

Phase 1 Geotechnical & Geo-environmental Site Investigation

Albrighton South

Boningale Homes Limited

28 March 2024

**PHASE 1
GEOTECHNICAL AND GEO-ENVIRONMENTAL
SITE INVESTIGATION**

ALBRIGHTON SOUTH

FOR

BONINGALE HOMES LIMITED

ISSUE 1



48842-ECE-XX-XX-RP-C-0001

28 March 2024

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Job No. : 48842
Report Status : Issue 1
Document Date : 28 March 2024

Approved :



Kate Edwards
Technical Director

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Appendix 1 Site Walkover Photographs

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1.0 EXECUTIVE SUMMARY

1. The approximately 47 hectare site is located to the north of Holyhead Road, to the south west of Albrighton, in Shropshire.
2. The site is currently occupied by arable agricultural fields, separated and bordered by hedgerows, with occasional areas of large mature trees. Five ponds are present across the site, and culverted watercourses are present across the central portion of the site and on the western half of the site.
3. A topographical survey has been reviewed; average gradients across the site are expected to range between 1 in 35 to 1 in 128.
4. Historically, the site has been agricultural land, with no significant development to the present day. There is however expected to be a number of infilled ponds within the site, one of which is classified as a landfill.
5. The solid geology beneath the majority of the site is expected to comprise strata of the Mercia Mudstone Formation (i.e. mudstones with subordinate siltstones, interbedded sandstones, and thick halite-bearing units). Sandstone units within the Mercia Mudstone Formation are present below the central southwest and central north of the site (below around 10% of the site). In the south western and south eastern corners of the site (below ~20% of the site), the solid geology is expected to comprise the Helsby Sandstone Formation (i.e. gravelly (pebbly) sandstone). Superficial deposits, comprising Glacial Till (i.e. clay with sand and gravel lenses) are recorded below around 50% of the site, below the western end, centre and north east.
6. Topsoil is anticipated to be present across the entire site. Isolated potentially deep areas of made ground are expected within the infilled ponds. The natural ground below the majority of the site is expected to consist of clay over mudstone bedrock. Sand over sandstone bedrock is expected below around 30% of the site. Shallow groundwater is expected to be present.
7. Given the high density of wells, ponds and watercourses shown on the site and surrounding area, a shallow water table is expected. Assuming no significant raising of ground levels, and where no deepening of foundations is required, the most suitable foundations are likely to be strip or trench fill footings taken onto undisturbed non-desiccated natural ground.
8. Due to the shallow water table, piled foundations should be considered where foundations are to be deepened due to tree influence, as well as where structures overlie backfilled ponds.

9. Where foundations span across different ground types, e.g., clay and rock, they should be taken down to found on the same material, or thickened and reinforced to minimise the effects of differential settlement.
10. Allowances may need to be made for groundwater control and support of foundation excavations prior to pouring concrete.
11. Excavation problems to take into consideration include poor side stability in trenches in granular soils and where there is shallow groundwater. Shallow bedrock may also be present which may make deeper excavations difficult.
12. Overhead service lines are present across the south of Zone B, and culverts potentially cross the eastern areas of both Zone A and Zone B.
13. A well was observed on the southern boundary of Zone A, and wells were also recorded on the central eastern edges of Zone A and B. Additional wells may also be present on the site. Where encountered wells should either be excavated and backfilled with well compacted material, or capped.
14. Where water-softened ground is present, additional strengthening should be allowed for in the road construction; this could comprise a thickened subbase/capping layer and the provision of a geogrid.
15. Given the expected cohesive ground conditions over the majority of the site and shallow groundwater table, it is not expected that soakaway drainage will be viable. Infiltration testing and groundwater monitoring will be required to confirm this.
16. No radon precautions are required. For buildings within 250 m of the infilled ponds, at this stage a fully sealed gas membrane system and passive ventilation (equivalent to Characteristic Situation 2) should be allowed for.
17. Significant contamination is generally not expected across the majority of the site. Where localised areas of made ground are present, allowances should be made for installing a minimum 600 mm thick clean capping in gardens and landscaped areas, minimum DS-2 AC-2 sulphate precautions in below ground concrete as well as protective water supply pipes.
18. Before more definite information regarding the properties of the ground and any contamination present can be given, an intrusive investigation will be required. The conclusions made in this report in relation to contamination are subject to agreement by the approving bodies and your warranty provider.

