be discontinued.
Environmental	The chemical analysis undertaken on the representative samples of topsoil have not identified any elevated concentrations of metals, inorganics, PAH or TPH compounds. Therefore, the topsoil is suitable for retention within a residential development.
Foundations	The underlying natural cohesive deposits are fairly uniform across the site and comprise of a boulder clay with varying quantities of sands and gravels. Based on the results from the standard penetration tests and hand vane tests, the natural strata strata are considered to offer a safe bearing capacity in the order of 150kN/m^2 at a minimum depth of 1.00m bgl. It is anticipated that the majority of the site will adopt a traditional strip type foundation, constructed at depths of around 1.00m bgl. BGS records show an inferred fault of unknown displacement located 22m north east the development site. As such, it is anticipated that the majority of plots can be found utilising traditional strip or deep strip foundations. However, reinforcement is required within all strip footings due to the presence of the geological fault (B385). Shallow ground conditions present within the site comprise of cohesive clays which are susceptible to volume change potential as a result of varying moisture content. Laboratory analysis undertaken confirms the site is classified as having a medium volume change potential as defined by the NHBC Handbook, Chapter 4.2.
Slabs	It is recommended that suspended ground floor construction be adopted for all properties located within this site. These floors may be of a pre-cast concrete beam and block arrangement or of a suitably designed cast in-situ reinforced concrete.
SUDS	Assessment of the ground conditions present within this site in terms of sustainable urban drainage confirms the presence of topsoil overlying effectively impermeable cohesive natural strata across the majority of the site. As such, we consider the site is unsuitable for the adoption of a soakaway system and other means of surface water disposal should be considered.
Further Works	If any unusual or suspicious strata or ground conditions are encountered during the subsequent site stripping preparation work, it will be necessary for these areas to be bought to the attention of the appropriate authorities so that all necessary inspection, sampling and testing may be undertaken to determine whether these materials present a hazard to human health. It is incumbent upon the site contractors to advise a responsible authority of any unusual findings within the site which may then be further investigated.

This brief summary should not be assumed to represent a complete account of all the potential geo-environmental issues that may exist at the site. As such it is strongly recommended that the report be read in its entirety.

GEO-ENVIRONMENTAL INVESTIGATION WORKS

LIVERPOOL ROAD, HUTTON, PRESTON

1.0 INTRODUCTION

1.1 Instructions

1.1.1 We are instructed by Lancashire County Council to undertake a programme of ground investigation works at a site located off Liverpool Road, Hutton, Preston, which they intend to redevelop in a residential manner.

1.2 Object

1.2.1 The object of these investigations are as follows:

- To determine the engineering properties of the soils, present within the site to form a basis upon which foundation and general infrastructure recommendations and design may be based;
- To enable sufficient information regarding ground conditions to be obtained from which risks to end users and the environment can be assessed;
- To utilise the information obtained from the investigations to provide recommendations for remediation measures where required.

1.3 Scope

1.3.1 The investigations considered within this report have comprised of the following elements:

- An initial environmental and engineering desk study based upon existing reports, services location information, geological, hydrogeology and hydrological information, a commercially available database and old Ordnance Survey maps;
- An initial walkover survey of the site has been undertaken prior to any intrusive investigations being commenced to determine the presence of any visible hazards or features which may affect the design of the ground investigation works;
- Undertake ground investigation works by window sample boreholes and mechanically excavated trial pits;
- Determine the presence, nature and extent of any soil and groundwater contamination at the site;
- Determination of the engineering properties of the soils present within the site to form a basis upon which recommendations for foundations and infrastructure construction may be based;
- Identify the potential requirements for any remedial action, where required.

1.4 Development Proposals

1.4.1 At the time of preparation of this report, we have not been provided with a proposed development plan. However, we understand that the site is to be re-developed in a residential manner with associated rear gardens, areas of hard standing and access roads

1.4.2 It is acknowledged that the development proposals for the site are likely to be amended as a result of local planning requirements. It is however anticipated that the current proposals will be representative of the final development approval. However, if the final development proposals are radically different from the current proposals, then recommendations made within this report may become inappropriate.

1.5 Services

1.5.1 Service records show overhead electricity cables cutting across the site from east to west. Any exploratory hole positions have been located so as to give an adequate safe working distance from the cables. No further services enter the site and are believed to be concentrated within Liverpool Road and surrounding residential areas.

2.0 THE SITE

2.1 Location

2.1.1 The site is irregular in shape and extends to an area of approximately 5.807 hectares, located north of Liverpool Road, Hutton. The appended Groundsure maps and report show a slightly larger site area but this represents a buffer zone included within the mapping. The centre of the site is situated at approximate National Grid Reference SD 49535 26731. The site location is shown in figure 1 below.

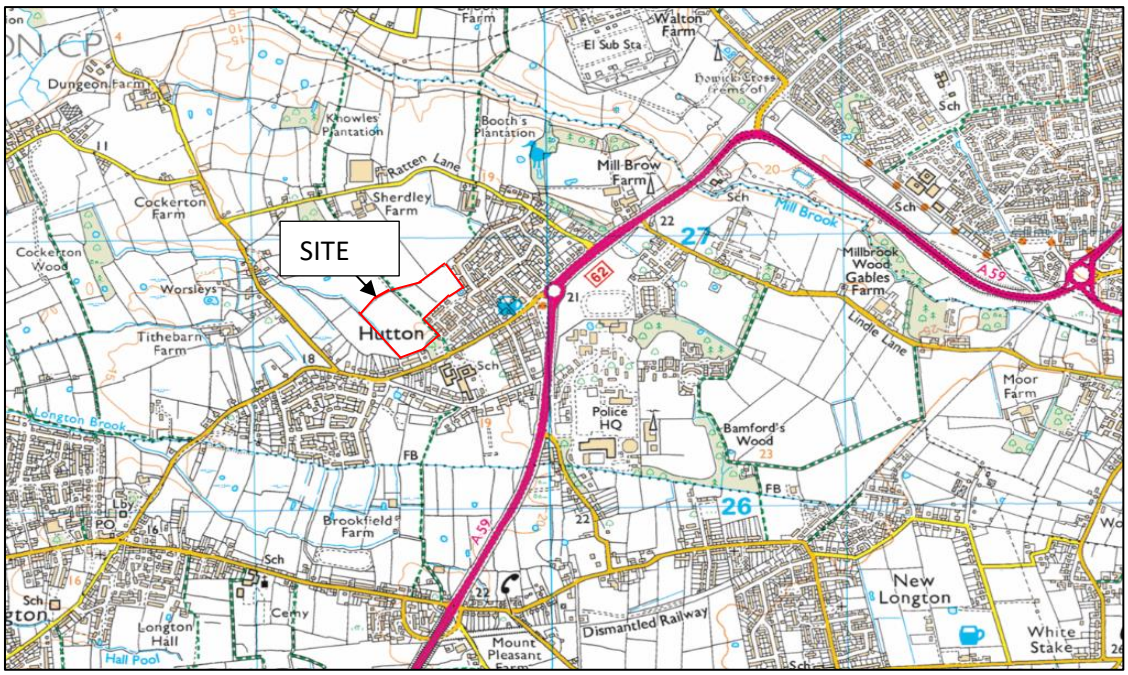

Figure 1 Site Location

2.2 Boundaries

2.2.1 The site is bound to the north and west by further parcels of farmland, whilst the southern and eastern boundaries are formed by residential estates and developments.

