Roy & Rachael Allum

SYCAMORE LODGE, GREEN LANE, HICKLING PASTURES, NOTTINGHAMSHIRE

Phase II Ground Investigation Report

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PHASE II GROUND INVESTIGATION REPORT FOR ROY & RACHAEL ALLUM AT SYCAMORE LODGE, GREEN LANE, HICKLING PASTURES, NOTTINGHAMSHIRE

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FOREWORD

This report has been prepared by Castle Rock Geotech with all reasonable skill, care and diligence within the terms of the Contract with the client and taking account of the information made available by the client, as well as the manpower and resources devoted to it by agreement with the client.

Castle Rock Geotech disclaims any responsibility to the client and others in respect of any matters outside the scope of the above Contract.

This report is confidential to the client and their assigns, and Castle Rock Geotech accepts no responsibility whatsoever to third parties to whom this report, or any part thereof, is made known.

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1.0 INTRODUCTION

1.1 Background

Castle Rock Geotech (CRG) was instructed by Alan Joyce Architects Ltd ('*Project Managers'*) acting on behalf of Roy & Rachael Allum ('*Client*') to undertake an intrusive Phase II geo-environmental ground investigation for a proposed residential redevelopment at Sycamore Lodge, Green Lane, Hickling Pastures, Nottinghamshire, LE14 3QF.

The investigation was based on a scope of works / proposed by CRG in their Phase I Geo-Environmental Desk Study (referenced in Section **1.3** - below).

1.2 Proposed Development

At the time of writing, details of the proposed redevelopment had not been finalised. Preliminary discussions with the Consulting Engineer and the Client indicate a preliminary proposal of a residential redevelopment re-using certain walls and floor slabs of the existing structures and the conversion and possible extension of existing barns.

The location and potential layout of the proposed development are shown on the '*Proposed Site Plan*' drawing presented as **Figure 3**.

It has been assumed that site levels will not change significantly. If the above is not the case, the recommendations contained within this report may require some amendment.

1.3 Objectives

The objectives of the intrusive Phase II Ground Investigation included the following:

- Ascertain the sequence and engineering properties of the substrate in order to determine suitable methods of design and construction for foundations and surface slabs.
- Provide an assessment of any ground contamination in order to identify issues potentially affecting site redevelopment.

This report was prepared solely for the use of Roy & Rachael Allum, Alan Joyce Architects Ltd, Price & Myers ('*Consulting Engineers*'), their clients and appointees. No responsibility will be accepted where this report, either in its entirety or in part, is used by a third party, or for any development other than that described here.

The current report should be read in conjunction with Castle Rock Geotech's '*Phase 1 Geo-Environmental Desk Study Report*', (Ref No. 220103N, dated 8th July 2023), which includes a Preliminary Conceptual Site Model (CSM).

Whilst this report may express an opinion on the possible configuration of strata between or beyond exploratory hole positions or on the possible presence of features based on visual, verbal or published evidence, this is for guidance only and no liability can be accepted for its accuracy.

The investigation was undertaken in accordance with the conditions described for '*Phase I Desk Study & Phase II Ground Investigation*' in the attached Notes on Limitations (**Appendix VIII**).

1.4 Scope of Works

The site work was undertaken on the 15th September 2023 and comprised the following:

- Five (5 no.) windowless sampler boreholes advanced to a maximum depth of 5.45m below existing ground level (begl) in order to investigate the ground and groundwater conditions underlying the site.
- Standard Penetration Tests (SPTs) and Hand Shear Vane (HSV) tests in order to determine soil strength.
- Three (3 no.) hand excavated trial holes to be advanced to a maximum depth of 1.20m in order to expose the existing foundations.
- Six (6 no.) slab breakout trial holes with follow-up shallow hand excavation advanced to a maximum depth of 0.60m in order to determine the slab construction, sub-base thickness and depth to subgrade.
- Soil sampling for environmental and geotechnical laboratory testing.
- Logging and description of soil samples.

Subsequent laboratory testing comprised:

- Chemical contamination (screening) analysis of 3 no. soil samples.
- Asbestos screening of 3 no. soil samples.
- Atterberg Limit and moisture content determinations – 6 no. soil samples.
- Water soluble sulphate and pH tests – 11 no. soil samples.

This report contains a summary of the desk study research, details of the site, fieldwork and laboratory testing undertaken. The strata encountered are described and an interpretative geo-environmental assessment of the ground conditions is made with respect to the proposed residential redevelopment at Sycamore Lodge, Hickling Pastures.

2.0 SITE LOCATION AND DESCRIPTION

2.1 Site Location

The redevelopment site is located on the northern side of Green Lane approximately 2.0kms to the south-west of the village of Hickling and 11kms north-west of Melton Mowbray. The site lies within Sycamore Lodge, a former farm, as shown on the Site Location Plans presented as **Figure 1**. Currently, the development site comprises a two-storey brick and tile residential property with a number of surrounding barns and stables and associated courtyards, lawns, garden beds and landscaped garden areas. The site is centred on approximate Ordnance Survey Grid Reference ^{4}67435E, ^{3}27400N.

2.2 Site Description

The overall site is approximately rectangular in plan and covers an area of approximately 0.86 hectares. The site is broadly flat lying at an elevation of between 110m OD and 111m OD, as shown on the '*Topography Survey*' drawing presented as **Figure 2**.

The site is entered via a recently constructed asphalt surfaced drive off Green Lane which replaces a former driveway to the west of the existing dwelling house or by a gravel landscaped driveway to the east. Green Lane forms the southern boundary of the site. The gravel driveway to the east curves around the grassed front lawn and ends in a square gravel surfaced parking space adjacent to the main brick and tile residential dwelling (Sycamore Lodge) and is bounded by a series of single storey brick and tile roofed, concrete floored covered garage spaces and the southern eave end of a single storey brick and slate roofed outbuilding to the north.