2.0 INTRODUCTION

2.1 Terms of Reference

This report presents the findings of a Phase 1 Geotechnical and Geo-environmental Site Investigation carried out by Eastwood & Partners (Consulting Engineers) Limited trading as Eastwood Consulting Engineers (ECE) for, and on the instructions of Boningale Homes Limited. Any other parties using the information in this report do so at their own risk and any duty of care is excluded.

2.2 Context

ECE are not aware of any previous investigations undertaken on this site.

2.3 Aims and Objectives

The aims and objectives of this investigation were as follows:

To assimilate and review information extracted from published documentation and a site walkover to derive an outline conceptual model identifying potential contaminants, pathways and receptors, as well as possible linkages between these;

To detail the expected ground conditions and their geotechnical properties enabling outline foundation proposals to be made for the proposed residential development; and

To outline proposals for a Phase 2 intrusive investigation, the purpose of which would be to obtain information to test the conceptual model and assess the risks to receptors as well as to confirm the foundation proposals.

2.4 Scope of Investigation

The investigation involved a review of information extracted from published documentation. Information regarding the current and former land uses both on and surrounding the site, as well as the environmental sensitivity of the location as determined by factors including geology, hydrogeology and hydrology have been examined.

Information analysed has been obtained from a variety of sources and included the following:

A Landmark Envirocheck;

British Geological Survey maps and memoirs; and

A site walkover.

2.5 Limitations of Investigation

This report is based on the assumption that the site will be developed predominantly with residential properties with private gardens. It is also proposed to construct a secondary school, care home and community centre on the western portion of the site. It is assumed that existing ground levels will not alter significantly. If this is not the case, then the advice given in this report may not be appropriate.

Where assessments of site areas affected in particular ways are given, these are approximate. All information, comments and opinions given in this report are based on the documentary information examined. This report considers the ground and groundwater and does not cover any buildings, their fabric or the constituents of any hardstanding. Risks to ecological receptors, such as bats, have not been considered.

3.0 THE SITE

3.1 Description

The approximately 47 hectare site is located to the south west of Albrighton, in Shropshire, and is centred on grid reference 380450, 302990. The site is located to the north of Holyhead Road, with the north-south trending Patshull Road crossing the centre of the site, and Cross Road and Newhouse Lane bordering the western and eastern edges of the site, respectively.

For the purpose of this report, the site has been separated into two areas, referenced as Zone A (west) and Zone B (east) as shown below:



Zone A comprises three arable agricultural fields, separated and bordered by hedgerows. Three ponds are present in this zone located on the north east corner, on the central southern boundary and on the central north of the zone. All of the ponds are surrounded by large mature trees, with sporadic isolated larger mature trees across the fields, and occasional large mature trees within the perimeter hedgerows. Surface water was also observed in isolated areas of this zone.

A drainage ditch (~2 m wide by 1.0 to 1.5 m deep) with water present, is located along the eastern boundary of the zone, in a north south orientation, adjacent to Patshull Road.

A log pile with some tyres was observed along the south eastern boundary of Zone A, predominantly on the adjacent property.

A 600 mm diameter brick-lined feature, which appears to be a well, with water present at a depth of 1.5 m to 2.0 m from ground level, is present on the southern boundary of the western field, in Zone A.

Lea Farm is not part of the site, but is within the central south of Zone A, surrounded by the fields of the site.

