ONYXGEO
CONSULTING LTD.

Phase II Site Investigation Report

at

Lower Perryland Farm, Basing Hill, Dial Post, West Sussex

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Prepared for:
Lower Perrylands Limited

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CONTENTS

Appendices

1 INTRODUCTION & BACKGROUND

1.1 INSTRUCTION & APPOINTMENT

Onyx Geo Consulting Ltd (referred to as Onyx Geo) was commissioned by Lower Perrylands Limited to carry out a Phase II Site Investigation for the site at Lower Perryland Farm, Basing Hill, Dial Post, West Sussex.

The appointment was confirmed on the 18th of April 2025 via email signed by Mike Jones of Lower Perrylands Limited.

The work was carried out based on Onyx Geo's fee proposal letter dated 17th April 2025, quote ref: ON251030, including the outlined terms and conditions. The quotation serves as the formal agreement between Onyx Geo and the Client.

1.2 SITE LOCATION & DESCRIPTION

The site comprises an irregularly shaped 0.95 ha plot of land situated to the southwest of the village of Dial Post and to the west of the A24 centred on grid reference 514471, 118810. A site location plan is included as Figure 1 within Appendix B. The current layout is shown in Figure 2.

The site is accessed via a track/driveway from the A24, which extends along the site's northern boundary into a farmyard. The farmyard is surfaced with poorly maintained concrete hardstanding it is reported that the farm was used to house livestock.

In the centre of the site there are five barns in varying states of disrepair. The western barn is of steel frame construction with an asbestos cement roof. Fragments of suspected asbestos cement were noted on the ground surface adjacent to this barn. A caravan/mobile home, and a boat are stored in this barn. There are two other barns attached to this building with block brick sides and corrugated steel roofs and two steel roofed barns in the east of the site.

A concrete track is present along the northern side of all the barns with two smaller barns to the north of the track. These both have asbestos cement roofs and are in a poor state of repair. There is a grain silo located in the centre of the site.

Within the barns a concrete track was present in the centre and soft ground on either side where the cattle stalls would have been located.

There is a further barn on the eastern side of the site, of brick construction with an asbestos roof and a larger barn along the northern boundary also with an asbestos roof. Two smaller barns are located on the western side of the site at the southern end of the area of hardstanding.

A large oak tree is located in the centre of the northern site boundary. There are smaller immature trees and shrubs growing close to the barns within the hardstanding. The site is bound to the east by a hedgerow with a residential property and gardens beyond. There is a greenhouse in the southeast of the site which was overgrown, and it was not possible to fully inspect.

A stream (Lancing Brook) is present, aligned east to west through the northern part of the site, culverted under the hardstanding access road and along the eastern side of the site. The stream is approximately 1- 1.5m below current ground level and the banks are overgrown with vegetation.

There are several spoil heaps of waste dotted around the site with concrete and breeze blocks identified within the vegetation. There are also tyres stockpiled in front of the central barn building and a stack of suspect asbestos cement sheets within the middle barn.

1.3 Proposed Development

It is proposed to redevelop the site by demolishing the most western barn and converting the remaining barns to form five residential properties, including private gardens and associated areas of car parking. The proposed development layout is presented in Figure 3.

To establish the minimum requirements for the scope and content of geotechnical investigations, BS EN 1997-1:2004+A1:2013 (Eurocode 7) requires the complexity of each geotechnical design, along with the associated risks, to be identified. The geotechnical design categories range between 1 to 3 with increasing complexity.

Given that the proposal consists of only minor extensions to the existing buildings, the development would be considered to comprise of Category 1 structures.

1.4 Aims & Objectives

The purpose of this investigation is to identify, and where possible quantify risks associated with the ground on site, which may impact the proposed development. The specific objectives are:

- Conduct an intrusive investigation of the underlying ground and groundwater conditions including field and laboratory testing to quantify the risks highlighted within the preliminary conceptual model reported in the phase 1 desk study (see section 1.6.1).
- Refine the conceptual model based on the ground investigation and analysis undertaken.
- Provide guidance on the potential geotechnical and contaminative risks present on site to aid the design process.
- Address the requirements for Horsham District Council planning condition 1(b) for application reference DC/24/1087, which states that:

An intrusive site investigation scheme, based on (a) (the Desk Study) *to provide information for a detailed risk assessment to the degree and nature of the risk posed by any contamination to all receptors that may be affected, including those off site.*

Planning condition 1 also refers to the preparation of a remediation strategy (1c) and a verification plan (1d) subject to the findings of the site investigation.

1.5 Regulatory Framework, Guidance and Best Practice

The investigation of the site has been undertaken line following guidance and British Standards:

- BS 5930:2015+A1:2020 Code of Practice for Ground Investigations
- BS10175:2011+A2:2017 Investigation of potentially contaminated sites. Code of practice.
- BS EN ISO 14688 (2018) Geotechnical investigation and testing - Identification and classification of soil. Parts 1-2
- BS 8004:2015+A1:2020 Code of Practice for foundations

The guidance outlines a systematic approach whereby the need to evaluate risks from site is understood, any potential contaminant linkages between sources of contamination, pathways, and receptors are first identified and then quantified, followed by an assessment on whether any risks are unacceptable.

A tiered approach is applied, utilising a structured process to thoroughly evaluate the risks, namely:

- Preliminary risk assessment (PRA)
- Generic quantitative risk assessment (GQRA)
- Detailed quantitative risk assessment (DQRA) if required

1.5.1 Preliminary Risk Assessment

The PRA is reported separately in the report ref. ON251025-ON-PD-XX-RP-G-701-C01 dated 14/04/25 and the findings are summarised in section 1.7.

1.5.2 Intrusive Investigation

This part of the works has been undertaken in general accordance with BS EN 1997-2:2007, BS 5930 Code of Practice for Ground Investigations and BS10175 Investigation of potentially contaminated sites. Whilst this report would comply with the requirements of a ground investigation report it does not comply with the requirements of a geotechnical design report as set out within BS EN 1997 Eurocode 7. The recommendations are provided to aid preliminary geotechnical design, detailed design must consider both ultimate and serviceability limit state scenarios.

To achieve the aims outlined in section 1.4 above, the proposed intrusive site works comprised the following activities:

- GPR service clearance and GPS positioning of each trial hole location.
- Machine dug trial pitting extending to approximately 3.0 m below ground level (bgl).
- Laboratory geotechnical classification testing to aid shallow foundation design including Atterberg limits, moisture content, and BRE SD1 suite tests.
- Laboratory chemical tests for potential contaminants of concern, including metals, polycyclic aromatic hydrocarbons (PAH), pesticides and asbestos screening.