A wooden 5-bar gate is located on the northern curve of the driveway and gives access to an open area of lawn and landscaping in the north-eastern corner of the property. A small, landscaped pond is present in the western corner of this area and the wider grassed area is bounded to the west (from south to north) by a concrete floored wooden post supported steel roofed shelter and a single storey, brick built and corrugated asbestos roofed series of old barns/byres.

At the northern end of these outbuildings is a series of corrugated iron roofed wooded lean-tos, and an asbestos roofed wood store which give access to a narrow north-south trending concrete floored yard between the eastern series of single storey barns and a single storey brick and slate roofed outbuilding to the west.

Another, west–east trending, double storey, Victorian brick walled and pitched asbestos roofed outbuilding is present to the north-east, with an associated corrugated iron lean-to and a large circular metal silo. Several broken asbestos sheets were present leaning on the concrete base of the silo. A derelict corrugated iron tunnel house is present across the grassed lawn to the north of the pitched roof barn, with an overgrown meadow beyond extending to the site boundary.

At the eastern end of the pitched roof barn a single storey series of brick built, corrugated asbestos roofed barns extend to the south and enclose a small gravel surfaced courtyard with some localised landscaping and garden beds between the pitched roof barn and the surrounding single storied brick barns/byres. Concrete and brick floors in the byres and barns were observed to be in moderate to good condition, with no evidence of staining.

Photographs / plates of the site area are presented in Appendix III of the Phase I Geo-Environmental Desk Study Report.

3.0 GEOLOGICAL SETTING

3.1 Sources of Information

Relevant information relating to the site history, geology, hydrogeology, hydrology, mining and extracts from the environmental database review, which was reported as part of the Phase 1 Geo-Environmental Desk Study Report, is summarised below for convenience.

3.2 Geology

Artificial / Made Ground

There are no records of Artificial or Made Ground on site or within 500m of the site.

Superficial Deposits

The site is directly underlain by an unknown thickness of Glacial Till deposits (Diamicton – formerly termed Boulder Clay) comprising strata of the Oadby Member (ODTL) of Quaternary age.

The Glacial Till (Oadby Member) is described as *'brown to reddish-brown with stones and matrix derived primarily from Upper Carboniferous and Triassic rocks; subordinate sand, gravel and stoneless clay and silt. Red pebbly clay and silty clay with rock fragments'.*

Bedrock

The geological maps indicate the superficial drift deposits to be directly underlain by strata of the bedrock strata of the Foston Member, part of the Scunthorpe Mudstone Formation (SMd, formerly termed the Lower Lias Clay), of Lower Jurassic age. The Foston Member (Fst) is described as comprising '*a group of several thin, probably impersistent limestone beds separated by mudstone beds, approximately 35m thick*'.

Faults

A west to east trending fault is identified by the BGS geological maps within the northern part of the site. The fault described as a 'normal fault, inferred' and is downthrown to the south.

3.3 Hydrogeology

The superficial geology beneath the site comprising the Glacial Till is classified as a Secondary - undifferentiated (formerly classified as Minor) Aquifer. Secondary Aquifers (undifferentiated) comprise of layers which have previously been designated as both minor and non-aquifer in different locations due to the variable characteristics of the rock type.

3.4 Hydrology

Surface Waters

A surface water course is identified approximately 275m to the north of the site and a small pond is present adjacent to the central eastern boundary of the site.

Flood Risk

The site lies within Flood Zone 1 and has a Low probability of flooding.

3.5 Mining

Coal Mining

The site does not lie within an area requiring the commission of a Coal Mining Report in accordance with The Coal Authority and The Law Society publication '*Coal Mining and Brine Subsidence Claim Searches – Directory and Guidance*', Sixth Edition (2006).

The site is not located within a Coal Mining area as defined by the Coal Authority.

Reference to the Coal Authority Interactive map viewer confirms the site as not lying within a '*Development High Risk Area*'.

No specific investigation or mitigation measures in relation to coal mining issues are considered necessary for the proposed development of the site.

Non-Coal Mining

The site does not lie within a brine affected area.

3.6 Radon Gas

The site is not situated in a Radon Affected Area. Radon gas protective measures are not required.

4.0 METHODS OF INVESTIGATION

4.1 General

The scope of the ground investigation was designed with reference to the published geology, surface conditions / anticipated ground conditions, the findings of the Phase I geo-environmental assessment and available details of the proposed development.

The ground investigation fieldwork methods were undertaken in general accordance with the principles set out in the following published guidance:

- BS EN 1997-2. 2007. Eurocode 7: Geotechnical Design. Part 2 '*Ground Investigation and testing*'. British Standards Institution (BSI), 2010 (revised text).
- BS 5930. 2015. '*Code of practice for ground investigations*'. BSI.

The geo-environmental aspects of the ground investigation complied with the general requirements of BS 10175. 2011. '*Investigation of potentially contaminated sites – Code of practice*', BSI.

The site works were carried out on the 15th September 2023 under the supervision of experienced and suitably qualified Geo-Environmental Engineers from CRG. The boreholes were positioned at appropriate locations within and adjacent to the proposed development footprint given the site constraints and in order to provide adequate site coverage.

The hand excavated trial holes and slab 'breakout' holes were positioned at approximate locations indicated by Alan Joyce Architects Ltd in conjunction with Price & Myers.

Exploratory Hole Location Plans are presented as **Figure 4** (1) and **Figure 4** (2). The main intrusive works are summarised in **Table 1** below.

TABLE 1: SUMMARY OF GROUND INVESTIGATION WORKS

Investigation Method	*No. of Positions*	*Maximum Depth (m begl)*	*In-situ Testing & Backfill*
Boreholes (windowless sampler)	5 BH01 to BH05 incl.	5.45	SPTs, HSV Arisings x 5
Trial Holes (hand excavated)	9 TH01 to TH09 incl.	1.20	Foundation Pits x 3 Slab Breakout x 6 Arisings x 9

4.2 Clearance of Underground Services

Before any intrusive works were undertaken and in order to avoid underground services, the Client was consulted with respect to the location of known services. Each proposed exploratory hole location was also scanned using a cable avoidance tool (CAT - *Radiodetection* RD7000+) to check for 'live' electricity and radio cables. In addition, simple dowsing techniques were also used in order to check for any potential sub-surface anomalies.