Zone B comprises two arable agricultural fields, separated and bordered by hedgerows with occasional areas of, and isolated, large mature trees. A pond is present on central north of this zone, surrounded by large mature trees. Surface water was also observed in isolated areas of this zone. A culvert is present to the south east of the pond, trending south east towards Newhouse Lane. Drainage ditches, with water present, are along the northern (~2.60 m wide and ~1.50 m deep) and eastern (~2.00 m wide by ~1.10 m deep) boundaries of the zone.

There appears to be evidence of animal setts along the boundaries of the site.

A topographical survey was undertaken in 2024, and shows that Zone A generally slopes from 96.50 m AOD in the north west to 91 m AOD in the south east, at a gradient of approximately 1 in 76. The south western area of Zone A slopes slightly steeper down towards the east than the rest of the site, from 98.50 m AOD in the west to 93 m AOD in the east, at a gradient of approximately 1 in 35.

Zone B is relatively flat in the north, but generally slopes towards the south from 92.50 m AOD in the north to 87.50 m AOD in the south, at a gradient of approximately 1 in 128. The southern area of Zone B slopes slightly steeper down to the south, from 93 m AOD to 87.50 m AOD, at a gradient of approximately 1 in 55.

An overhead cable follows the south western boundary of Zone A. Telephone cables follow the north eastern and north western boundaries of Zone A and the eastern and south western boundaries of Zone B. An overhead electric cable crosses the south of Zone B, orientated eastwards.

The surrounding area is predominantly agricultural land, with a number of residential properties along Cross Road to the west of Zone A, Patshull Road between Zone A and Zone B and along Newhouse Lane to the east of Zone B. There is a business park adjacent to the western boundary of Zone A, and an animal feed shop to the south west of the site. A storage yard was also present to the north west of Zone B.

Photographs from the site walkover are included in the Appendix.

3.2 History

Historical Ordnance Survey maps provided in the Envirocheck, and aerial photography, have been reviewed to assess the previous use of the site and surrounding area. The maps, together with the Envirocheck, can be found in the Appendix.

3.2.1 The Site

Zone A

The earliest historical maps, dated 1882 to 1888, shows that Zone A is occupied by around ten agricultural fields, separated and bordered by tree-lined field boundaries. Three tree-lined ponds are present in this zone, located on the north east corner, on the central southern boundary and on the central north of the zone. A small pond is also present on the central eastern boundary of the zone.

By 1924, a north-south trending, southerly flowing watercourse is shown to cross the eastern edge of the zone.

By 1988, a number of field boundaries have been removed and the fields have been amalgamated into three large fields. It appears that the watercourse on the eastern edge of the site has been culverted.

By 2023, a small watercourse is shown to issue on the central eastern boundary of the zone, and remains along the south eastern boundary of the zone.

No other significant changes are shown on the subsequent historical maps or aerial photography.

Zone B

The earliest historical maps, dated 1882 to 1888, shows that Zone B is occupied by around seven agricultural fields, separated and bordered by tree-lined field boundaries. Four tree-lined ponds are located on the centre of the zone, and one pond is located on the central eastern boundary of the site. A well is present on the central eastern boundary of the zone.

By 1924, a north-south trending, southerly flowing watercourse is shown to cross the north western corner of the zone.

By 1960 to 1966, the three ponds located on the centre of the zone have combined into one large pond and the remaining ponds have been infilled. A number of field boundaries have been removed,

and the fields have been amalgamated into five fields. A portion of the watercourse on the north west of the zone has been infilled.

By 1989, the pond on the centre of the zone has reduced in size and is shown as two separate ponds

By 2023, further field boundaries have been removed, and the fields have been amalgamated into two fields. A portion of watercourse appears to remain along the north western boundary of the zone.

No other significant changes are shown on the subsequent historical maps or aerial photography.

3.2.2 The Surrounding Area

The earliest maps, dated 1882 to 1888, indicates that the majority of the surrounding area is occupied by agricultural land, with occasional residential properties (including Lea Hall to the south of the site, The Birches to the west, New Houses to the east and Stonehouse to the south east). Lea Farm is not part of the site, but is within the central south of Zone A, surrounded by the fields of the site. A blacksmiths is located to the south of the site. A number of ponds, wells and water pumps are present in the surrounding area.