2.3 Access

2.3.1 The site is currently assessed via a double metal gate off Walton Gardens. A smaller gate is also available for pedestrian access only into the fields.

2.4 Topography

2.4.1 Elevation differs slightly across the site, creating small low patches in some areas where water was residing and creating various sized ponds and areas of standing water. However, the wider site area shows minimal topographical change. Consideration will be needed on final site levels, especially towards the north of the site.

2.5 Site Conditions

2.5.1 At the time of the site walkover the site comprised several large parcels of farmland, bound by mature trees and hedgerows, with the vegetation also acting as informal field partitions.

2.6 Trees

2.6.1 Abundant mature trees and vegetation was noted within the site and along most of the sites boundaries. There will therefore be a requirement to undertake an arboricultural report.

2.7 Walkover Survey

2.7.1 Prior to commencing the ground investigation works, we have undertaken an initial walkover survey of the site to identify any areas which may impact upon the proposed site redevelopment works. These features are identified upon the walkover survey plan which is appended to this report for reference.

2.7.2 The site walkover was conducted on Monday 06.01.2025 and at the time of the walkover the weather was cold and frosty. The site could be entered through either a large metal gate or a small pedestrian wooden gate located off Walton Gardens, south east of the site. The eastern and southern boundaries are bordered by residential properties and the northern and western boundaries are encompassed by agricultural grassland. The site is comprised of three grassed fields, intersected twice by a significant series of trees and shrubbery running perpendicular to the northern site boundary. Overhead power lines intersect the western boundary in the north and run through the site where they end in the eastern parcel of land, therefore four wooden poles are present across on the site. Elevation differs slightly across the site, creating small low patches in some areas where water was residing and creating various sized puddles.

2.7.3 Upon entrance to the site in the south there is a public footpath along the boundary which continues through to the northern boundary. Along the southern boundary there is a section of wooden fencing followed by residential fencing and bushes meeting the western boundary. The western boundary is aligned with a mixture of hedgerows and brambles, with a small water coarse running along the border.

2.7.4 The northern border is made up of a series of hedgerows and brambles. Where the pathway, from the south, intersects the northern boundary there are wooden fences and gates with metal wiring to separate the site from neighbouring land but can be accessed by the public using the public footpath. A water bath for livestock is present close to the fencing. Another wooden gate is situated along the northern boundary towards the east, along with numerous well established trees. An inaccessible area of deep brambles is situated in the north eastern corner of the site.

2.7.5 The eastern boundary is a mixture of residential fencing and hedgerows. An area of tall grass is present in the south eastern corner. A combination of wired and wooden fencing is present along the south eastern border where it eventually reaches the site entrance in the south.

2.7.6 Along the southern boundary, directly between the central and eastern parcels of grassland there is a small section of land which has been scattered on the surface with bricks, gravel and fragments of ceramic and plastic. Elevation reduces slightly within this region and as a result there was a large accumulation of water, preventing access and creating an onsite pond. The scattered gravel created a pathway along a section of the southern border.

3.0 DESK STUDY

3.0.1 As part of our environmental desk studies we have commissioned an Enviro+Geo Insight report by Groundsure which gives detail of all recorded environmental features relating to the site and its immediate surrounding area. We have also obtained copies of all available old Ordnance Survey maps for the area, and these give some historical guidance regarding the former usage of the site area and its immediate vicinity.

3.1 Historical Industrial Sites

3.1.1 The Enviro-Insight report has identified seventeen (17 No.) records of historical industrial land uses within 500m of the site, four (4 No.) of which are within 250m of the development boundary. The closest of these records is situated 48m south east and relates to an old clay pit on the 1914 year of mapping. A further unspecified pit is located 82m east, with a smithy 175m east and a sewage disposal works 247m south.

3.1.2 The Groundsure report has identified one (1 No.) historical tank within 500m of the site boundary, located 432m west on the 1991 year of mapping. Due to the distance of the tank from the development site, there is no risk of contamination.

3.1.3 The Groundsure report has identified nine (9 No.) historical energy features within 500m of the site boundary. All records relate to electricity substations, with the closest situated 117m south. Due to the distance of the substation from the development site, it is not believed to pose a PCB contamination risk.

3.1.4 The report has not recorded any historical petrol stations within 500m of the site boundary, and only seven (7 No.) historical garages. The closest three garages are located 129m, 135m and 144m south west, with further records from 225m east.

3.2 Landfill Sites

3.2.1 The Groundsure report has not identified any active or recent landfills, or historical landfills (BGS records, LA/mapping or EA/NRW records) within 500m of the search boundary.

3.2.2 The report has not identified any historical waste sites within 500m and no licensed waste sites within 350m of the site boundary, although records of licensed waste sites do exist beyond this point.

3.2.3 The report has not identified any waste exemptions within 250m of the development site, although records do exist beyond this point.

3.3 Current Land Uses

3.3.1 The Groundsure report has identified four (4 No.) recent industrial land uses within 250m of the site. The first record located 149m east off Anchor Drive, Hutton is for fuel distributors and suppliers. An electricity substation is noted 161m east, with a pumping station 196m north east and a mast 146m east.

3.3.2 The report has records of two obsolete petrol stations located 160m south west and 247m east. These former petrol stations are believed to be at such a distance as to not form a contamination risk.

3.3.3 The Groundsure report has not identified any records of licensed industrial activities (Part A(1)) or licensed pollutant release (Part A(2)/B) permits within 250m of the site boundary.

3.3.4 The report has identified eleven (11 No.) licenced discharges to controlled waters within 500m of the search boundary. The first three records are situated 187m north east for sewages discharges, sewer storm overflow into the Trib Mill Brook. Two of the records have been revoked in march and April of 2017, whilst one record is still in effect.

3.3.5 There have been six (6 No.) recorded pollution incidents (EA/NRW) within 500m of the search boundary, with the closest of these records situated 54m south. The incident occurred on the 16th October 2001, with a pollutant of agricultural materials and wastes, descripted as silage liquors. There was no impact (category 4) to the land and air and only a minor impact (category 3) to the water.