4.3 The Boreholes

Five (5 no.) geo-environmental windowless sampler boreholes (designated BH01 to BH05 incl.) were advanced using a track mounted '*Premier 110*' window sampling rig (see Plate 6, **Appendix V**). The boreholes were progressed to depths ranging between 4.40m (BH04) and 5.45m begl (BH01). The boreholes were drilled commencing with a 101mm diameter sampler and reducing the diameter of the sampler every metre with depth.

From ground level or the base of the concrete slab, 1m length tube samplers (with plastic core liners) were driven into the underlying substrata. Category A and B samples were recovered (sample disturbance being influenced by the specific soils encountered).

Throughout the boreholes, Standard Penetration Tests (SPTs) were carried out using the open-drive shoe (S), in order to provide a measure of the strength of the substrate. Testing was undertaken in general accordance with BS 1377: Part 9: 1990, nominally at 1.00m intervals. Uncorrected SPT 'N'- values are shown on the borehole logs, the number of blows required to drive the cone over the final 300mm penetration being totalled to give the 'N'- value.

Representative small disturbed (D) samples were recovered from the boreholes for descriptive purposes and for environmental and geotechnical laboratory testing in accordance with accepted industry standards. Disturbed soil samples (sub-samples taken from the core liners) were recovered from the various deposits encountered and were placed in 500ml plastic tubs (T) for detailed examination and subsequent laboratory testing. In addition, environmental samples were recovered throughout the near surface deposits and placed in 250ml glass jars and vials (J) in addition to the plastic tubs described above.

Environmental samples were placed in a cool box with ice packs prior to submission to a UKAS / MCERTS accredited laboratory (under Chain of Custody documentation) as promptly as possible to maintain sample integrity.

Descriptions and depths of the various strata encountered are included on the borehole logs presented in **Appendix I**, together with sample depths, the results of SPTs, comments on the groundwater conditions and other relevant information. Selected photographs / plates (Plates 1 to 5 incl.) of the arisings from the boreholes are presented in **Appendix V**.

4.4 The Trial Holes

A total of nine (9 no.) trial holes (nos. TH01 to TH09 incl.) were advanced by hand excavation to depths ranging between 0.40m and 1.20m.

Trial holes TH01, TH2 & TH03 were advanced to a maximum depth of 1.20m adjacent to the existing Garage and Barns in order to facilitate inspection of the existing foundations.

Trial holes TH04 to TH09 incl. were advanced to depths ranging between 0.40m and 0.60m initially using a hydraulic breaker to 'break out' the surface slab followed by hand excavation to determine the slab construction, sub-base thickness and depth to subgrade.

Descriptions and depths of the various strata encountered are included on the trial hole logs presented in **Appendix II**, together with foundation details (TH01, TH02 & TH03), slab construction details, comments on the groundwater conditions and other relevant information.

On completion, the trial holes were backfilled with arisings, as detailed on the exploratory logs.

Selected photographs / plates of the trial hole excavations and arisings (Plates 7 to 21 inclusive) are also presented in **Appendix V**.

5.0 LABORATORY TESTING

5.1 Soil Chemical Contamination Testing

Representative small disturbed samples were obtained for all soil types encountered within the exploratory holes. Samples for environmental chemical testing were scheduled reflecting the findings of the on-site observations.

As part of the assessment for potential contamination at the site, chemical analysis was undertaken on 3 no. samples of the Made Ground deposits recovered from the boreholes.

The samples were analysed for a general suite of metals, inorganic and organic compounds, with asbestos screening being carried out on selected Made Ground samples.

The analytical analysis was carried out at the UKAS / MCERTS accredited laboratory (No. 2683) of The Environmental Laboratory (ELAB). The testing was scheduled by CRG and is summarised in **Table 2** below for the following determinants:

TABLE 2: SUMMARY OF ANALYTICAL TESTING

Soil Analysis Test Suite	***No.***
• Metals: arsenic, beryllium, cadmium, chromium, copper, lead, mercury, nickel, selenium, vanadium and zinc. • Inorganic chemical compounds: elemental sulphur, free cyanide, hexavalent chromium, total sulphide, total cyanide and water soluble boron. • Water soluble sulphate. • pH value. • Total Phenols. • Speciated Polycyclic Aromatic Hydrocarbons (PAHs) (16 compounds). • Total Petroleum Hydrocarbons (TPH) speciated to the UK Criteria Working Group (TPHCWG) aliphatic and aromatic compounds. • BTEX – benzene, toluene, ethyl benzene, xylenes and methyl tert-butyl ether (MTBE). • Soil Organic Matter (SOM). • Asbestos Screen.	3

The full analytical results (Analytical Report No. 23-50168) are presented in **Appendix III**.

5.2 Geotechnical Laboratory Testing

Geotechnical laboratory testing was carried out in general accordance with BS 1377-2022 `*Method of test for soils for civil engineering purposes´*, where applicable. The tests listed below in **Table 3** were carried out on selected samples of the Made Ground and natural soils.

The soil classification test results are presented in **Appendix IV**. The results of the pH and water soluble sulphate concentration analyses (Analytical Report No. 23-50168) are also included within the soil analytical test results also presented in **Appendix III**.

TABLE 3: SUMMARY OF GEOTECHNICAL TESTING		
Test	***No.***	***Test Method***
Moisture Content	6	BS 1377-2:2022 Part 4
4 Point Liquid & Plastic Limit (Plasticity Indices – Atterberg Limits)	6	BS 1377-2:2022 Parts 5 & 6
Water soluble sulphate (mg/l as SO_4) and pH	11	BS 1377-3:2018+A1:2021

The Plasticity Index (PI) is the numerical percentage difference between the liquid limit and the plastic limit of the soil. It can be related to the shrinkage potential of the soil with regard to building near trees. The moisture content can be used to assess the existing state of desiccation of the sample (when interpreted with the Atterberg Limits).