By 1924, a westerly flowing watercourse is present directly to the north east of the site, flowing into the watercourse crossing the site.

By 1950, a small residential development is present approximately 50 m to the north of the site.

By 1966, further more extensive residential development has occurred to the north of the site.

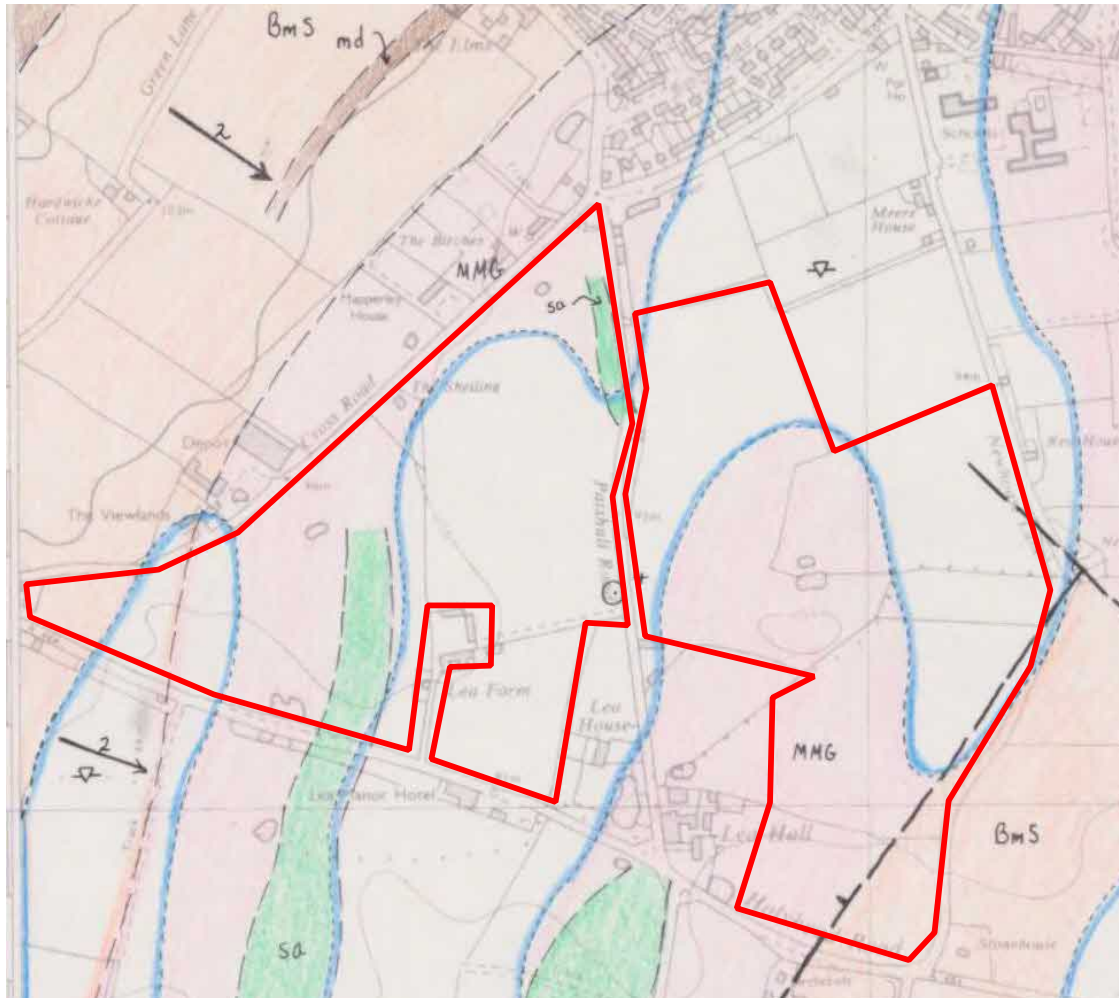
By 1989, shows a depot adjacent to the north western boundary of the site.