1.6 Previous Studies

The site has been the subject of one previous report by Onyx Geo, namely:

- Desk study report by Onyx Geo dated 14/04/25 (report ref: ON251025-ON-PD-XX-RP-G-701-C01).

A short summary is provided below.

1.6.1 Desk Study Report

The desk study and walkover survey were completed by Onyx Geo in April 2025. The report noted that the site was occupied by several barns, which were reportedly used to house cattle although a caravan and boat were also being stored in one. Aerial imagery indicated that the site had at times been occupied by several cars / vans and some material storage had occurred on the west of the site which had subsequently been removed. A stream crossed the northern area of the site

aligned from east to west. Historical mapping indicated that a farm building was present to the west of the current structures which was demolished sometime between 1993 and 2003.

A preliminary conceptual site model (pCSM) was prepared for the site and the proposed development. From a contaminated land perspective, the key drivers for the intrusive investigation were the potential contaminant linkages associated with the following sources: asbestos in the barns themselves and the shallow soils surrounding them; the potential for metal, PAH and asbestos contamination within made ground in the farmyard; and pesticides potentially associated with historical farming activities.

Contaminant linkages with respect to ground gas and groundwater were not identified.

Geotechnical hazards identified included the potential need for: deepening of foundations associated with the volume change potential of the Weald Clay Formation; the potential for elevated sulphate and sulphide concentrations within the Weald Clay which may impact concrete design; the potential for perched water within the made ground (if present), and the potential for frost susceptibility of the Weald Clay was also highlighted.

The report recommended that a site investigation be undertaken to enable sampling for chemical and geotechnical laboratory testing.

1.6.2 Other Information

Documents noted on the planning portal report the presence of a diesel store and cesspit / septic tank on site. However, these were not observed as part of the desk study walkover or during the current site investigation.

2 INTRUSIVE INVESTIGATION

2.1 BASIS OF INTRUSIVE INVESTIGATION

The aims of the intrusive investigation are set out in Section 1.4.

2.2 HEALTH & SAFETY

The site works were undertaken in line with a site-specific risk assessment and method statement (RAMS) prepared for the site. The RAMS was sent to the client and subcontractors prior to site attendance. A site induction and relevant toolbox talks were given to site attendees who were also signed in to site and onto the RAMS.

2.3 WORKS UNDERTAKEN

The works were carried out on the 6th May 2025 during a dry and sunny period. The Met Office weather and climate summaries[1] have been reviewed for information pertaining to the three months prior to the site works. The summaries indicate that the three months preceding the site work were all drier than average. The Met Office indicate that England experienced 79% and 25% of average monthly rainfall in February and March 2025 respectively. The south of England experienced 47% of average precipitation in April 2025.

The investigation comprised trial pitting with a backhoe excavator and soil sampling for geotechnical and chemical laboratory testing.

A summary of the works and depths achieved together with any variation from the proposed scope is presented in Table 1 below. Further details on the investigation methodologies can be found in Appendix D. Details on the individual exploratory holes are provided on the hole logs given in Appendix E.

Table 1: Summary of the intrusive investigation

Method and Number	Depths achieved (m)	Date	Notes
GPR clearance & GPS positioning	n/a	06/05/25	The proposed trial pit locations and the surrounding area were scanned and cleared of underground services using GPR and positioned using GPS.
Machine excavated trial pits TP01 – TP08	2.7 – 3.0	06/05/25	Provide general site coverage to provide information on the ground conditions and enable sampling for geotechnical and chemical laboratory testing. TP08: was situated in the location of the former farm building demolished post 1993.

[1] https://www.metoffice.gov.uk/research/climate/maps-and-data/summaries/index accessed May 2025

Method and Number	Depths achieved (m)	Date	Notes
Surface sampling	0.0	06/05/25	Surface sample 1: collect fragment of suspected ACM cement for confirmatory testing. Surface sample 2: To collect a shallow soil sample from within the footprint of the existing barn.

2.4 Exploratory Hole Distribution

The trial hole locations were determined based the proposed scope, available space, access and the presence of below ground services. The trial hole locations are shown in Figure 4, Appendix B. The investigation spacing is broadly consistent with the recommended density of 25 to 50 m for an exploratory investigation after BS 10175 Section 7.7.

It was not possible to undertake machine excavated trial pits within the footprint of the existing structures. However, a single sample of the made ground present at surface within one of the barns (as shown on Figure 4) was collected and analysed.

2.5 Logging, Sampling and In situ Testing

2.5.1 Soil Logging and Sampling

Soil samples were recovered from the trial holes and inspected for detailed logging and sampling. Soils were logged in general accordance with BS 5930 and ISO 14688.

2.6 Soil Laboratory Analysis

2.6.1 Chemical Analysis

Soil samples were subjected to chemical laboratory testing, as per BS 10175:2011+A2:. Samples were selected for testing based on the findings of the conceptual site model in the preliminary contamination risk assessment and from visual and olfactory evidence noted during the intrusive investigation stage.

The laboratory testing was carried out by i2 Analytical. Details of the UKAS and MCERTS accreditation for the individual laboratory test results are shown on the result certificates which are included in Appendix G.

A summary of the analytical chemical testing undertaken is presented in Table 2.

Table 2: Summary of chemical laboratory testing

Contaminant or contaminant suite	Number of samples per soil type			
	Topsoil / Subsoil	Made Ground	Natural Clay	Suspected ACM Fragment
Onyx standard soil suite (As, Cd, Cr, CrVI, Cu, Pb, Hg, Ni, Se, Zn, USEPA 16 PAHs pH TOC, asbestos)	2	4	2	-
Organochlorine and organophosphorus pesticide suites	2	-	-	-
Asbestos identification	-	-	-	2

2.6.2 Geotechnical Laboratory Testing

To provide information to aid the geotechnical assessment the following laboratory testing has been carried out by Geolabs Ltd. Where possible the following guidance has been followed BS 1377 Methods of test for soils for civil engineering purposes, BS EN ISO 17892 Parts 1-12 Geotechnical Investigation and Testing. Laboratory testing of soil and BS EN ISO 22475 Parts 1-3 Geotechnical Investigation and Testing.

The following laboratory tests have been undertaken and the full results presented in Appendix F:

Table 3: Summary of geotechnical laboratory testing

Laboratory Test	Samples per soil type tested	
	Superficial Clay	Weald Clay
Moisture Content	1	4
Atterberg Limit Test	1	4
BRE SD1 Suite (B)	-	3

2.7 Ground Conditions

The ground conditions encountered within the trial holes are presented in Table 4 below. The borehole log is included in Appendix E.