Water soluble sulphate analyses are undertaken in accordance with the requirements of BRE Special Digest 1: '*Concrete in Aggressive Ground*' in order to assess the potential aggression of the soil at depth to buried concrete.

6.0 RESULTS OF THE INVESTIGATION

6.1 Summary of Ground Conditions

The strata encountered have been shown to be generally consistent with the published geological mapping, with Glacial Till deposits of the Oadby Member being encountered at shallow depth. A summary of the ground conditions encountered in the boreholes is presented in **Table 4** below:

TABLE 4: SUMMARY OF GROUND CONDITIONS		
Description of Strata	***Thickness (m)***	***Depth to top of surface (m)***
MADE GROUND: Variable surface materials e.g. concrete, asphalt, pea gravel or topsoil, generally overlying subsoil or soft to firm structureless CLAY with various anthropogenic inclusions.	0.30 to 1.50	G.L.
Generally firm or firm to stiff grey brown yellow mottled gravelly silty generally medium strength CLAY with rare pockets of yellow sand. Gravel content is fine to coarse angular to sub-rounded of various lithologies, mainly chalk. (**Glacial Till** – **Oadby Member**)	1.15 to 2.50	0.30 to 1.50
Generally stiff grey mottled brown becoming grey closely fissured gravelly silty high strength CLAY with occasional chalk cobbles. Gravel content is fine to coarse angular to sub-rounded of various lithologies, mainly chalk. (**Glacial Till** – **Oadby Member**)	Penetrated for a maximum 3.45m in BH01	1.70 to 2.80

6.2 Made Ground

Various Made Ground (Anthropogenic) materials were encountered near surface in each of the exploratory holes extending to depths ranging between 0.30m (BH02) and 1.50m begl (BH04).

The Made Ground comprises a variable mixture of surface materials e.g. concrete, asphalt, pea gravel or topsoil, generally overlying subsoil or soft to firm structureless clay with various anthropogenic inclusions.

A single (un-corrected) SPT was carried out within the Made Ground horizon in BH04, this recorded an 'N' value of 7.

6.3 Glacial Till

Cohesive Glacial Till deposits (Oadby Member) consisting mainly of sandy silty clay were encountered directly beneath the Made Ground at depths ranging between 0.35m and 1.50m. These initially comprise an upper horizon of generally firm becoming stiff initially grey brown yellow mottled gravelly silty generally medium strength CLAY with rare pockets of yellow sand. The gravel content of the upper horizon of Glacial Till is fine to coarse angular to sub-rounded, consisting mainly of chalk with various other lithologies.

Seven (un-corrected) SPTs carried out within the upper horizon of Glacial Till recorded 'N' values in the range 7 to 19, generally confirming the above strength descriptions for this material.

Underlying the upper horizon of Glacial Till, a generally stiff grey mottled brown becoming grey closely fissured gravelly silty high strength CLAY with occasional chalk cobbles was encountered. The gravel content of this lower horizon of the Glacial Till is fine to coarse angular to sub-rounded, also consisting mainly of chalk with various other lithologies.

A further thirteen (13 no.) SPTs carried out within the lower horizon of Glacial Till recorded 'N' values in the range 11 to >50 for partial penetration (245mm), also generally confirming the above strength descriptions for this material.

Several hand shear vane (HSV) tests were undertaken within the Glacial Till deposits at depths ranging between 0.80m and 3.50m. These recorded undrained shear strengths (uncorrected) in the range 60kN/m^2 to >130kN/m^2, also generally confirming the above strength descriptions for these materials.

6.4 Groundwater Observations

Groundwater was not encountered during the advancement, or on completion, of any of the boreholes.

It should be appreciated that groundwater levels are likely to fluctuate in response to seasonal, rainfall related effects and other changes.

6.5 Contamination Observations

The soil arisings were examined by the Geo-Environmental Engineers for visual or olfactory evidence of volatile, mobile (e.g. hydrocarbons) or physical (e.g. suspected asbestos containing materials - ACMs) soil contamination. No gross visual, olfactory evidence or physical soil contamination was identified.

6.6 Obstructions / Structures

No underground obstructions or structures were encountered during the advancement of the exploratory holes.

6.7 Trial Hole Findings – Foundations

The findings of the trial hole (foundation) excavations to the existing structures may be summarised as follows:

- TH01 (located on the southern elevation of the Garages) identified brickwork extending to a depth of 600mm begl bearing upon a concrete footing. The depth of footing could not be determined as it extended beyond 1.20m (the maximum feasible depth of hand excavation).
- TH02 (located on the western elevation of the Store) identified brickwork extending to a depth of 450mm begl bearing upon a 250mm thick concrete footing, which extended to a depth of 700mm. The footing is founded on Glacial Till comprising firm slightly sandy silty CLAY.
- TH03 (located on the eastern elevation of the Workshops) identified brickwork extending to a depth of 650mm begl bearing upon a concrete footing. The depth of footing could not be determined as it extended beyond 1.20m (the maximum feasible depth of hand excavation).

6.8 Trial Hole Findings – Slab Construction

The findings of the six trial holes (nos. TH04 to TH09 incl.) advanced in order to determine the slab construction, sub-base thickness and depth to subgrade may be summarised as follows:

A 100mm to 120mm thick non-reinforced concrete slab, generally with a polythene membrane at base overlies sub-base of 'dense' brick rubble fill including whole bricks in a brown sandy matrix extending to depths of between 0.25m and 0.30m. The underlying sub-grade comprises Glacial Till deposits consisting of soft or firm sandy silty clay with rare gravel.