3.4 Hydrogeology & Hydrology

3.4.1 The superficial deposits below the site are recorded as a Secondary Undifferentiated. This is assigned where it is not possible to attribute either category A or B to a rock type. These layers have previously been designated as both minor and non-aquifers in different locations due to the variable characteristics of the rock type.

3.4.2 The underlying bedrock is noted to be a Principal aquifer, containing geology of high intergranular and/or fracture permeability, usually providing a high level of water storage. Principal aquifers were previously classified as major aquifers.

3.4.3 The groundwater vulnerability map of the site shows the superficial deposits within the site to be of a low vulnerability, with a thickness greater than 10m. The underlying Principal aquifer within the bedrock is considered to be of a low vulnerability with a flow mechanism of well-connected fractures.

3.4.4 The site and surrounding 500m is not located within a Source Protection Zone (SPZ).

3.4.5 The report has not identified any surface water abstractions within 2,000m of the site boundary, no licensed groundwater abstractions within 1,800m, although records do exist beyond this point.

3.4.6 The water network of Great Britain shows the flow and central course of very river, stream, lake and canal. The site has records of an inland river not influenced by normal tidal action on the ground surface and contains water all year round in normal circumstances.

3.4.7 The Water Framework Directive (WFD) is an EU-led framework for the protection of inland surface waters, coastal waters and groundwater through river basin-level management planning. In terms of surface waters, these basins are broken down into smaller units known as management, operational and water body catchments. The development site is located within a WFD surface water body catchment, relating to coastal catchment and not being part of a river, with an operational catchment of the Douglas OC and a management catchment of the Douglas.

3.4.8 The site lies within a WFD for groundwater bodies relating to the Fylde Permo-Triassic Sandstone Aquifers, with a poor overall and quantitative rating and a good chemical rating.

3.5 Flooding

3.5.1 The site is not located within an area at risk of flooding from rivers and seas (RoFRaS) without defences.

3.5.2 The highest risk both on site and within 50m of the site boundary for surface water flooding is 1 in 30 years with a maximum modelled depth between 0.3m and 1.0m. Additionally, the highest risk on site for groundwater flooding is moderate to high, whilst the highest risk within 50m is high.

3.5.3 Records of historic flood events from rivers, the sea, groundwater and surface water have been logged since 1946. There are four (4 No.) records within 250m of the site boundary, with the closest event situated 64m south east, dated 26/09/2015 and 27/12/20215. There was an unknown flood source, flood cause and no data relating to the type of flood. Further records are situated from 139m east.

3.6 Environmentally Sensitive Areas

3.6.1 The site is located within a SSSI Impact Risk Zone and therefore an initial assessment of the potential risks to the SSSI are required, relating to the development proposals. The zones around each SSSI reflect particular sensitivities of the features for which could have potentially adverse impacts.

3.6.2 The report has identified that the site is located within an area of greenbelt land under Merseyside and Greater Manchester, with a Local Authority of South Ribble.

3.6.3 The land has been classified taking into consideration multiple factors including climate, physical geography and oil properties. The development site has been classified as Grade 3, containing good to moderate quality agricultural land with moderate limitations.

3.6.4 The Countryside Stewardship Scheme covers a range of schemes that provides financial incentives, foresters and land managers to look after and improve the environment. The site is located within the Countryside Stewardship Scheme (higher tier), with a start date of 01/08/2023 and an end date of 31/07/2026.

3.6.5 The southern boundary of the site lies within a priority habitat inventory for traditional orchard. This could represent a slight mis plot of the site boundary, but due care and attention is required when developing the site.

3.7 Geology

3.7.1 The Groundsure report has not identified any made ground or artificial ground within 250m of the search boundary, although records do exist beyond this point, they are at such a distance as to not be considered a risk of toxic ground gas.

3.7.2 The Groundsure report has indicated that the site is underlain by superficial deposits of diamicton till comprising predominantly of clays with minor sands and gravels. The qualitative classification of estimated rates of vertical movement of water from the ground surface through the unsaturated zone of the superficial deposits have a low to high permeability with a mixed flow type.

3.7.3 The bedrock geology underlying the site comprises of the Sherwood Sandstone Group of sandstone units. The rate of vertical movement of water within the bedrock has a high permeability with a mixed flow type.

3.7.4 The report has identified a normal, inferred fault with an unknown displacement located 22m north east. Based upon this information, there will be a requirement for all foundations to be provided with suitable reinforcement.

3.7.5 The site is located within an area where less than 1% of properties are above the action level for Radon gas and as such, no further consideration is required with regards to radon gas.

3.8 Ground Workings

3.8.1 The Groundsure report has recorded twenty-one (21 No.) surface ground working within 250m of the site boundary. The nine records are located within the development site and relate to ponds and a water body. Subseqent records include a pond (26m west), old clay pit (48m south east) and an unspecified pit (82m east).

3.8.2 The report has not identified any underground workings within 1,000m of the site.

3.9 Mining & Ground Stability

3.9.1 The site is not located within a coal mining reporting area and as such, no further consideration is required to the risks associated with historical mining activities.

3.9.2 The report indicates that there is a ‘negligible’ hazard rating for compressible deposits and ground dissolution of soluble rocks, whilst running sands, collapsible deposits, shrink swell clays and landslides all have a ‘very low’ hazard rating.

3.10 Background Soil Chemistry

3.10.1 The Geo-Insight report includes an estimated geometric mean soil concentration of various elements. Assessment of this information suggests that all determinands listed are at concentrations below the current tier 1 assessment criteria.

3.11 Railways & Tunnels

3.11.1 The Groundsure report has not identified any records relating to any railway infrastructure and projects within 250m of the development site boundary.

3.12 Site History

3.12.1

Table 1 – Review of Historical Maps & Aerial Photography		
Date	**Site**	**Adjacent Land**
1848	The site forms several parcels of farmland, with a couple of ponds both within the site and on the site boundaries.	The surrounding area predominantly comprises farmland, with the village of Hutton towards the south of the site boundary off Liverpool Road.
1891 – 1892	Several more ponds are recorded within the development site. Schoolhouse Farm is noted along the southern boundary, with an access driveway off Liverpool Road.	Slight increase in residential properties along Liverpool Road, including the construction of Hutton Grammar School (70m south).
1909 – 1911	A large pond within the center of the site is no longer represented on the maps.	No significant changes.
1929 – 1931	No significant changes.	Increase in residential properties south of Liverpool Road towards the south east. Expansion of Hutton Grammar School.
1938	Slight expansion of Schoolhouse Farm, with the construction of an outbuilding towards the south. Areas of marshy ground noted within the locations of the former ponds.	Furthe expansion of Hutton Grammar School, with playing fields towards the east. Increase in residential properties across the wider area.
1951 - 1955	No significant changes.	No significant changes.
1963	No significant changes.	Increase in residential properties towards the south west of the site.
1967 – 1968	No significant changes.	Residential development constructed on the eastern boundary.
1974 – 1979	No significant changes.	Increase in residential development towards the southwest.
1986 – 1989	No significant changes.	Residential properties constructed south of Liverpool Road.
1993	The remaining pond towards the west of the site has been lost from the survey. Schoolhouse Farm and associated infrastructure has also been lost from the survey.	No significant changes.
2000	No significant changes.	No significant changes.
2005 - 2009	No significant changes.	No significant changes.
2013 – 2015	No significant changes.	No significant changes.
2017	No significant changes.	Development has begun of a new residential estate on the south eastern boundary.
2020 - 2023	No significant changes.	No significant changes.
2025	No significant changes.	No significant changes.