Table 4: Summary of ground conditions

Soil Type	Depth encountered m	Depth to base m	Typical Description	Interpreted Stata
TOPSOIL	0.0	0.20 / 0.25	Light brown to grey brown slightly sandy clayey silty TOPSOIL with rootlets. Rare flint gravel noted in TP03 and TP06 with rare chalk gravel also present in TP03. (Present in TP03, TP04, TP05 & TP06 only)	Topsoil
SUBSOIL	0.20 / 0.25	0.40 / 0.60	Yellowish to orangish brown slightly sandy silty clayey SUBSOIL. (Present in TP03, TP04, TP05 & TP06 only)	Subsoil
MADE GROUND	0.0 / 0.10	0.20 / 0.50	MADE GROUND comprising grey sandy gravel. Gravel is predominantly concrete, flint, brick, tile and whole bricks. Asphalt gravel was noted in TP02. (Present in TP01, TP02, TP07 & TP08 only)	Made Ground
CLAY	0.20 / 0.45	0.90 / 1.40	Stiff brown to orange brown mottled grey, occasionally iron stained black slightly sandy silty CLAY with rare to occasional fine to coarse subangular flint gravel. (Present in TP01, TP02, TP06, TP08)	Head / Reworked Weald Clay
SAND	0.90 / 1.40	2.0	Brown to dark red brown slightly clayey to clayey gravelly SAND. Sand is fine to medium. Gravel is medium to coarse subangular flint. (Present in TP06 only)	Head
CLAY	0.40 / 1.40	2.20 / 2.90	Stiff mottled orange brown occasionally red brown and grey slightly silty to silty CLAY with occasionally fine mudstone gravel increasing with depth.	Weald Clay Formation
MUDSTONE	2.20 / 2.70	2.7 / 3.0	Extremely weak to very weak brown to red brown and blue grey laminated silty MUDSTONE. (Absent in TP08)	Weald Clay Formation

*Full depth of investigation

2.7.1 Trends and Observations

The ground conditions on site comprised either topsoil and subsoil or made ground over natural clay deposits. In one location (TP02) the made ground was overlain by a 0.1 m thick layer of concrete hardstanding. Made ground was encountered in the north and western areas of the site and was generally around 0.3 m in depth, although it extended to 0.6 m bgl in TP07 in the southwest of the site.

Although not mapped on site slightly sandy clays with rare flint gravels, which were interpreted to represent either Head Deposits or reworked Weald Clay were encountered. These were generally situated in the north of the site, adjacent to the stream and extended to a maximum depth of 1.4

m bgl. TP06 encountered a 0.6 m thick layer of clayey gravelly sand potentially associated with a former route of the stream, no other granular deposits were encountered within any of the other trial holes. The superficial deposits were underlain by stiff silty clays of the Weald Clay Formation which transitioned to mudstone with depth.

2.7.2 Groundwater

Groundwater was encountered in the following exploratory holes at the time of the intrusive works. Groundwater strikes are recorded in Table 5, below.

Table 5: Summary of groundwater strikes and levels

Exploratory Hole	Depth to Groundwater strike bgl (mAOD)	Comments
TP03	2.3	Arisings recovered damp.
TP05	2.8	Slight groundwater seepage.

A slight groundwater seepage was recorded at 2.8 m bgl in TP05 while the arisings were noted to be damp below 2.3 m in TP03. In both cases these levels broadly correspond to the boundary between the stiff clay and the underlying mudstone.

3 GEOTECHNICAL CHARACTERISTICS

3.1 MADE GROUND

The area of the site surrounding the existing buildings is underlain by made ground, which extends to depths of between 0.2 and 0.6 m bgl. The made ground comprises sandy gravel with the gravel component consisting of flints, concrete, tile and brick.

Made ground is present due to the placement of various materials overtime for reasons such as to levelling a site, infilling of a depression or to provide hardcore on which to construct something. Therefore, made ground is generally variable and due to this it is subject to differential settlements when loads are applied. As such made ground is generally unsuitable as a load bearing stratum.

3.2 SUPERFICIAL DEPOSITS

The topsoil/subsoil and made ground is underlain by superficial deposits in some areas of the site comprising slightly sandy silty clay with occasionally flint gravel to between 0.9 m and 1.4 m bgl. A 0.6 m thick layer of clayey gravelly sand was encountered between 1.4 m and 2.0 m bgl in TP06.

Table 6: Geotechnical laboratory test results for the cohesive superficial deposits

Test Type	Unit	Test Results Range
Moisture Content	(%)	27.4
Liquid Limit	(%)	52
Plastic Limit	(%)	24
Plasticity Index	(%)	28

A single Atterberg limit test undertaken on the superficial cohesive deposits in TP08 and indicate they comprise high plasticity clays. An A line plot is presented in Figure 5.

3.3 WEALD CLAY FORMATION

The subsoil, made ground, and where present, superficial deposits were underlain by stiff silty clay of the Weald Clay Formation which transitioned to mudstone with depth.

3.3.1 Clay

The results of the geotechnical laboratory testing completed on the cohesive strata are summarised in Table 7 below.

Table 7: Geotechnical laboratory test results for the Weald Clay Formation

Test Type	Unit	Test Results Range
Moisture Content	(%)	21 – 25.9
Liquid Limit	(%)	47 - 63
Plastic Limit	(%)	22 - 27
Plasticity Index	(%)	25 - 36
Water Soluble Sulphate Content	mg/l	34 - 2600
Acid Soluble Sulphate	%	0.077 – 8.0
Total Sulphur	%	0.025 – 2.2

Test Type	Unit	Test Results Range
pH	-	5.8 – 7.7

The results of Atterberg limit testing of the Weald Clay deposits indicate that they comprise intermediate to high plasticity clay. An A line plot presenting the results of all Atterberg limit tests undertaken is presented in Figure 5.

Sulphate and sulphur testing returned highly variable results with significantly higher concentrations recorded within one sample taken from TP01. It is noted that this sample contained significant amounts of selenite and therefore the elevated sulphate concentrations are to be anticipated.

3.3.2 Mudstone

Mudstone was encountered below the clays in all trial holes other than TP08. Geotechnical laboratory testing of the rock at depth was beyond the scope of the investigation, based on field observations the material is classified as extremely weak becoming very weak with depth in some areas.

4 GEOTECHNICAL ASSESSMENT

The following assessment provides recommendations and guidance to aid the geotechnical design of the proposed structure(s). This is not a geotechnical design report (GDR), the final design should consider both the immediate and long-term design scenarios as well as both ultimate (ULS) and serviceability limit state (SLS) conditions.