By 2000, a number of drains and watercourse are shown in the surrounding area.

3.3 Geology

The geological maps SJ80SW (1:10,000), Wolverhampton 153 (1:50,000 scale), and the British Geological Survey (BGS) Online Viewer have been consulted.

An extract of the 1:10,000 geological map is provided below, with site boundary shown in red:



The solid geology beneath the majority of the site is expected to comprise strata of the Mercia Mudstone Formation (i.e. mudstones with subordinate siltstones, interbedded sandstones, and thick halite-bearing units). Sandstone units within the Mercia Mudstone Formation are present below the central southwest and central north of the site (below around 10% of the site). In the south western and south eastern corners of the site (below ~20% of the site), the solid geology is expected to comprise the Helsby Sandstone Formation (i.e. gravelly (pebbly) sandstone).

According to the Envirocheck, there is no hazard potential for ground dissolution stability hazards.

The geological map shows that the solid geology generally dips to the south east at approximately 2 degrees.

Superficial deposits, comprising Glacial Till (i.e. clay with sand and gravel lenses) are recorded below around 50% of the site, below the western end, centre and north east of the site.

A BGS borehole indicates that a well may be present on the central eastern boundary of Zone A, however this location may be an erroneous placement on the map, as the record details the location

of the well as Lea Farm. The well record details that sandstone bedrock was present close to ground level and that groundwater was encountered at 2.4 m.

Two faults, trending north east to south west and north west to south east cross the eastern edge of the site.

3.4 Extractive Industries

3.4.1 Coal Mining

The geological mapping does not show any outcropping coal seams within several kilometres of the site. Both the Coal Authority Interactive Map and the Envirocheck state that the site is in an area not likely to be affected by coal mining. Precautions against shallow coal mining are therefore not considered to be necessary.

3.4.2 Halite

The Mercia Mudstone Formation is recorded to contain halite lenses. There is no evidence on the geological or historical maps or geological memoirs to indicate that halite extraction has occurred on site or in the surrounding area. Therefore, halite extraction is not considered to present a significant risk to the site.

3.5 Hydrogeology

3.5.1 Groundwater Vulnerability

The Helsby Sandstone Formation, below the south western and south eastern corners of the site, is classified as a Principal Aquifer. This is defined as strategically important rock units that have high permeability and water storage capacity.

The Mercia Mudstone Formation bedrock is classified as a Secondary B Aquifer. This is defined as lower permeability layers that may store and yield limited amounts of groundwater through characteristics like thin cracks or fissures. The sandstone units of the Mercia Mudstone Formation are classified as a Secondary A Aquifer. This is defined as 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.

The superficial Glacial Till deposits are classified as Secondary Aquifer – Undifferentiated. This is assigned when it is not possible to attribute either category A or B to a rock type, due to its variable characteristics.

3.5.2 Groundwater Abstractions

According to the Envirocheck, there is one water abstraction within 500 m of the site, located 8 m to the east of the site, for agricultural use (spray irrigation). The licence has been revoked.

The site lies within a groundwater Source Protection Zone 3.

3.6 Hydrology

A number of surface water features, including ponds, drainage ditches and minor unnamed watercourses, are present on the site and in the immediate surrounding area. The nearest watercourse is an unnamed tributary of Pasford Brook, located approximately 550 m east of the site.

3.7 Ground Gas

According to the Envirocheck, the site is within a lower probability radon area (less than 1% of homes are estimated to be at or above the Action Level). No radon protective measures are therefore considered necessary in the construction of new dwellings or extensions.