3.12.2 Careful appraisal of the historical maps show that the site has remained a parcel of farmland until the present day. Several ponds of varying sizes have been noted throughout the sites recorded historical, with the final pond being lost from the survey in the early 1990's. Schoolhouse Farm was situated on the southern tip of the development site for around 100 years, being demolished around the early 1990's. The remainder of the site has experienced minimal change, with development consisting primarily of residential properties and Hutton Grammar School to the south of Liverpool Road.

3.13 Anticipated Ground Conditions

3.13.1 Based upon the information obtained during the initial desk study phase, the anticipated ground conditions are expected to comprise of strata as detailed in table 2 overleaf.

Table 2 – Anticipated Ground Conditions	
Ground Material	**Anticipated Condition**
Topsoil	Topsoil is expected across the majority of the site at varying thicknesses.
Made Ground Deposits	Little to no made ground deposits are expected within the site but if any deposits are found they are anticipated to be minimal and laterally discontinuous. There is a potential for made ground within the former location of Schoolhouse Farm.
Superficial Deposits	Diamicton till deposits comprising of clays and silts with minor sand and gravel beds.
Bedrock	Sherwood Sandstone Group – Sandstone units.
Groundwater	Expected to lie at depth within bedrock.

3.13.2 Based upon the data available within the desk study and tables 1 and 2 above, potential ground related issues associated with the proposed redevelopment of this site are likely to include the elements noted in table 3 below.

Table 3 – Potential Ground Related Issues		
Type of Issue	**Site Specific Issue**	**Remarks**
Potential on Site Contamination Sources.	Potential varying depths of made ground in the location of the former ponds and Schoolhouse Farm.	Schoolhouse Farm was located on the southern boundary, whilst the ponds were dotted around the wider site area.
Potential off Site Contamination Sources.	Changing site usages directly adjacent to the development boundary.	Possible minor levels of contamination from neighbouring properties.
Potential Geotechnical Hazards.	Volume change potential of soils Organic deposits in the location of the former ponds	Till deposits comprising of clays and silts with minor sands and gravels. Softer ground conditions.

3.14 Preliminary Conceptual Model

3.14.1 The information presented within this Desk Study section of this report has been used to compile a preliminary conceptual model for the site. The identified potential contaminant and receptors have been considered along with any possible pathways that may link them. The resulting pollution linkages are considered in table 4. The risk classification has been estimated in accordance with the terms and definitions based upon CIRIA C552 Contaminated Land Risk Assessment, A Guide to Good Practice.

Table 4 – Preliminary Conceptual Site Model

Potential Source	Potential Receptor	Possible Pathway	Probability	Consequence	Risk	Mitigation / Investigation
Contaminated soils	Future site users	Direct contact of soils Inhalation or ingestion of soil / dust	Ul	Md	Low	Sampling and testing of topsoil deposits to determine their suitability for retention within a residential environment. Sampling and testing of any made ground strata encountered.
	Surface water in the vicinity of the site	Leaching of contaminants through drainage system	Ul	Md	Low	
	Ground water in aquifer	Leaching of contaminants to ground water	Ul	Md	Low	
	Future site users	Vapour migration from soils	Ul	Md	Low	
	Proposed buildings and services	Direct contact with contaminated soils	Lw	Md	Moderate/ Low	
	Plants in gardens and soft landscaping	Direct contact	Lw	Md	Moderate/ Low	
Contaminated ground water	Site personnel during construction	Water entering excavations	Lw	Mi	Low	Sampling of ground water if contamination noted.
	Future site Users	Retained surface water	Lw	Mi	Low	
Toxic and explosive gases	Proposed buildings and occupiers	Ground gas migration into buildings	Ul	Md	Low	No ground gas risk have been identified. Review on site if deep made ground or organic deposits encountered.
Radon gases	Proposed buildings and occupiers	Ground gas migration into buildings	Ul	Md	Low	Less than 1% of properties above the action level. No radon precautions required.

Key: Consequence: Sv = Severe, Md = Medium, Mi = Mild, Mr = Minor
Probability: Hi = High, Li = Likely, Lw = Low Likelihood, Ul = Unlikely

4.0 SITE WORKS

4.1 Intrusive Works

4.1.1 The ground conditions present within this site have been investigated utilising a series of five (5 No.) window sample boreholes and thirty-one (31 No.) trial pits supervised by a REFA Engineer utilising a backhoe style excavator.

4.1.2 Representative samples of strata encountered during these investigation works have been retained for laboratory analyses and testing where considered to be appropriate. Visual appraisal of the strata present has also been undertaken during these investigations.

4.2 Locations

4.2.1 The locations of the boreholes were chosen by ourselves in conjunction with the desk study information. The locations were chosen in an effort to identify the representative ground conditions and shallow geology present across the whole site area.

4.2.2 The locations of each of the window sample and trial pit positions are indicated upon the appended exploratory hole location plan 24182/01. These locations are shown in relation to site features present at the time of the investigations. It should be noted that these intrusive investigations have been limited to the areas where access was available within the site.

4.3 Records

4.3.1 During the investigation's details of the strata types, water entries, ground conditions and levels have been maintained by the site engineer. This information has been collated into a series of borehole and trial pit journals which are appended to this report for reference.

4.4 Targeting

4.4.1 The investigation locations were undertaken to identify the shallow superficial strata present over the whole site area, though it is acknowledged that ground conditions may vary between investigation locations.

4.4.2 The investigation locations have been spread over the whole area of the site in accordance with the recommendations laid down in BS10175: 2011 "Investigation of Potentially Contaminated Sites". The initial ground investigation strategy is detailed within table 5.

Table 5 - Initial Ground Investigation Strategy

Exploratory Hole No.	Target	Purpose
WS01–WS05 TP01 – TP31	Generally, over the site	To determine the general nature of underlying soils and geology including: 1. Nature, distribution and thickness of made ground. 2. Nature, degree and extent of potential contamination. 3. Content of unacceptable material e.g., peat and biodegradable matter etc. 4. Suitability of the ground for the founding of structures. 5. Engineering properties of the ground.