4.1 SOIL AGGRESSIVITY / CONCRETE DURABILITY

The strata underlying the site are known to potentially contain elevated levels of sulphides in the form of pyrite. Construction, particularly the excavation of foundations, service runs and basements will result in disturbance of the underlying deposits. This has the potential to expose these sulphur bearing minerals leading to oxidation and the generation of sulphate containing minerals, which are soluble in water and can cause damage to concrete.

As set out in BRE Special Digest 1 where soils have the potential to contain pyrite a total of three samples of the Weald Clay were tested for water and acid soluble sulphate, total potential sulphate, total sulphur and pH.

The laboratory testing results indicate that oxidisable sulphides are generally present at concentrations below 0.3%, indicating that large volumes are pyrite are not present. Using highest sulphate class calculated from the water-soluble sulphate, total potential sulphate the soils are classified as **Design Sulphate Class DS-4.**

The groundwater conditions are considered to be static and therefore the site falls within ACEC class AC-3s.

4.2 VOLUME CHANGE POTENTIAL

The NHBC[2] provides guidance for the construction of foundations on soils subject to shrinkage and swelling due to their volume change potential (VCP) and the impact of trees and other vegetation. Based on the results of Atterberg limit testing the soils on site are classified as **High** VCP. Deepening may be terminated where intact mudstone is encountered.

The BGS GeoClimate study (UKCP18)[3] projects an increase in potential subsidence due to climate change with the percentage of properties impacted by shrinkable soils increasing from 3% in 2020 to 11% in 2070.

4.3 FROST SUSCEPTIBILITY

Based on the results of Atterberg limit testing the clay soils are non frost susceptible as the plasticity indices exceed 20% for poorly draining soils.

[2] NHBC Standards 2024 Chapter 4.2 Building near trees.

[3]https://www.bgs.ac.uk/news/maps-show-the-real-threat-of-climate-related-subsidence-to-british-homes-and-properties/

4.4 GROUNDWATER

A groundwater seepage was encountered in TP05 at 2.8 m bgl, and arisings were recovered damp in TP03 at 2.3 m bgl. In both cases the groundwater/damp soils appear to broadly correspond to the boundary between the clays and the underlying mudstone. Based on the findings to date minor groundwater seepages should be anticipated at the clay / mudstone boundary situated at between 2.0 and 3.0 m bgl. However, it should be noted that the investigation was undertaken during an exceptionally dry spring and therefore, there is the potential that shallower groundwater seepages may be encountered particularly during the winter months.

Winter groundwater monitoring has not been undertaken on site and may be required to confirm that worst case groundwater conditions on site. It should be noted that due to climate change, with anticipated wetter winters and periods of more intense rainfall groundwater levels across much of the south of England are expected to rise. Therefore, higher groundwater levels than those reported here may be anticipated in the medium term.

4.5 FOUNDATIONS

It is our understanding that the proposed development comprises redevelopment of the existing barn structures into residential properties. We understand that these properties will maintain the broad outline of the existing structures. However, some minor extensions are proposed which will require the installation of foundations.

It is key to ensure that the foundations extend below any made ground, loose, disturbed or desiccated ground. If foundations are anticipated to span different soil types e.g. between sands and gravels and clay, then allowance should be made for nominal reinforcement of the foundation to accommodate differential movement .

The bearing capacity is dependent on proposed foundation dimensions and depth as well as the buildings settlement tolerance. The below provides preliminary bearing capacities for specific foundation depths and widths and assumes a maximum tolerable settlement of 25 mm.

4.5.1 Shallow Foundations

4.5.1.1 Strip Foundations

Assuming a 600 mm wide and at least 1.0 m deep strip foundation, which is founded within the stiff clays then a preliminary allowable bearing capacity of 125kPa may be assumed for the cohesive deposits present on site. Foundations will require deepening to account for the High VCP of the underlying deposits and the presence of mature trees and hedge rows on site. High plasticity clays soften rapidly when wet and it is advisable that once excavated foundation trenches are not left exposed for significant periods of time where this can be avoided.

Where foundations are stepped or span different soil types, allowance should be made for nominal reinforcement.

Based on the current development layout at the findings of the investigation it is considered that the proposed foundations should not intersect the area of granular soils encountered in TP06. However, should the development layout change, or should granular soils be encountered within the foundation trenches then further investigation or probing of the encountered deposits is advised to confirm their extent and density.

4.6 Excavations

Excavations in made ground are likely to be unstable and subject to collapse. Excavations within the clay soils are likely to be stable in the short term, although minor groundwater seepages may be anticipated where excavations extend to the clay / mudstone boundary. A single area of clayey gravelly sand was encountered in TP06, excavations in this material are likely to be unstable in the short term particularly within the winter months where perched groundwater may be present within these more granular deposits.

Given the potential for groundwater seepages allowance should be in place for periodic pumping of excavations.

Appropriate precautions must be in place to ensure the safety of all operatives where entry into excavations is required. Alternative foundation methods may need to be adopted where footing excavations cannot be safely constructed.

4.7 Floor Slabs

Given the high VCP of the deposits and the required foundation deepening the NHBC[4] indicates suspended floor slabs should be adopted.

4.8 Pavements and Carriageways

It is understood that the proposed development includes access roads and private driveways. The investigation scope did not include allowance for California bearing ratio (CBR) testing. However, LR1132[5] indicates that preliminary CBR values for cohesive soils may be estimated based on the results of Atterberg limit testing. Based on the results of the plasticity testing a preliminary CBR value of 3% is considered appropriate for the silty clay subgrade.

High plasticity clay such as the Weald Clay softens rapidly when exposed to moisture, as such where possible excavation of formation level should be avoided during the wet winter months. Once excavated the formation level should be left exposed to the environment for as short a time as possible. Where softening occurs, over excavation, proof rolling and replacement with suitable compacted fill is recommended.

4.9 Level Alterations

The recommendations set out in this report assume that no significant level changes (cut or fill) are proposed as part of the design. Significant level raising may induce settlement particularly over areas of soft ground.

Should significant filling activities be proposed further investigation will be required to assess the impact of such earthworks of the proposed development.

[4] NHBC Standards 2024 Chapter 5.1 Substructure and ground-bearing floors

[5] TRRL Laboratory Report 1132 The structural design of bitumous roads. Powell, Potter Mayhew and Nunn (1984)

Where filling is proposed as part of residential developments, guidance and recommendations for using engineered fill on the development is given in Chapter 4.6 of the NHBC guidance[6].