The Envirocheck records two landfills on the site, located on the centre of Zone B, and on the central northern boundary of the site. The landfill on Zone B is relatively small, and is likely associated with the backfilling of a pond or depression. It is recorded as containing household waste, however, there are no input dates provided. There are no details for the landfill on the central northern boundary of the site and extent of the landfill is not shown. The Local Authority has been contacted and reports there is only one landfill record corresponding to the landfill located in the centre of Zone B. The Local Authority state there is no record of any monitoring, waste input or dates relating to this landfill site however, the Local Authority noted that the area was shown on a 1976 OS plan as a refuse tip.

Two potentially infilled land features are recorded on the site, associated with the infilled ponds on Zone B. Five potentially infilled features are recorded within 250 m of the site, located 41 m to 220 m north and east of the site, appearing to be predominantly associated with infilled ponds.

Given there are a number of potentially infilled features recorded on site, one of which is a recorded to be a landfill, a programme of gas monitoring is recommended to determine the level of gas precautions required.

3.8 Pollution Incidents to Controlled Waters

According to the Envirocheck, there is one pollution incident within 250 m of the site, located 155 m to the north east of the site. This incident was classified as a Category 3 (minor incident) and involved

surface water sewage entering a ditch, in 1999. Due to the incident type, distance from the site, and age of the incident, it is not considered likely to pose a significant risk to the site.

3.9 Local Authority Pollution Prevention and Controls

There are no Local Authority Pollution Prevention and Controls recorded within 1 km of the site.

3.10 Discharge Consents

There are two discharge consents recorded within 250 m of the site, located 11 m east and 37 m south east the site, relating to sewage discharges.

3.11 Flooding

The Envirocheck records that the site lies within a Flood Zone 1.

According to the Envirocheck, the centre and central north of the site, and portions of the eastern and western halves of the site (covering approximately 40% of the site) have a low (1,000-year return) to high (30-year return) risk of flooding from surface water. The high-risk areas are predominantly associated with the watercourses crossing and bordering the site.

The Envirocheck shows that the central and western portions of the site (around 30% of the site, associated with the Glacial Till deposits) have potential for groundwater flooding to occur at the surface. The eastern end of the site (around 20% of the site, associated with the Glacial Till deposits) is recorded as having the potential for groundwater flooding of property situated below ground level. Small portions of the site (around 10% of the site, associated with the sandstone bedrock), are recorded as having a limited potential for groundwater flooding, and the remainder of the site is not recorded to be at risk of groundwater flooding.

3.12 Soil Geochemistry

The Envirocheck estimates the following concentrations of arsenic, cadmium, chromium, nickel and lead to be present in the natural soil at the site. These have been compared to the appropriate assessment value protective of residential human health receptors with homegrown produce.

Contaminant	Estimated Concentration (mg/kg)	Assessment Value (mg/kg)
Arsenic	<15	37
Cadmium	<1.8	11
Chromium	40 to 90	910
Lead	<100	200
Nickel	<15 to 30	180

The concentrations of these contaminants are therefore not expected to be elevated within the natural soils.

3.13 Contemporary Trade Directory Entries and Fuel Station Entries

There are three contemporary trade directory entries recorded within 250 m of the site, located 4 m north, 30 m north west and 35 m north of the site, relating to a power transmission service, agricultural merchants and vehicle repair garage.

The Envirocheck does not record any fuel stations within 250 m of site.

4.0 EXPECTED GROUND CONDITIONS

4.1 Surface Covering

Topsoil is anticipated to cover the majority of the site.

4.2 Made Ground

Given the site history, a significant depth of made ground is not anticipated below the majority of the site.

Isolated deeper areas of made ground are expected within the infilled ponds.

4.3 Natural Ground

Geological maps indicate Glacial Till (clay with sand lenses) may cover ~50% of the site. A BGS record for a well sinking within Zone A indicates sandstone is present near ground level, indicating the superficial deposits are not that thick.

The solid geology is expected to consist of clay over mudstone bedrock. Sand over sandstone bedrock is expected on the south western and south eastern corners of the site and portions of the western half of the site (below around 30% of the site).