6.9 Chemical Contamination Laboratory Testing of Soil Samples

Introduction

The UK Contaminated Land Regime (CLR) allows for a tiered approach to the assessment of ground contamination which is designed to allow increasingly site-specific assessment. In order to assess the potential risk posed by contaminants contained within the soils at the study area a generic quantitative risk assessment (GQRA) has been undertaken by comparing recorded concentrations of chemical constituents in soil with Generic Assessment Criteria (GAC) to identify whether, at the concentrations recorded, the presence of the constituent has the potential to adversely affect the health of site users (a Tier 1 assessment). GAC are set at levels where potential exposure is deemed to be within acceptable limits.

If the recorded concentrations of a particular constituent are below the GAC, then the risk is generally considered to be acceptable and further assessment / or mitigation measures are not required. Where a substance is recorded at concentrations higher than GAC this does not necessarily indicate that a particular risk is present, however, it does typically signify the requirement to undertake further assessment in line with the UK tiered risk assessment framework.

Generic Assessment Criteria

GAC are derived by means of a computer model using standard land-uses and exposure pathways and using defined sensitive receptors for each land use type. UK relevant chemical fate and transport properties and toxicological parameters are then used to derive GAC for each land use scenario. In March 2014, the Department of Environment, Food and Rural Affairs (DEFRA) published Category 4 Screening Levels (C4SLs) for a limited number of contaminants in soil with 6% Soil Organic Matter (SOM) using the Contaminated Land Exposure Assessment (CLEA) Model, for use in evaluating sites under Part 2A of the Environmental Protection Act 1990. Contaminant concentrations below C4SLs are considered to pose an acceptably low risk.

Where C4SLs have been published, these values have been used as GACs and, where not available, values produced by CIEH/LQM have been used – termed Suitable for Use Levels (S4ULs), although it should be noted that they are based on minimal or tolerable risks and as such are more conservative than the C4SLs. Where no published screening values are available CRG have derived their own values, which have been derived using CLEA version 1.06, in line with the current guidance for their derivation.

The CLEA model states that '*For most exposure pathways, the contamination is assumed to be at or within one metre of the surface*' (Environment Agency, 2009). It is considered that at depths greater than 1.0m, the probability of human exposure via the direct contact pathways are significantly reduced, leaving inhalation of volatile compounds as the dominant pathway with regard to human health risks. Typically, volatile compounds only significantly affect the indoor inhalation pathway. The same screening concentrations have been used for all depths at this stage, though it is noted that these are highly conservative for depths below 1.0m begl.

The GACs used in the assessment of risks to human health from soil are based on generic land-use scenarios modelled over the operational life of the site. Consequently, short term (acute) exposure risks arising from activities which deviate from the assumed land-use scenario (i.e. risk to construction workers) are not considered by this assessment process. Similarly, issues of waste classification and management are not addressed by the UK CLR Framework.

Screening criteria have been developed for the following land use scenarios:

- Residential with home-grown produce (*with plant uptake*)
- Residential without home-grown produce (*without plant uptake*)
- Allotments
- Public open space (park and residential)
- Commercial / Industrial

Based on the proposed end land use the results of the chemical analyses have initially been assessed against a precautionary '***Residential with Plant Uptake'*** land use assessment criteria.

For organic contaminants, the generic soil screening values have been derived for a range of concentrations of soil organic matter (1%, 2.5%, 6%). The SOM values of the 3 no. samples tested ranged between 2.7% and 3.7%. Determinants have in the first instance, been compared to GAC adopting a conservative SOM value of 1%.

A copy of the Tier 1 GAC screening thresholds used in this assessment is presented in **Appendix VI**.

Soil analytical test results are presented in **Appendix III** and the results are summarised below.

Tier 1 – Soil Screening

Metals and Inorganic Compounds

The total soil concentrations of the sampled soils were all compliant with the adopted Tier 1 GAC.

PAHs

The PAHs individual species concentrations were in all cases below the laboratory limits of detection of <0.1mg/kg and <0.01mg/kg and therefore, in all cases compliant with the adopted Tier 1 GAC.

TPH

No exceedances of the TPH-CWG Tier 1 GAC were recorded with concentrations of several ranges generally below the laboratory limits of detection of 0.01mg/kg and 1mg/kg. Total petroleum hydrocarbon TPH CWG $C_5 – C_{40}$ aliphatic / aromatic concentrations were recorded in the range of <1.0mg/kg to 7.8mg/kg.

BTEX concentrations were all below the laboratory limit of detection of 10µg/kg and therefore, were also compliant with the adopted Tier 1 GAC.

Asbestos

There is currently no published GAC for asbestos. Three samples of the Made Ground were submitted to the laboratory for microscopic analysis to determine the presence or not of Asbestos Containing Materials (ACM's – microscopic fibres). No positive identification for asbestos was detected.

pH

The pH values of the three (3 no.) contamination (screening) analyses samples are moderately to very strongly alkaline and range between 8.2 and 9.4.

A ground contamination risk assessment based on these results is presented in Section **8.8**.

6.10 Geotechnical Testing of Soil Samples

Plasticity Index

Plasticity Index (PI) testing was undertaken on 6 no. samples recovered from the Glacial Till deposits. The results recorded liquid limits (w_L) of between 42% and 48%, plastic limits (w_P) of between 20% and 22% and plasticity indices (I_P) in the range 22% to 26%.

The results indicate the clay soils from the Glacial Till deposits, present from depths ranging between 0.80m and 2.70m to be of intermediate (CI) plasticity. These results also classify the Glacial Till soils to be of 'Medium' volume change potential (as defined in the NHBC Standards, Chapter 4.2 '*Building near Trees*').

Moisture Content

The moisture content (w) tests carried out on the same 6 no. samples of Glacial Till soils recorded results of between 17% and 21%.