4.10 Settlement

Based on the preliminary bearing capacity provided above, settlements should be within tolerable limits assuming footings are founded within the stiff clays or weak mudstone. If soft / loose deposits are encountered at formation level or below, greater settlement or potential differential settlement may be anticipated, and serviceable limit state analyses, or further investigation may be required. Settlement analysis is usually required for geotechnical category 2 and 3 structures.

Where foundations are stepped or span different soil types and allowance should be made for nominal reinforcement.

4.11 Heave and Uplift

The NHBC guidance[7] indicate safeguards against heave apply where foundations are within the influence of trees and the depth is greater than 1.5m. In this instance compressible material should be installed against the inside faces of the external wall foundations.

4.12 Retaining Structures

Onyx Geo is not aware of any retaining walls being proposed as part of the development.

[6] NHBC Standards 2024 Chapter 4.6 Engineered Fill

[7] NHBC Standards 2024 Chapter 4.2 Building near trees.

5 GEO-ENVIRONMENTAL RISK ASSESSMENT

5.1 UPDATED CONCEPTUAL SITE MODEL

The conceptual site model presented in the desk study identified potential risk from:

- Asbestos within existing structures, including a stockpile suspected to contain asbestos.
- Heavy metals, PAH compounds and asbestos within made ground (potentially associated with historical buildings, demolished structures and material storage).
- Pesticides from former farming activities.

Following the intrusive investigation, and prior to undertaking the Generic Quantitative Risk Assessment (GQRA) it is necessary to update the conceptual model to account for the findings of the investigation. No additional contaminant sources were identified in the areas investigated.

5.2 HUMAN HEALTH RISK ASSESSMENT

The GQRA for human health has been undertaken in accordance with the land contamination risk management (LCRM) guidance and the contaminated land exposure assessment (CLEA) methodology. Concentrations of contaminants of concern within soils have been compared directly to Generic Assessment Criteria (GAC) derived using the CLEA model for a residential with homegrown produce end use.

Ten soil samples were subjected to chemical analysis with a further two fragments of suspected ACM scheduled for asbestos identification testing. The soil samples tested comprised the topsoil, natural clay, as well as the made ground.

For some contaminants the assessment criteria varies depending on soil organic matter (SOM) content. GACs are available for soil SOM contents of 1%, 2.5% and 6%. The laboratory analysis includes total organic carbon (TOC). In order to convert the TOC into SOM a conversion factor of 1.72 is applied. The TOC concentration within the samples analysed ranged from 0.2% to 3.7% equating to an SOM range of 0.34% to 6.36%. The most conservative generic assessment criteria are for lower SOM soils therefore 1% SOM has been adopted.

The risk assessment does not include statistical analysis. CL:AIRE 2020[8] provides guidance on the appropriate sample sizes required for statistical analysis and the current testing regime does not comply with the minimum number of samples required. Therefore, direct comparisons of recorded concentrations and GAC have been made.

5.3 RISK ASSESSMENT

The most critical human receptor are future residents of the proposed development assuming private gardens are present. The table below compares the recorded contaminant concentrations within the samples analysed against the residential with homegrown produce generic assessment criteria. The full laboratory results are included in Appendix G.

[8] CL:AIRE (2020) Professional Guidance: Comparing Soil Contamination Data with a Critical Concentration.

Table 8: Summary of laboratory results

Contaminant	Conc. Range (mg/kg)	Generic Assessment Criteria (mg/kg)	GAC source[9],[10]	Exceedances
Arsenic	1.7 – 29	37	C4SL	None
Cadmium	<0.2 – 0.6	22	C4SL	None
Chromium	4.2 – 33	910	S4UL	None
Hexavalent Chromium	<1.8	21	C4SL	None
Copper	10 - 19	2,400	S4UL	None
Lead	6.1 – 38	200	C4SL	None
Mercury (inorganic)	<0.3	200	C4SL	None
Nickel	3.1 - 30	130	S4UL	None
Selenium	<1.0 – 5.9	250	S4UL	None
Zinc	37 – 340	3,700	S4UL	None
Benzo(a)pyrene^	<0.05 – 9.8	5	C4SL	9.8mg/kg in TP02 at 0.1m
Naphthalene	<0.05 – 0.12	15	C4SL	None
Total PAHs	<0.80 – 102	N/a	-	-

^Benzo(a)pyrene as surrogate marker for genotoxic PAHs

Chemical testing for metals and PAH compounds was undertaken on eight soil samples comprising of four of the made ground, two of the topsoil/subsoil and two underlying Weald Clay. One elevated concentration of the PAH marker compound benzo(a)pyrene (BaP) was recorded in made ground at 0.2m bgl in TP02 in the north of the site. No metals or PAH exceedances were recorded within any of the other samples tested and no exceedances of GAC were recorded within any of the natural soil samples tested.

The results indicate that the made ground in the areas tested is locally impacted with elevated PAH concentrations, which would pose an unacceptable risk to human health should they remain in areas of soft landscaping.

[9] SP1010 Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination (2014).

[10] Nathanail et al 20.15 The LQM/CIEH S4ULs for Human Health Risk Assessment. Land Quality Press, Nottingham. Copyright Land Quality Management Limited reproduced with permission; publication number S4UL3509. All rights reserved.

5.3.1 Pesticides

Two samples of the topsoil from TP03 and TP05 were tested for the presence of pesticides. Neither of the samples analysed recorded any of the determinants tested above the laboratory limit of detection (10 µg/kg).

5.3.2 Asbestos

Eight soil samples were screened for the presence of asbestos or asbestos containing materials (ACM). Two fragments of suspected asbestos containing cement were also tested for bulk asbestos, one fragment was collected from the ground surface adjacent to the western barn (surface sample 1) and the other from the made ground in TP01.

Asbestos was detected within two of the eight soil samples analysed, both positive results were from the made ground. Loose chrysotile fibres were recorded in TP01 at 0.2 m bgl (<0.001% by weight) and a chrysotile asbestos cement fragment was identified in TP02 at 0.1 m bgl and quantified at 0.173% by weight in the sample.

The cement fragments collected from TP01 and at the ground surface next to the western barn tested positive for chrysotile asbestos.

The results indicate that the shallow made ground around the existing barns is impacted with asbestos fibres and cement fragments with further fragments of cement present on the ground surface. These asbestos impacted soils would present an unacceptable risk to future residents if retained within areas of soft landscaping, including private gardens.