5.0 GROUND CONDITIONS

5.1 Topsoil

5.1.1 Topsoil deposits were recorded across the site to a maximum depth of 0.45m and comprised a dark brown slightly gravelly, silty clay with gravel of sandstone, mudstone and quartzite. The topsoil material has been sampled and sent for laboratory testing to determine its suitability for reuse and retention within a residential environment.

5.2 Made Ground

5.2.1 These investigation works have not encountered any made ground or artificial deposits.

5.3 Natural Strata

5.3.1 These investigations have identified cohesive strata across the site, comprising of an upper firm light brown mottled grey, slightly gravelly clay to an average depth of 0.70m bgl. Gravel was noted of sandstone and mudstone with occasional pockets of orange fine to coarse sand. Strength within the clay units increased and was recorded as a stiff dark brown mottled light grey slightly sandy, slightly gravelly clay with occasional yellowish green silty pockets and a low cobble content. Gravel and cobbles of sandstone and mudstone were noted throughout the strata.

5.3.2 Strength of the cohesive clay units increases with depth, with a marked transition from around 0.70m below existing ground level. In situ standard penetration tests (SPTs) have recorded 'N' values ranging from 16 to 40 within the clay. Whilst in-situ hand vane tests have recorded results between 70kPa and 118kPa.
Based upon this information we can consider the clay strata of offering a safe bearing capacity in the order of 150kN/m^2 at a minimum depth of 1.00m bgl. Greater bearing capacities can be achieved with increasing depth.

5.3.3 WS01 was the only location to record a medium dense dark brown, slightly gravelly silt between 4.90m and 5.45m below existing ground level, with gravel of siltstone and sandstone. In-situ testing within this strata recorded an 'N' value of 23' at 5.00m bgl.

5.4 Bedrock

5.4.1 Bedrock has not been encountered during this phase of investigation works.

5.5 Groundwater

5.5.1 These intrusive investigations have not identified any groundwater ingress within any of the exploratory hole positions. This suggests that the groundwater table lies at a significant depth below the site, possibly within the bedrock strata. Groundwater is not considered to represent an important hazard to the development of the site but waster entries into excavations cannot and should not be discontinued.

5.5.2 It should be acknowledged that further localised groundwater may accumulate within the clay deposits, especially during episodes of intense rainfall, and that this may locally result in flooding of deeper excavations and require localised sump pumping techniques.

5.6 Excavations

5.6.1 The natural strata across the site typically comprises of firm becoming stiff cohesive clays units. Excavations within the clay strata is anticipated to be capable of remaining open for a significant period of time without side support. However, the presence of inherent weaknesses within the clay strata are such that sudden catastrophic collapse of any excavation made within this site cannot be ruled out. Accordingly, all excavations made within the site should be provided with appropriate side support.

5.6.2 It is essential that personnel should not be allowed to approach or enter any excavation made upon this site unless appropriate precautions have been adopted to ensure that hazardous side instability has been prevented.

This is particularly important in relation to foundation and drainage construction where personnel may be specifically required to enter deeper excavations for construction purposes. Reference should be made to H.S.E. publications 150 for guidance.

5.7 Contamination

5.7.1 The intrusive investigations have not identified any significant visual or olfactory evidence of contamination and the underlying natural strata is not known to be affected by any naturally occurring environmental hazards.

5.7.2 Topsoil deposits have been recorded across the wider site area and further samples have been obtained to determine the topsoil's suitability for reuse and retention within the proposed residential development.

5.8 Sampling

5.8.1 Based upon the initial site appraisal in conjunction with the findings of the intrusive investigation, a series of representative samples of the strata encountered have been retained for laboratory analyses. These analyses have been intended to determine the potential presence of any contamination which may represent a hazard to the site operatives or end users of the site. This section of work is considered in more detail in section 7 of this report.

5.9 SUDS

5.9.1 Assessment of the ground conditions present within this site in terms of sustainable urban drainage confirms the presence of topsoil overlying effectively impermeable cohesive natural strata across the majority of the site. As such, we consider the site is unsuitable for the adoption of a soakaway system and other means of surface water disposal should be considered.

6.0 CONTAMINATION ANALYSIS & ASSESSMENT CRITERIA

6.1 Sampling

6.1.1 This investigation has identified topsoil deposits across the wider site area. A total of fifteen (15 No.) samples of strata have been retained during this investigation for chemical analysis. These samples are considered to be representative of the ground conditions within the site and form a basis for assessment of their potential for retention within a residential environment.

6.1.2 All samples obtained from this site were considered to be subject to a programme of PAH analyses. Accordingly, all samples have been placed into a 500ml wide necked brown glass jar. All soil samples have been stored in cool boxes at temperatures of approximately 4º (+ or - 2ºC) until delivery to the selected laboratory. All sample containers were marked with the site address, trial pit or borehole number, depth and date of sampling. All samples have been tested within the specified handling period to accord with the sampling protocol presented by i2 Analytical Ltd.

6.2 Range

6.2.1 Topsoil deposits have been recorded to extend across the whole site area, with no made ground deposits identified. Representative samples of the topsoil have been retained for analysis to determine whether their suitable for retention within the proposed development.

6.2.2 Desk Study information has not indicated any potentially naturally occurring elevated concentrations of contaminants within the natural strata and therefore, the natural strata is considered suitable for retention within the proposed development.

6.3 Laboratory

6.3.1 All samples selected for chemical analyses have been returned to i2 Analytical Ltd, who are an MCERTS and UKAS accredited laboratory facility. Each sample has been subject to a range of chemical analyses to determine the concentrations of a wide range of common contaminants applicable to the former use of this site and the materials present. Details of the analysis programme are shown in table 6 below. Confirmation of the UKAS and MCERTS accreditations for each test is indicated within the results which are appended to this report.

6.4 Development Proposals

6.4.1 We understand that the site is to be re-developed in a residential manner with associated rear gardens, areas of hard standing and access roads. It is essential to ensure that the materials present within the sensitive site areas are suitable for retention within a residential environment.

6.5 Analysis Range

6.5.1 The preliminary conceptual model identifies that there is the potential for a pollutant pathway linkage to be present at the site and that further assessment is required. Table 6 below confirms the range of analyses undertaken upon the samples of made ground and topsoil obtained from this site.

Table 6: Chemical Testing Schedule

Analysis	Determinands	No. of Samples
Metals	Arsenic, Cadmium, Chromium (total), Copper, Lead, Mercury, Nickel, Selenium, Zinc	15
Organics 1	PAH – USEPA 16 suite, Phenol	15
Asbestos	Asbestos Screen	15
Inorganics	Cyanide, Soluble sulphates, Sulphide, pH, TOC	15
Hydrocarbons	TPH (CWG) (BTEX)	1

6.6 Results

6.6.1 Full details of the chemical analyses results are appended to this report for reference and should be read in conjunction with the comments and recommendations regarding risk assessments. Summaries of the test results are presented in conjunction with the current assessment criteria in Section 7 of this report.