4.4 Groundwater

Given the geology and topography of the surrounding area, the ponds, drains and watercourses on and in the surrounding area of the site, and the potential for groundwater flooding on the site, groundwater may be encountered at shallow depth.

5.0 OUTLINE CONCEPTUAL MODEL

It is assumed that the site will be developed predominantly with residential properties with private gardens. It is also proposed to construct a secondary school, care home and community centre on the western portion of the site.

5.1 Potential Sources of Contamination

Historically, the site has been agricultural land, with no significant development to the present day.

A number of infilled ponds are expected, one of which is noted to be a landfill. Any made ground which is present may contain elevated concentrations of metals/metalloids, polycyclic aromatic hydrocarbons (PAHs), asbestos fibres and sulphates. Volatile/semi organic compounds (VOCs/SVOCs) and petroleum hydrocarbons (TPH) may also be encountered in these localised areas.

The surrounding area is predominantly open farmland or housing which are not expected to pose a significant contaminative risk to the site. A small depot which features a vehicle parts manufacturer is present on the north western site boundary, but aerial photography indicates the site is predominantly hard surfaced, which would cut off the pathway between the depot and this site.

5.2 Ground Gas

No radon protective measures are considered necessary.

There are a number of potentially infilled features recorded on site, one of which is a recorded to be a landfill. A programme of gas monitoring is required to determine the level of gas precautions required. At this stage, a fully sealed gas membrane system and passive ventilation should be allowed for in buildings constructed within 250 m of these features.

5.3 Potential Pollutant Linkages

The following table details the possible sources and associated contaminants of concern, pathways and receptors:

Source	Potential Contaminants	Potential Pathways	Potential Receptors
Made ground (general)	Heavy metals/metalloids Asbestos PAHs	Ingestion Inhalation Direct contact Biological uptake	Site end users & and visitors Site construction workers Principal, Secondary A and B and Secondary Undifferentiated Aquifers
Made ground (landfill / infilled ponds)	Heavy metals/metalloids Asbestos PAHs VOCs/SVOCs TPH	Migration through ground	Plants Water supply pipes
Made or natural ground	Sulphates Low pH	Direct contact	Below ground concrete
Infilled ponds, including 'landfill'	Ground gas	Migration through ground.	Site end users & and visitors Site construction workers Buildings

5.4 Remedial Measures

Significant contamination is generally not expected across the majority of the site. An intrusive investigation is required to confirm the site won materials are suitable for re-use.

For buildings within 250 m of the infilled ponds and landfill, a fully sealed gas membrane system and passive ventilation (equivalent to Characteristic Situation 2) should be allowed for. With regards to the infilled ponds, there may be opportunity to excavate the backfill and place in areas of open space where levels are to be raised.

Where localised areas of made ground are present, it is considered that you make allowance for the following:

A minimum 600 mm thick clean capping for gardens and landscaped areas;

A minimum DS-2 AC-2 level of sulphate precautions in below ground concrete structures within contact with made ground; and

Protective water supply pipes.

6.0 GEOTECHNICAL APPRAISAL

6.1 General

Topsoil is anticipated to be present across the entire site. Isolated potentially deep areas of made ground are expected within the infilled ponds. The natural ground below the majority of the site is expected to consist of clay over mudstone bedrock. Sand over sandstone bedrock is expected below around 30% of the site. Shallow groundwater is expected to be present.

The Party Wall Act will need to be considered for structures associated with neighbouring properties along the site boundaries.

6.2 Foundations

Given the high density of wells, ponds and watercourses shown on the site and surrounding area, a shallow water table is expected. A possible well was observed to contain water from around 1.5 m depth, and drainage ditches also contained water around 1 m bgl during our walkover which was undertaken in March 2024.

Assuming no significant raising of ground levels, and where no deepening of foundations is required, the most suitable foundations are likely to be strip or trench fill footings taken onto undisturbed non-desiccated natural ground. The minimum footing depth is likely to be 900 mm in clay soils and 600 mm in granular soils.