5.4 Construction Worker Risk Assessment

The CLEA model has been designed to assess chronic exposure and risk and is therefore not suitable for assessing the acute exposure risks to a site worker. Employers have a legal duty to ensure that suitable health and safety procedure are in place to protect demolition / construction workers from the risk posed by working in or close to potentially contaminated soils.

The existing buildings contain suspected chrysotile asbestos cement sheeting with more of this material likely to be present in the stockpiles and ACM debris at surface across the site. This material would pose a risk to demolition / construction workers. Removal and disposal of the ACM should be undertaken by a suitably qualified, competent contractor with all the necessary control measures in place to reduce the risks to the workforce and prevent the spread of asbestos across the site.

5.5 Controlled Waters Risk Assessment

The risk to groundwater was discounted within the desk study due the negligible permeability of the underlying strata and the absence of a high-risk / high sensitivity ground water receptor.

To date no gross contamination has been identified in the soil that would be considered to pose a significant risk to the surface water receptor (Lancing Brook) present in the north of the site. Localised PAH contamination within one made ground sample on site is not considered to pose a significant risk to surface water. In the soil samples tested, arsenic, cadmium, copper, lead,

mercury and nickel were reported at concentrations below normal background concentrations[11] published by the BGS. However, during the construction phase, controls should in place to prevent surface water runoff from entering the stream and include measures to prevent siltation of the stream.

5.6 Geo-Environmental Summary and Recommendations

Laboratory testing indicates that the made ground on site is impacted with loose asbestos fibres and ACM fragments, as well as localised PAH contaminated soils. Chemical analysis of the natural topsoil, subsoil and clay have not recorded the contaminants tested at concentrations above GACs. Where made ground soils are present in areas of proposed soft landscaping including private gardens they present an unacceptable risk to future residents.

Asbestos debris is also present within the buildings, at ground surface and suspected to be present in stockpiles around the site. These not only pose a risk to the future land users, but also to site workers during the demolition and construction phase.

It is noted that with the exception of one surface sample, no investigation or testing has been possible beneath the footprint of the existing structures, although given the intention for the proposed properties to match the current location of the barn's contaminant linkages from the underlying soils will be limited by the floor slab and other hardstanding. Limited testing was undertaken in the land to west of the barns, where historically stockpiles of unknown materials were stored. However, the current proposed development layout does not indicate any development in that part of the site.

Based on the findings of the investigation and generic risk assessment we recommend the following:

- A remediation strategy should be prepared for the site to manage or mitigate the risk posed by the asbestos and PAH contaminated made ground soils.
- The strategy should include a discovery strategy to deal with the potential for any unidentified contamination found on site.
- All works with asbestos and asbestos contaminated soils should be in accordance with the Control of Asbestos Regulations 2012.
- It is our understanding that the new properties are within the existing barn footprint and therefore the new ground floor slab will significantly limit the potential for direct contaminant exposure to future land users. However, following demolition it is recommended that the exposed material is visually inspected by a geoenvironmental consultant and any suspect material encountered is sampled and scheduled for laboratory testing.
- When it is known whether soils are to be disposed off site as a waste they should be suitably classified in advance of disposal. Consideration for a definition of waste code of practice materials management plan should also be part of the initial design works.

[11] https://www.bgs.ac.uk/geology-projects/applied-geochemistry/g-base-environmental-geochemistry/nbc-defra-project/

With respect to the topsoil it is a resource, and care should be taken not to damage the soil structure. Over working of topsoil when wet can lead to damage and reduce the soil's ability to drain once placed. Therefore, any soil stripping, stockpiling or placement should be completed during dry weather.

APPENDIX A – LIMITATIONS

This report, including any related study, inspection, testing, sampling, or interpretation (collectively referred to as "deliverables"), was prepared by Onyx Geo Consulting Limited (Onyx Geo), for the client specified in the first paragraph, following the terms outlined in Onyx Geo's fee proposal and standard terms (the "Appointment"). Onyx Geo delivered the Services with the level of expertise typical of geo-environmental consultants at the time. The report does not imply any specific fitness for purpose. The Services were completed within the limitations of scope, timing, and resources as agreed between Onyx Geo and the Client.

Except as specified above, Onyx Geo makes no further representations or warranties, either express or implied, concerning the Services. Liability for any actions related to this report expires six years from the report date or as legally specified, unless altered within the Appointment terms.

Onyx Geo conducted the Services exclusively for the Client's intended purpose. If this report or its contents are used by any third party without explicit written consent from Onyx Geo, any risk or liability lies solely with that party. It is recommended that third parties seek their own independent geo-environmental consultation.

The Client may not transfer or assign the benefits of this report to any third party without written permission from Onyx Geo. Should an assignment be agreed upon, any third-party rights provided will require a fee and will not extend beyond the terms initially agreed with the Client.

Onyx Geo understands this report is intended for the purpose outlined in its introduction. Any alterations in the site's intended use may invalidate the report. Onyx Geo is not liable for any use of this report outside its original purpose without a formal review.

Over time, changes in site conditions, regulations, technology, or economic circumstances may affect the accuracy or relevance of this report. For future reliance, written confirmation from Onyx Geo is advised.

The conclusions in this report are based on the specific Services provided as outlined in the Appointment. Onyx Geo holds no responsibility for undiscovered conditions that fall outside the scope of services originally agreed upon.

The Services were based on visible site conditions, historical site data, and publicly available information, relying on third-party data where applicable. Onyx Geo is not liable for inaccuracies in this information or for failing to independently verify third-party data.

Drawings included in this report are illustrative and may not be suitable for precise measurements. Marked features are approximate and for reference only.

Any subsequent review or update of this report may require additional fees at the agreed rates.