6.7 Approach

6.7.1 The current UK approach to the consideration of contaminated land is based upon the Principals of risk assessment. This in turn is founded upon the use of a source-pathway-target Principal in order to establish the presence of a potential pollutant linkage. Our approach to the risk assessment is consistent with UK guidance and best practice. As advocated in the EA Policy Statement: Guidelines for Environmental Risk Assessment and Management a tiered approach has been adopted. This tiered approach is central to Part IIA of the Environmental Protection Act 1990 and the Town and Country Planning Act 1990.

6.8 Site Classification

6.8.1 We have not been provided with a proposed site layout at the time of this investigation, however, we have been made aware that the site is intended to be developed on a private residential basis with private rear garden areas Accordingly, the site usage has been considered on the basis of an end land use of **residential with plant uptake** as defined by EA Science Report SC050021/SR3 2009 in relation to the most recent soil guideline values.

6.9 Criteria

6.9.1 The concentrations of contaminants within the ground have been compared to a range of generic soil guideline values that have been prepared by DEFRA and the Environment Agency. Where published, soil guideline values (SGV) have been utilised as intervention values for the purpose of an initial tier 1 assessment.

6.9.2 At the time of the preparation of this report soil guideline values were available only for a limited number of contaminants and the development of both the CLEA model and additional soil guideline values is on-going. Where published soil guideline values are available, they have been utilised as intervention values for the purposes of an initial tier 1 assessment. A number of SGV's have recently been updated to reflect a modern approach to the protection of human health.

6.9.3 In March 2014 the Department for Environment Food & Rural Affairs published SP1010: Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination Policy Companion Document. This document provides a series of Category 4 screening levels based upon differing land uses.
Reference has been made to the values presented within this report in relation to the appropriate land usage.

6.9.4 Where soil guideline values were not published at the time of preparing this report, generic assessment criteria (GAC) published by Land Quality Management Ltd., in conjunction with the Chartered Institute of Environmental Health have been adopted. The values published in the "LQM/CIEH S4UL's for Human Health Risk Assessment" Registration No. S4UL3265.

6.9.5 Reference has also been made to published soil screening values presented by Atkins Ltd., under their Atrisk Subscription Service. The SSVs have been adopted where SGVs or GACs are not available. The remaining contaminants have been considered based upon information that was the best available at the time of the study.

7.0 RESULTS OF ANALYSIS & QUALITATIVE RISK ASSESSMENT

7.1 Model

7.1.1 As discussed above, assessment of contaminated land is based upon a simple assessment of pollutant linkages referred to as the source-pathway-target model.
This assessment considers the current or proposed usage of the site in terms of suitability for use. This implies the use of risk assessment in Principal in order to evaluate the potential effects and concerns of contamination on a site-specific basis.

7.1.2 Initial assessment of the chemical analyses results has been undertaken to assess the concentrations of determinands in relation to tier 1 assessment criteria. The summary of these test results is detailed below.

7.2 Results Summary

7.2.1 The samples were obtained from the topsoil deposits across the whole of the site. Tables 7 to 10 have been prepared as a summary of the laboratory analyses depending upon the class of analyses undertaken and the strata type present. The test results have been compared to the adopted assessment criteria, relating to a proposed residential with home grown produce land usage.

7.3 Metals & Inorganics

7.3.1 Table 7 indicates the range of contaminants that were included within the metals and inorganics analyses along with their respective assessment criteria. A review of the results shows no elevated readings.

Table 7: Summary of Contamination Analysis: Metals & Inorganics

	No. of Samples	Range of Values (mg/kg)	Assessment Criteria (mg/kg)	No. of Samples Failing	Locations
Arsenic	15	5.3 – 20	37[3]	0	-
Cadmium	15	<0.2 – 0.3	11.0[3]	0	-
Chromium (total)	15	26 - 43	910[3]	0	-
Copper	15	13 – 39	2400[3]	0	-
Lead	15	17 – 59	200[1]	0	-
Mercury	15	<0.3	1.2[3]	0	-
Nickel	15	17 – 46	130[3]	0	-
Selenium	15	<1.0	250[3]	0	-
Zinc	15	34 – 120	3700[3]	0	-
Total Cyanide	15	<1.0	34.2[2]	0	-
Phenol	15	<1.0	280[3]	0	-
pH	15	5.5 – 8.5	-	0	-
SOM	15	1.89 – 7.01	-	0	-
TOC	15	1.1 – 4.1	-	0	-
SO_4 (2:1)	15	23 – 92	500	0	-
Asbestos	15	ND	Present/Absent	0	-

[1] DEFRA : SP1010 : Category 4 Screening Levels
[2] Atkins Atrisk SSV residential with home grown produce (1% SOM)
[3] LQM and CIEH S4UL's for Human Health Risk Assessment (Registration No. S4UL 3265) 2015 residential with home grown produce (1% SOM)
[4] BRE Special Digest 1:2005 DS-1 *ND – None Detected*

7.3.2 Samples of the topsoil have been screened for the presence of asbestos. No asbestos fibres have been identified and therefore, no remedial works are required in terms of asbestos containing materials and fibres.

7.4 Speciated PAH

7.4.1 The topsoil samples retained from the site investigation have been subject to a programme of analyses which have assessed the concentrations of the individual constituents of the polycyclic aromatic hydrocarbon series. A summary of these results is shown in table 8. The assessment criteria utilised are based upon the presence of 1.0% soil organic matter within the samples generally. Reference to the tests results does however show more variable soil organic matter content.

Table 8: Summary of Contamination Analysis: Organics: PAH USEPA 16 Suite					
	No. of Samples	**Range of Values (mg/kg)**	**Assessment Criteria[1] (mg/kg)**	**No. of Samples Failing**	**Locations**
Naphthalene	15	<0.05	2.3	0	-
Acenaphthylene	15	<0.05	170	0	-
Acenaphthene	15	<0.05	210	0	-
Fluorene	15	<0.05	170	0	-
Phenanthrene	15	<0.05 – 0.26	95.0	0	-
Anthracene	15	<0.05 – 0.05	2400	0	-
Fluoranthene	15	<0.05 – 0.69	280	0	-
Pyrene	15	<0.05 – 0.64	620	0	-
Benzo{a}anthracene	15	<0.05 – 0.38	7.2	0	-
Chrysene	15	<0.05 – 0.42	15.0	0	-
Benzo{a}pyrene	15	<0.05 – 0.47	2.2[2]	0	-
Indeno{123-cd}pyrene	15	<0.05 – 0.21	27.0	0	-
Dibenz{ah}anthracene	15	<0.05	0.24	0	-
Benzo{ghi}perylene	15	<0.05 – 0.26	320	0	-
Benzo{b}fluoranthene	15	<0.05 – 0.47	2.6	0	-
Benzo{k}fluoranthene	15	<0.05 – 0.24	77.0	0	-

[1] LQM & CIEH S4UL's for human health risk assessment (Registration No. S4UL 3265) – Residential with home grown produce (1% SOM) 2015
[2] DEFRA : SP1010 : Category 4 Screening Levels

7.4.2 Assessment of table 8 has indicated there are no elevated concentrations of PAH compounds above the adopted assessment criteria.