Footings within clay are dependent on the volume change potential of the soil. This would need to be determined as part of an intrusive investigation.

Where foundations are in clay and within influencing distance of past, present or proposed trees, the footing depth will need to be increased in accordance with the NHBC Standards Chapter 4.2. Precautions against soil heave due to the influence of past or present trees are likely to be required wherever the footing depth is greater than 1500 mm. Due to the shallow water table, piled foundations should be considered where foundations are to be deepened due to tree influence.

Piled foundations should also be considered for structures overlying infilled ponds.

Two faults are inferred to cross the site. Where foundations span across different ground types, e.g., clay and rock, they should be taken down to found on the same material, or thickened and reinforced to minimise the effects of differential settlement.

Groundwater control may need to be allowed for in deeper excavations, and time of year considered when planning excavations.

6.3 Ground Slabs

Ground bearing floor slabs are considered to be appropriate across the majority of the site if there is no significant raising of ground levels.

Where more than 600 mm of made ground is present, reinforced suspended slabs or precast concrete floors with a minimum 150 mm high ventilated void should be used. The void height will need to be increased where heave precautions are required.

If gas precautions are required, a precast concrete floor with an underlying minimum 150 mm high ventilated void will be necessary.

6.4 Superstructure Precautions

At this stage, no additional superstructure precautions are expected to be required due to the anticipated ground conditions below the site.

6.5 Excavation Problems & Obstructions

Allowances may need to be made for groundwater control and support of foundation excavations prior to pouring concrete.

A BGS well sinking record noted sandstone at 2.4 m in the nearby farm. Shallow bedrock may therefore be present below a proportion of the site.

The stability of trenches may be poor in made ground and where shallow groundwater is encountered. Temporary support will be required in accordance with current Health & Safety Regulations wherever access is required to trenches deeper than 1.2 m or less where there is risk of collapse.

Overhead service lines are present across the south of Zone B, and culverts potentially cross the eastern areas of both Zone A and Zone B.

A well was observed on the southern boundary of Zone A, and wells were also recorded on the central eastern edges of Zone A and B. Additional wells may also be present on the site. Where encountered wells should either be excavated and backfilled with well compacted material, or capped.

6.6 Roads

A CBR value of at least 2% is likely to be appropriate for road design. Though, this may be lower in the vicinity of the landfills and infilled ponds. The ground should be assumed to be frost susceptible and a minimum construction thickness of 450 mm will therefore apply. It is recommended that CBR

tests are undertaken along any proposed roads prior to construction so that more accurate CBR values can be obtained.

Where water-softened ground is present, additional strengthening should be allowed for in the road construction; this could comprise a thickened subbase/capping layer and the provision of a geogrid.

6.7 Surface Water Drainage

Given the expected cohesive ground conditions over the majority of the site and shallow groundwater table, it is not expected that soakaway drainage will be viable. Potentially permeable sandy/granular ground is expected below ~30% of the site, but a shallow water table is still expected which may preclude the use of soakaways.

Infiltration testing and groundwater monitoring undertaken as part of the intrusive investigation will be required to confirm this.

7.0 RECOMMENDATIONS FOR FURTHER WORK

Before more definite information regarding the properties of the ground and any contamination present can be given, an intrusive ground investigation will be required. Investigation by mechanically dug trial pits would be the preferred method of investigating the soils on site, as this allows a larger volume of soil to be viewed.

The potential pollutant linkages presented in Section 5.3 will need to be investigated by means of soil analysis. The chemical testing suite should be chosen to cover the range of potential contaminants indicated. Geotechnical testing should be carried out on clay soils to determine their volume change potential.

Infiltration testing should be undertaken to assess the feasibility of surface water discharge by soakaways. This should be combined with seasonal groundwater monitoring.

Where infilled ponds and landfill is present, gas monitoring wells should be installed to target these areas, as well as the land surrounding the features, to determine if gas measures are required in the proposed development.