Comparison of the recorded moisture content values to the Atterberg Limits and also taking into the % >425µ (sand/gravel content) indicates that the moisture content values of the fine soils marginally identify the potential onset of desiccation in the sample of the Glacial Till deposits recovered from BH01 at a depth of 1.50m to 1.70m. The remaining samples do not identify the potential onset of desiccation.

Water Soluble Sulphate

Water soluble sulphate testing has been undertaken on a total of 3 no. samples of the Made Ground and 8 no. samples of the underlying natural soils. The results indicate water soluble sulphate contents for all samples to range from 40mg/l to 2870mg/l.

pH

Associated pH values recorded from the same 11 no. samples range between 8.2 and 9.4, indicating moderately to strongly alkaline conditions to prevail within the Made Ground and the natural soils.

7.0 CONCEPTUAL SITE MODEL AND GROUND CONTAMINATION RISK ASSESSSMENT

7.1 Introduction

The Environmental Protection Act 1990 (Part IIA) makes provisions for a risk-based framework for the identification, assessment, management and redevelopment of Contaminated Land within the UK. The provisions of the Act came into effect in England and Wales in July 2001 and are aimed at ensuring that actions taken with respect to contaminated land are directed by a technically well-founded assessment of risk.

The process of risk assessment is an evaluation of the probability of harm, and comprises the identification of sources of contamination, receptors that may be affected by the contamination and pathways by which the receptors may be harmed forming a pollution linkage. The site Conceptual Model (presented below) forms the basis for the qualitative assessment of ground contamination risks associated with the site.

The following sections outline the revised Conceptual Site Model and identify the confirmed contaminant sources detected during the ground investigation. Observations, analytical and monitoring results have all been taken into account in this revised CSM.

7.2 Potential Sources of Contamination

The analytical testing has demonstrated that metal, inorganic and organic determinant concentrations in the near surface soils / materials are in all cases below the adopted conservative Tier 1 GAC for the proposed end-use of the site.

From the relevant historical data and the CRG Phase II Ground Investigation no potential sources of contamination have been identified in the context of the proposed residential development.

7.3 Conceptual Site Model

The revised / updated Conceptual Site Model based on the findings of the geo-environmental investigation works and given that the redevelopment will predominantly comprise hardstanding with limited areas of landscaping post-development, is summarised in **Table 5** below.

TABLE 5: CONCEPTUAL SITE MODEL

Source / Medium	Receptor	Potential Exposure Route	Mitigation/Comment	Residual Risk Rating
Contaminants (Made Ground)	Site / Construction Workers	Direct ingestion of soil & dust, inhalation of particulates & vapour, indirect ingestion by means of dermal contact, inadvertent ingestion and dust inhalation.	PPE and Best Practice. No significant source identified.	Low / Very Low
	Site End Users (Residents)		Severance of exposure pathways by floor slab and hardstanding. No significant source identified.	Very Low / Negligible
	Plants	Direct contact with phytotoxic contaminants.	Provision of 'clean' subsoil & topsoil within soft landscaped areas.	Very Low
Contaminants (Made Ground)	Controlled Waters in underlying Secondary Aquifer	Mobilisation via incident rainfall and lateral / vertical migration to Controlled Waters receptor	No source identified and reduced infiltration due to hardstanding post-development.	Very Low / Negligible
Ground Gases Methane and carbon dioxide concentrations	Site / Construction Workers	Inhalation of gases & vapours	No Off-Site or On-Site sources of potential generation of ground gases were identified. Gas protection measures not required.	Very Low / Negligible
	Site End Users (residents)			Very Low / Negligible
	Buildings & Structures	Migration of gases through the surface and via permeable soils		Very Low / Negligible

The residual risk rating provided in **Table 6** above is based on risk descriptions provided in **Appendix VII**.

7.5 Discussion, Further Work and Potential Risk Mitigation

Risk from elevated Contaminants within the Made Ground

No metal, inorganic and oganic determinants were recorded above their Tier 1 GAC. The lack of a significant source within the Made Ground soils means there is no source-pathway-receptor linkage and therefore no remediation is required.

During the construction phase there is a risk to site personnel working in contact with potentially contaminated ground through the exposure pathways of inhalation, ingestion, and dermal contact. These risks can be mitigated using appropriate personal protective equipment (PPE) and adherence to established best practice working methods, for example as stated in '*HSG 66 Protection of Workers and the General Public During Redevelopment of Contaminated Land*'. As a minimum this would require full protective clothing, gloves, eye protection and the restriction of eating and smoking to controlled locations away from any areas of potentially contaminated ground.

Post-development, the Made Ground on the site will generally be beneath the proposed buildings (i.e., floor slabs) or external hardstanding, which will sever any potential exposure pathway to site end users.

Risk from Contamination to Controlled Waters

Soil analytical test results have not revealed concentrations of contaminants considered to be sufficiently elevated to represent a significant risk to Controlled Waters.

Risk from Contamination in Soils to Plants in Soft Landscaping

Any residual risk can be mitigated by the importation of a suitable thickness of 'clean' subsoil / topsoil for all landscaped areas post-development.

Imported topsoil should ideally conform to BS3882: 2015 '*Specification for topsoil*', with respect to the presence of contaminants, deleterious material and nutrient levels.

Risk from Contamination to Potable Water Supplies

It is considered that, based on the UK Water Industry Research (UKWIR) guidance, the concentrations of contaminants recorded to date are such that PE water (potable) supply pipes should be suitable for the site. There was no visual or olfactory evidence for the presence of petroleum hydrocarbons.

However, it is recommended that the local water supply company for the site be contacted to confirm their requirements with regard to pipe materials.

8.0 DISCUSSION AND RECOMMENDATIONS

8.1 General

A Phase II geo-environmental ground investigation was undertaken by CRG for a proposed residential redevelopment at Sycamore Lodge, Green Lane, Hickling Pastures, Nottinghamshire. The purpose of the intrusive investigation was to produce an interpretative assessment of the ground conditions at the site with respect to geotechnical issues, existing foundations and floor slabs and any potential ground contamination.