7.5 TPH (CWG

7.5.1 As part of the analysis of the topsoil material, chemical testing has been extended to the hydrocarbon fractions and the results are appended in table 9 overleaf. A review of the data indicates the results are below the assessment criteria and as such, there is no requirement for remediation in terms of hydrocarbons.

Table 9: Summary of Contamination Analysis: Organics: TPH (CWG) Suite					
	No. of Samples	**Range of Values mg/kg**	**Assessment* Criteria mg/kg**	**No. of Samples Failing**	**Notes**
Aliphatic EC> 5 - 6	1	<0.01	42.0	0	-
Aliphatic EC> 6 - 8	1	<0.01	100	0	-
Aliphatic EC> 8 - 10	1	<0.01	27.0	0	-
Aliphatic EC> 10 - 12	1	<1.0	130	0	-
Aliphatic EC> 12 - 16	1	<2.0	1100	0	-
Aliphatic EC> 16 - 35	1	<8.0	65000	0	-
Aliphatic EC> 35 - 44	1	<8.4	65000	0	-
Aromatic EC> 5 - 7	1	<0.01	70.0	0	-
Aromatic EC> 7 - 8	1	<0.01	130.0	0	-
Aromatic EC> 8 - 10	1	<0.02	34.0	0	-
Aromatic EC> 10 - 12	1	<1.0	74.0	0	-
Aromatic EC> 12 - 16	1	<2.0	140	0	-
Aromatic EC> 16 - 21	1	<10	260	0	-
Aromatic EC> 21 - 35	1	<10	1100	0	-
Aromatic EC> 35 - 44	1	<8.4	1100	0	-

**Criteria values based upon LQM & CIEH S4UL's for human health risk assessment (Registration No. S4UL 3265) – Residential with home grown produce (1% SOM) 2015*

7.6 BTEX

7.6.1 As part of the hydrocarbon analysis, the BTEX range of hydrocarbons have been analysed. All concentrations have been recorded below the limit of detection (LOD), and therefore no remediation is required in terms of BTEX fractions.

Table 10: Summary of Contamination Analysis: Organics: BTEX Suite

	No. of Samples	Range of Values (ug/kg)	Assessment* Criteria (mg/kg)	No. of Samples Failing	Notes
Benzene	1	<5	0.087	0	
Toluene	1	<5	130	0	
EthylBenzene	1	<5	47.0	0	
M/PXylenes	1	<8	59.0	0	
O - Xylene	1	<5	60.0	0	
Methyl tert–Butyl Ether	1	<5	20[1]	0	

Criteria values based upon LQM & CIEH S4UL's for human health risk assessment (Registration No. S4UL 3265) – Residential with home grown produce (1% SOM) 2015
[1]Atkins Atrisk SSV residential with home grown produce (1% SOM)

7.7 Sulphates

7.7.1 Within the programme of laboratory testing each sample has also been analysed to determine the concentration of water-soluble sulphates within the ground. Reference to the laboratory results presented by i2 Analytical Ltd confirms that soluble sulphates are present at concentrations of 23 and 92 mg/l. Reference to BRE Special Publication 1: 2005 "Concrete in Aggressive Ground" confirms that at <500 mg/l, the ACEC class for this site is assessed to be AC-1s on the basis that static water is present with a pH >2.5. Reference to table D1 of the BRE publication confirms that the ground contact concrete and mortar should be designed to DC-1 for an intended working life or at least 100 years.

7.8 Index Properties

7.8.1 A total of seventeen (17 No.) samples of the natural clay strata encountered during these investigations have been returned to a civil laboratory to determine their index properties. Copies of the laboratory tests are appended to this report for reference. A summary of the plasticity index tests are shown in table 11 overleaf.

Table 11: Summary of Plasticity Index Test Results			
Location	**Depth (m bgl)**	**Modified Plasticity Index (%)**	**NHBC Volume Change Potential**
WS04	1.70	21.56	Medium
TP01	1.50	19.53	Low
TP02	2.10	15.87	Low
TP07	1.60	18.05	Low
TP11	2.10	21.00	Medium
TP12	2.00	21.36	Medium
TP14	2.30	22.00	Medium
TP18	1.90	20.24	Medium
TP19	2.20	23.52	Medium
TP20	1.80	18.04	Low
TP22	2.00	18.90	Low
TP16	2.40	20.16	Medium
TP24	2.40	21.85	Medium
TP26	2.30	20.16	Medium
TP27	2.50	19.09	Low
TP28	2.20	14.82	Low
TP31	1.70	21.56	Medium

7.8.2 On average, the clays within the site exhibit a medium volume change potential, with modified plasticity index results between 20.16% and 23.52%. Several locations did exhibit a lower modified plasticity index between 14.82% and 19.53%. However, with reference to the NHBC Guidance, Chapter 4.2, on average the site could be classified as having a medium volume change based on the worst case scenario.

8.0 DISCUSSIONS

8.1 General

8.1.1 The desk study information has identified that the site has remained a parcel of farmland until the present day. Several ponds of varying sizes have been noted throughout the sites recorded historical, with the final pond being lost from the survey in the early 1990's. Schoolhouse Farm was situated on the southern tip of the development site for around 100 years, being demolished around the early 1990's. The remainder of the site has experienced minimal change, with development consisting primarily of residential properties and Hutton Grammar School to the south of Liverpool Road.

8.1.2 The ground investigation has identified relatively uniform ground conditions comprising of topsoil overlying predominantly cohesive clay deposits, with a silt bed noted only within WS01 from 4.90m bgl. Bedrock has not been encountered within any of the exploratory hole locations during this investigation.

8.1.3 The results of the chemical analyses undertaken upon representative samples of strata obtained from this site have been assessed in Section 7 above and subject to further discussion below.

8.2 Contamination

8.2.1 The chemical analysis undertaken on the representative samples of topsoil have not identified any elevated concentrations of metals, inorganics, PAH or TPH compounds. Therefore, the topsoil is suitable for retention within a residential development.

8.2.2 Where any visual or olfactory evidence of suspicious ground conditions are encountered during the development process, it is important that works within this area are terminated and appropriate authorities notified. Appropriate inspection, sampling and testing should then be undertaken to determine whether these materials represent a potential hazard to site operatives or end users of the site prior to works recommencing.