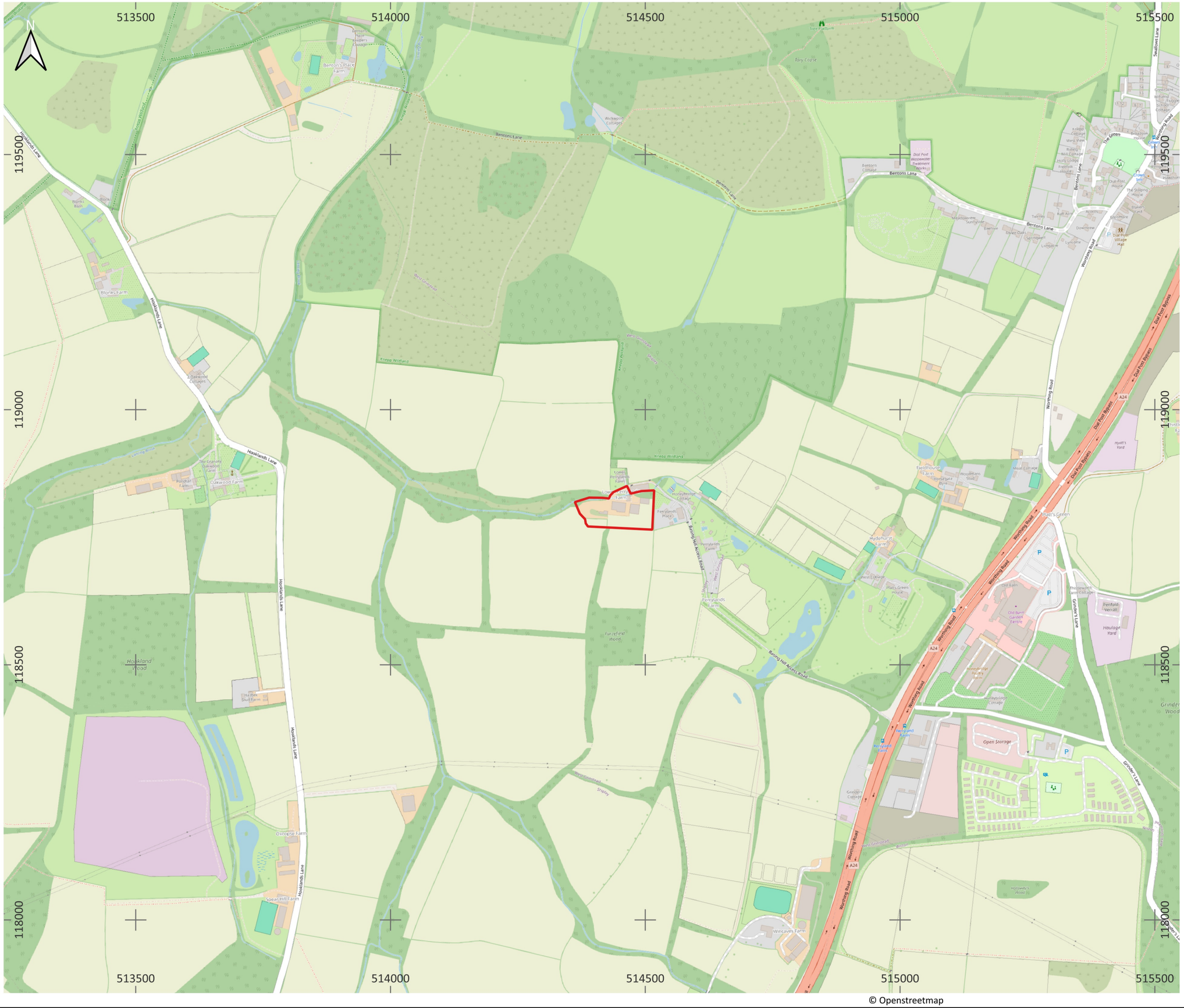
The conclusions from ground investigations rely on samples taken from specific site locations and represent only a limited area around these points.

Site conditions, particularly ground and groundwater variables, may change seasonally, and additional variation beyond that reported here cannot be ruled out.

The presence of asbestos, if any, is not fully assessed within this report. A comprehensive asbestos survey is recommended for any thorough evaluation.

Preliminary geotechnical recommendations are provided and should be validated in a final Geotechnical Design Report once structural design plans are confirmed.

APPENDIX B – FIGURES AND DRAWINGS



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3. The drawing is the property of Onyx Geo Consulting Ltd and is not to be used or the drawing copied, communicated or disclosed in whole or in part, except in accordance with a contract, license or agreement in writing with Onyx Geo Consulting Ltd

0 100 200 m

ONYXGEO CONSULTING LTD.

46 Victoria Road, Burgess Hill, RH15 9LR
e: info@onyxgeo.co.uk
w: www.onyxgeo.co.uk

Project name:
Lower Perryland Farm

Client:
Lower Perrylands Limited

Drawing No:
ON251030-ON-PD-XX-DR-G-111-C01

Description:
Figure 1 Site Location plan

Project no:	Rev:
ON251030	C01
Date: 14/05/2025	Scale: 1:7,000

Drawn	Checked	Approved
ADC	SC	SC

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Project name:
Lower Perryland Farm

Client:
Lower Perrylands Limited

Drawing No:
ON251030-ON-PD-XX-DR-G-112-C01

Description:
Figure2 current site layout

Project no:	Rev:
ON251030	C01
Date: 29/05/2025	Scale: 1:550

Drawn	Checked	Approved
ADC	SC	SC

© Client supplied drawing Ref. 504 P002 P1

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Project name: Lower Perryland Farm

Client: Lower Perrylands Limited

Drawing No: ON251030-ON-PD-XX-DR-G-112-C01

Description: Figure 3 Proposed Site Layout

Project no:	Rev:
ON251030	C01
Date: 29/05/2025	Scale: 1:400

Drawn	Checked	Approved
ADC	SC	SC

514400
514450
514500
118850
118800
TP01
TP02
TP03
TP04
TP05
TP06
TP07
TP08
Surface Sample 1
Surface Sample 2
UNIT 1
UNIT 2
UNIT 3
UNIT 4
UNIT 5

Notes:

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Project name: Lower Perryland Farm