8.2 Foundation Design

The near surface Made Ground, which consists mainly of a variable mixture of surface materials such as concrete, asphalt, pea gravel or topsoil, generally overlying subsoil or soft to firm structureless clay with various anthropogenic inclusions, is considered to be unsuitable to support the structural loadings likely to be associated with proposed development and will not, therefore, be considered further with respect to foundation design of the proposed development.

The upper levels of the underlying Glacial Till, which consist of generally firm becoming stiff initially grey brown yellow mottled gravelly silty generally medium strength CLAY would provide a suitable bearing horizon for moderately loaded conventional reinforced strip or trench fill foundations to the proposed development.

For preliminary foundation design purposes, the upper levels of the Glacial Till may be assigned a net allowable ground bearing pressure of 100kN/m^2. Should it be required to accommodate heavier structural loadings on similar foundations, the underlying stiff high strength clay, present from depths of 1.70m to 2.80m, may be assigned a presumed bearing value of the order 180kN/m^2. Settlements at the above bearing pressures should be less that 25mm total settlement, with differential settlements limited to 1 in 500.

Mesh reinforcement included in the top and bottom of foundations is recommended in order to minimize the potential for differential settlement.

The Glacial Till clay soils have modified plasticity indices ranging between 22% and 26%, indicating a 'Medium' volume change potential in accordance with NHBC Standards, Chapter 4.2, '*Building near Trees*'.

The base of foundation excavations should be inspected upon completion in order to ensure that the condition of the soil complies with that assumed in design. Although unlikely, should pockets of inferior material be present, they should be removed and replaced with fully compacted suitable 'granular' material or lean mix concrete.

The excavated surfaces should be protected from deterioration. A blinding layer of concrete should be placed where foundations are not completed without delay.

8.3 Floor Slab Design

From a geotechnical perspective, ground bearing floor slabs are a viable option at this site where less than 600mm of sub-slab fill is present. The sub-grade to ground bearing floor slabs should be proof-rolled and any soft zones should be removed and replaced with a well compacted 'granular' fill.

Where in excess of 600mm of sub-slab fill is present, a suspended ground floor slab should be adopted in accordance with NHBC Standards. When building near trees, NHBC Standards Chapter 4.2 may also require the inclusion of heave precautions in foundation designs, in this case suspended floor slabs would be required.

8.4 General Construction Advice

Ease of Excavation and Stability

Shallow excavations for drainage, services etc. through the Made Ground and Glacial Till materials encountered at this site should be readily achieved using conventional mechanical plant ('JCB 4CX' type backhoe excavator or similar).

Sidewall instability of excavations within the Made Ground materials should be anticipated. The stability of excavations within the Made Ground may deteriorate rapidly in short to medium term periods and excavations may require temporary shoring to maintain an open excavation.

Significant groundwater issues within shallow excavations are unlikely to be encountered. However, it should be noted that groundwater may be encountered during wetter periods of the year and may cause local difficulties. If dewatering is required, pumping from open sumps should be adequate.

Legislation on Personnel Entry into Excavations

The requirement for support will need to be evaluated under CDM Regulations and support will be essential for any excavations in excess of 1.20m where man entry is required. All excavations should be carried out in accordance with CIRIA Report 97 '*Trenching Practice*' (2001).

8.5 Protection of Buried Concrete

The geology of the site and the ground conditions have been considered in accordance with the guidelines contained in Part 1 of BRE Special Digest 1: *Concrete in aggressive ground* (2005) and on the basis of this the site has been categorised as a '*brownfield*' site.

The results of the water-soluble sulphate analyses from the Made Ground and the natural soils at the site generally fall within Design Sulphate (DS) Class DS-1, however, a single sample of the lower horizon of Glacial Till (BH03, 2.50 - 2.70m) falls within Design Sulphate (DS) Class DS-3.

The groundwater conditions at the site can be considered to be mobile and, on this basis and from consideration of the pH conditions at the site, at anticipated founding depths, the site may be assigned an ACEC (Aggressive Chemical Environment for Concrete) Class AC-1.

8.6 Soakaways / Drainage

Given the generally low permeability cohesive nature of the Glacial Till deposits underlying the site, it is considered that soakaways are unlikely to offer a viable means of surface water drainage at this site. If required, the viability of soakaways should be confirmed by *in-situ* testing.

8.7 Pavement Design

For preliminary design purposes, a California Bearing Ratio (CBR) value of 2% is recommended for the upper levels of the Glacial Till deposits in the vicinity of the access drive and parking court areas.

Care should be taken to ensure that the surface sub-grade formation is protected as there is a likelihood that it may become softened by the action of rain and construction plant, leading to rutting and surface deterioration.

8.8 Ground Contamination Risk Assessment Summary

Hazard Assessment – Human Health Receptors

The analytical testing has demonstrated that metals, inorganic and organic determinant concentrations in the near surface soils are in all cases below the adopted Tier 1 GAC for the proposed end-use of the site.

No contaminants of concern were identified within the Made Ground or within the near surface natural soils, and these are, therefore, considered unlikely to pose a risk to Human Health (current and future site users and construction workers).

Based on the general absence of contamination encountered during the ground investigation works at the site there are no specific remediation requirements.

Hazard Assessment – Controlled Waters

Soil analytical laboratory test results have not revealed concentrations of contaminants considered to be sufficiently elevated to represent a significant risk to Controlled Waters.

Hazard Assessment – Plant Growth in Soft Landscaping

Any risk can be mitigated by the importation of a suitable thickness of ‘clean subsoil / topsoil for all landscaped areas post-development.

Hazard Assessment – Buildings, Structures and Services

Contaminant concentrations observed at the site are unlikely to adversely affect buildings and structures on site.

We would recommend that this report is supplied to utility companies (including water supply), and that their recommendations relating to appropriate supply pipes are adhered to.