8.3 Revised Conceptual Site Model

8.3.1 As a result of these intrusive ground investigations and subsequent programme of chemical analyses, it has been possible to revise the preliminary conceptual site model presented in Section 3. The revised conceptual site model is now shown in table 12. This report adopts the methodology for risk evaluation presented in CIRIA report C552 'Contaminated Land Risk Assessment – A Guide to Good Practice', 2001. The method is qualitative and involves the classification of the following.

8.3.2 In the context of regulatory definition of 'Contaminated Land' (as defined by the EPA 1990), 'very high' and 'high' risks would fall under the classification of 'Contaminated Land'. 'Moderate' risk could also potentially be classified as 'Contaminated Land' but any lower risk rating would not. Thus, the following potential exposure pathways between potential and known contaminant sources based on information provided to date and receptors are tentatively identified in table 12 overleaf.

Table 12 –Conceptual Site Model

Potential Source	Potential Receptor	Possible Pathway	Probability	Consequence	Risk	Mitigation / Investigation
Contaminated soils	Future site users	Direct contact of soils Inhalation or ingestion of soil / dust	Lw	Mi	Low	Topsoil is deemed suitable for reuse and retention within a residential environment.
	Surface water in the vicinity of the site	Leaching of contaminants through drainage system	Lw	Mi	Low	
	Ground water in aquifer	Leaching of contaminants to ground water	Ul	Md	Low	
	Future site users	Vapour migration from soils	Ul	Md	Low	
	Proposed buildings and services	Direct contact with contaminated soils	Ul	Md	Low	
	Plants in gardens and soft landscaping	Direct contact	Lw	Mi	Low	
Contaminated ground water	Site personnel during construction	Water entering excavations	Lw	Mi	Low	No visual or olfactory evidence of groundwater contamination present.
	Future site Users	Retained surface water	Lw	Mi	Low	
Toxic and explosive gases	Proposed buildings and occupiers	Ground gas migration into buildings	Ul	Md	Low	No ground gas issues.
Radon gases	Proposed buildings and occupiers	Ground gas migration into buildings	Ul	Md	Low	Less than 1% of properties above the action level. No radon precautions required.

Key: Consequence: Sv = Severe, Md = Medium, Mi = Mild, Mr = Minor
Probability: Hi = High, Li = Likely, Lw = Low Likelihood, Ul = Unlikely

8.4 Foundations

8.4.1 The underlying natural cohesive deposits are fairly uniform across the site and comprise of a boulder clay with varying quantities of sands and gravels. Based on the results from the standard penetration tests and hand vane tests, the natural strata strata are considered to offer a safe bearing capacity in the order of 150kN/m^2 at a minimum depth of 1.00m below ground level, with greater bearing capacities achieved with increasing depth. Based upon this information, it is anticipated that the majority of the site will adopt a traditional strip type foundation, constructed at depths of around 1.00m bgl.

8.4.2 Available BGS records show an inferred fault of unknown displacement located 22m north east the development site. Taking into consideration the information gained from the investigation, alongside the presence of the fault, it is anticipated that the majority of plots can be found utilising traditional strip or deep strip foundations. However, reinforcement is required within all strip footings due to the presence of the geological fault (B385).

8.4.3 The majority of the shallow ground conditions present within the site comprise of cohesive clays which are susceptible to volume change potential as a result of varying moisture content. Laboratory analysis undertaken upon samples of clay strata have shown varying plasticity indices. However, under the worst case scenario, the site is classified as having a medium volume change potential as defined by the NHBC Handbook, Chapter 4.2.

8.5 Ground Floor Construction

8.5.1 It is recommended that all properties within the site should be provided with a suspended ground floor construction. This may be of a specialist manufactured pre-cast concrete beam and block type or of a designed cast in situ construction. In those areas where tree root effects are important it is recommended that a pre-cast concrete beam and block type floor is utilised to allow for the provision of a suitable air void below ground floor construction.

8.6 SUDS

8.6.1 Assessment of the ground conditions present within this site in terms of sustainable urban drainage confirms the presence of topsoil overlying effectively impermeable cohesive natural strata across the majority of the site. As such, we consider the site is unsuitable for the adoption of a soakaway system and other means of surface water disposal should be considered.

9.0 CONCLUSIONS & RECOMMENDATIONS

9.1 Further Work

9.1.1 If any unusual or suspicious strata or ground conditions are encountered during the subsequent site stripping preparation work, it will be necessary for these areas to be bought to the attention of the appropriate authorities so that all necessary inspection, sampling and testing may be undertaken to determine whether these materials present a hazard to human health. It is incumbent upon the site contractors to advise a responsible authority of any unusual findings within the site which may then be further investigated.

10.0 NOTES

11.1 All reports are for advisory purposes only and all design decisions are the ultimate responsibility of others.

10.2 Unless stated otherwise the investigation has been undertaken in general accordance with the recommendations given in BS 5930 : 1999 "A Code of Practice for site Investigations" and the laboratory testing has been carried out in accordance with BS 1377 : 1990 "Methods of Test for Civil Engineering Purposes".

10.3 Soil and rock descriptions are generally based on the scales of strength and relative density within BS 5930 although it should be noted that in certain circumstances descriptions are based on site records or a qualitative assessment without the benefit of in-situ or laboratory test results.

10.4 The assessment of ground conditions given in this report is based on the results of the fieldwork and laboratory testing carried out and there may be other conditions at the site not encountered by these works, which have not been taken into account.

10.5 The scope of the investigation and information provided may not necessarily reflect all the geotechnical and environmental aspects related to the site, and the omission of certain items does not mean that the site is unaffected by such problems.

10.6 It should be noted that groundwater levels can vary and may at times be significantly different to those recorded during the investigation and attention is drawn to BS 5930 which indicates that measurements may be necessary over an extended period of time to investigate changes in groundwater pressures due to seasonal, tidal and other causes.

10.7 Any recommendations on construction methods within this report are for initial guidance only and all design proposals remain the responsibility of the appropriate contractor/consultant.

10.8 Further assessment, investigation, construction activities or time may reveal conditions that were not found during the period of investigation and, therefore, could not have been taken into account in the preparation of the report and where such information might impact upon the stated opinion R. E. Fry & Associates Ltd request the opportunity to review such information and modify the report if necessary.

10.9 Where information has been obtained from sources other than the direct findings of the investigation, R. E. Fry & Associates Ltd cannot and does not guarantee the authenticity or reliability of this information.

10.10 Where opinions expressed in this report are based on current available guidelines and legislation, no liability can be accepted by R. E. Fry & Associates Ltd for the effects of any future changes to such guidelines and legislation.

10.11 This report has been prepared on the instructions and to the requirements of the named client and any unauthorised party using this information for any purpose does so at his own risk and any duty of care to that party is excluded.

Signed for and on behalf of
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