Client: Lower Perrylands Limited

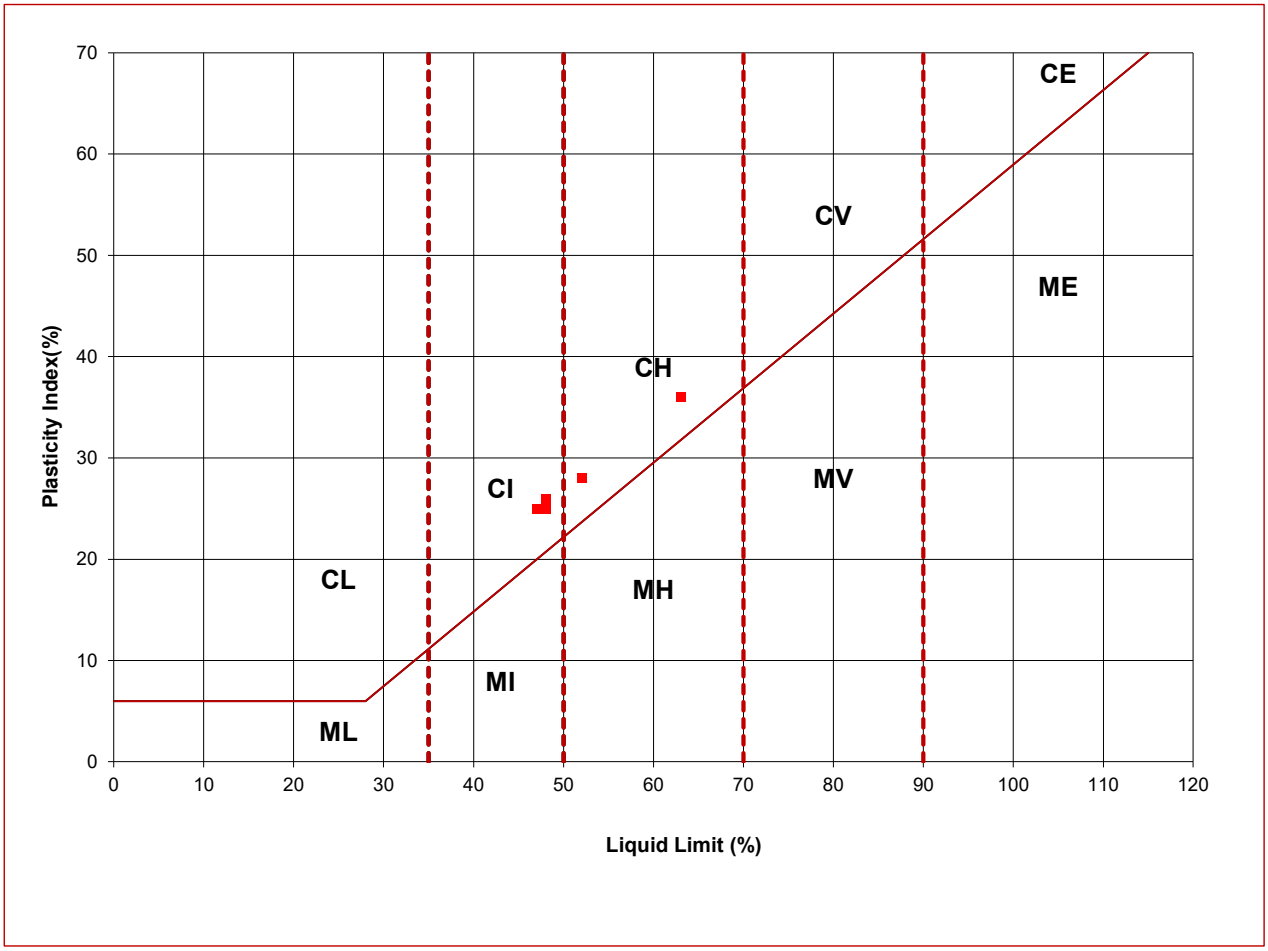
Drawing No: ON251030-ON-PD-XX-DR-G-222-C01

Description: Figure 4 Site investigation locations

Project no:	Rev:
ON251030	C01
Date: 29/05/2025	Scale: 1:400

Drawn	Checked	Approved
ADC	SC	SC

Atterberg Limits A-Line Plot



Project ID:	ON251030	**Project name:**	Lower Perryland Farm Phase II		
Client:	Lower Perrylands Limited	**Site Address:**	Lower Perryland Farm, Basing Hill, Dial Post, West Sussex		
Date:	27/05/2025	**Report Ref.**	ON251030-ON-PD-XX-RP-G-713-C01	**Figure No.**	5

APPENDIX C – PHOTOGRAPHS

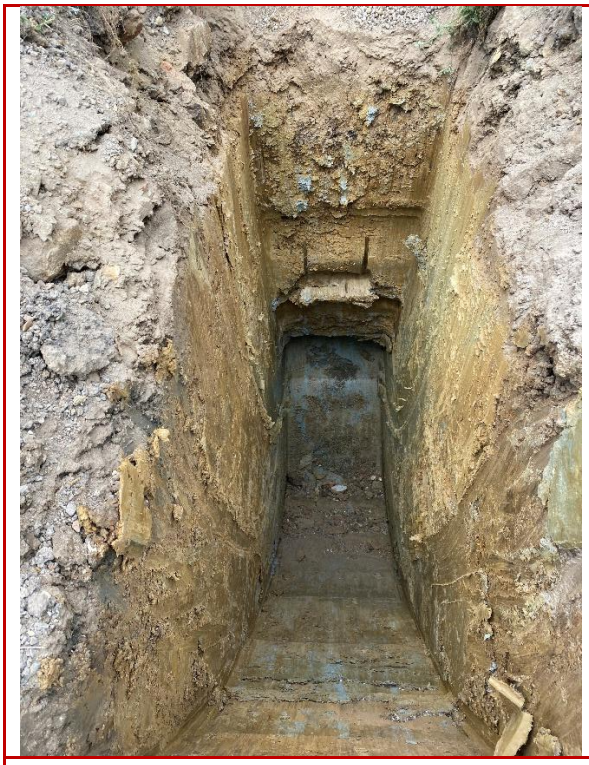


Photo 1 – TP01 prior to reinstatement.

Photo 2 – TP01 arisings.

Photo 3 – TP01 Arisings.

Photo 4 – TP03 prior to reinstatement.

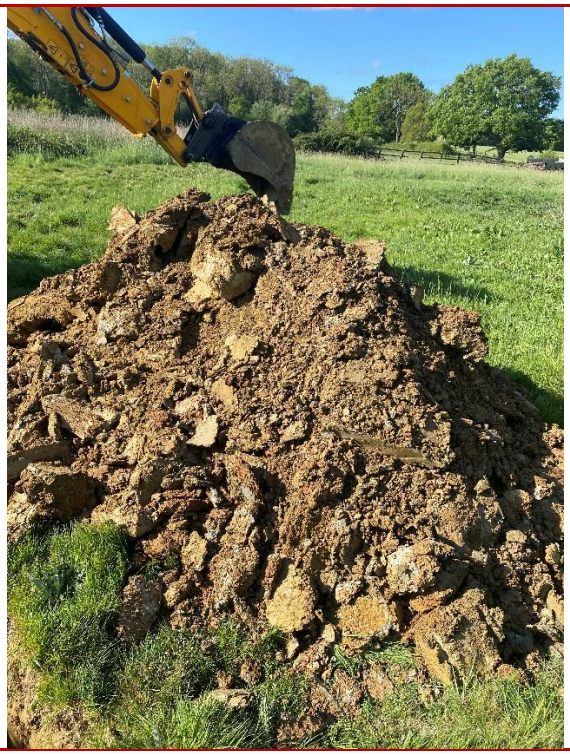


Photo 5 – TP03 arisings.

Photo 6 – TP04 arisings.