Hazards to Human Health – Site / Construction Workers

The investigation has not revealed any specific contamination risk to site workers. It is recommended that construction personnel involved in direct contact with the soils at the site use appropriate PPE equipment together with welfare facilities in accordance with general Health and Safety guidelines.

8.9 Off-Site Disposal & Waste Classification

Any soils removed from the site should be disposed of at either an appropriately permitted waste management facility (if necessary / required) or other such site deemed suitable for receiving the soils (in line with relevant legislation and duty of care requirements).

Waste Acceptance Criteria (WAC) testing may be required to classify any soils for off-site disposal with testing criteria to ascertain whether the soil is hazardous, non-hazardous waste, or inert. The natural strata underlying the site are likely to be classified as Inert for disposal purposes.

The existing analytical test data will assist this process. If disposal is necessary then the soil analytical test results (**Appendix III**) should be provided to several landfill operators for consideration and cost provision in the first instance, prior to any soil materials being removed from the site.

Prior to disposal, the characteristics of any excavated soils will need final classification in consultation with the relevant waste disposal facility and further testing may be required on the actual materials requiring off-site disposal.

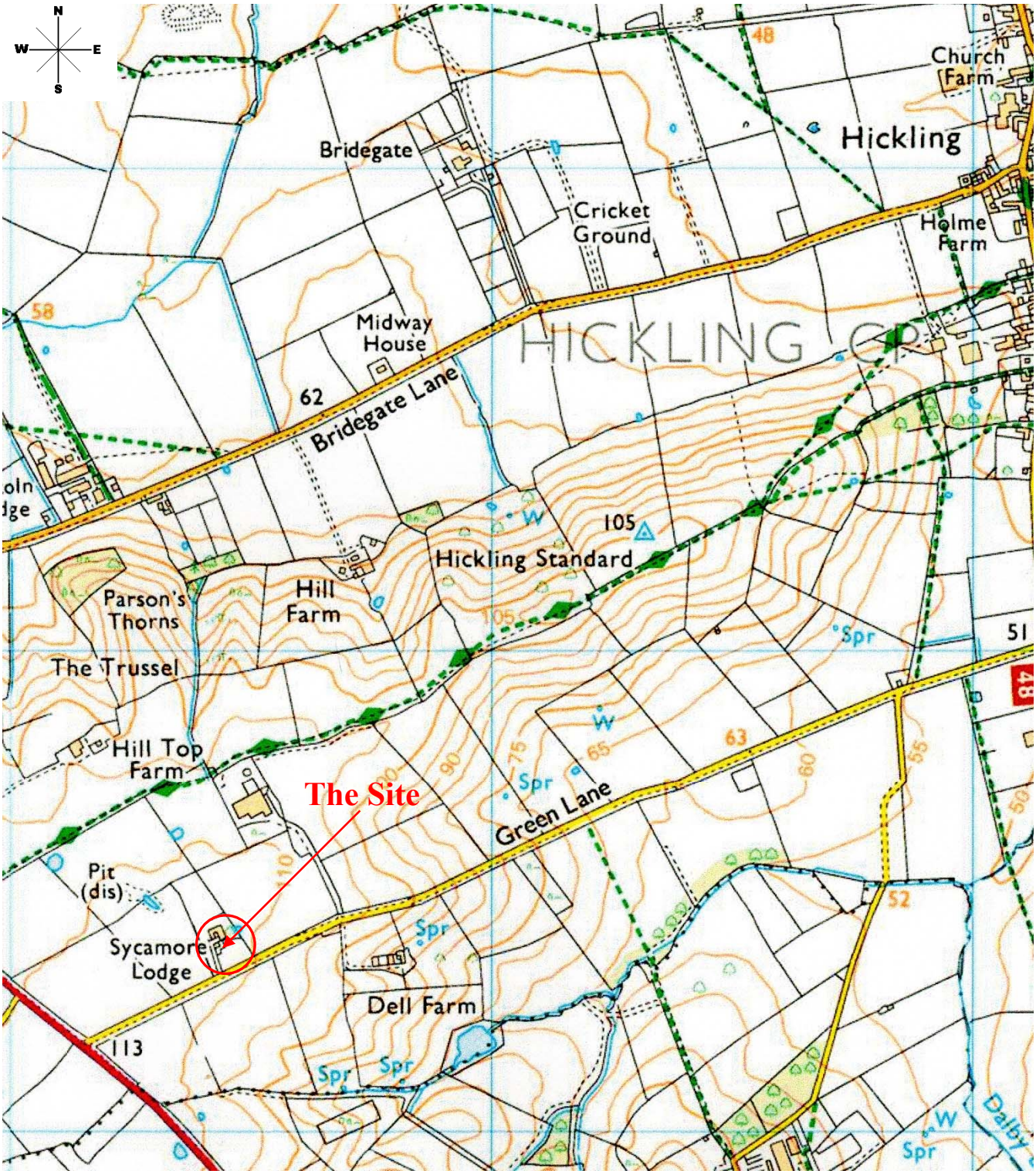
8.10 Discovery Strategy / Unforeseen Circumstances

Should any areas of potentially contaminated soil, odorous or visible contaminants be encountered during site preparation works, which appear significantly different from those encountered during the course of this investigation, immediate consultation with CRG is recommended, in order to ensure that the above recommendations would still apply. Any potentially contaminated soils should be left *in-situ* and subject to further assessment, to potentially include chemical testing and environmental risk assessment.

8.11 Statutory Consultation

In accordance with normal planning requirements, CRG would recommend that a copy of our report is issued to the Planning Department of the Local Authority / Local Authority EHO (Rushcliffe Borough Council) for review/comment and approval prior to commencing with the redevelopment of the site (CRG assume this will be undertaken by the Client).

FIGURE 1
Site Location Plans



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Project: **Sycamore Lodge, Green Lane, Hickling Pastures, Notts.**

Title: **SITE LOCATION PLAN**

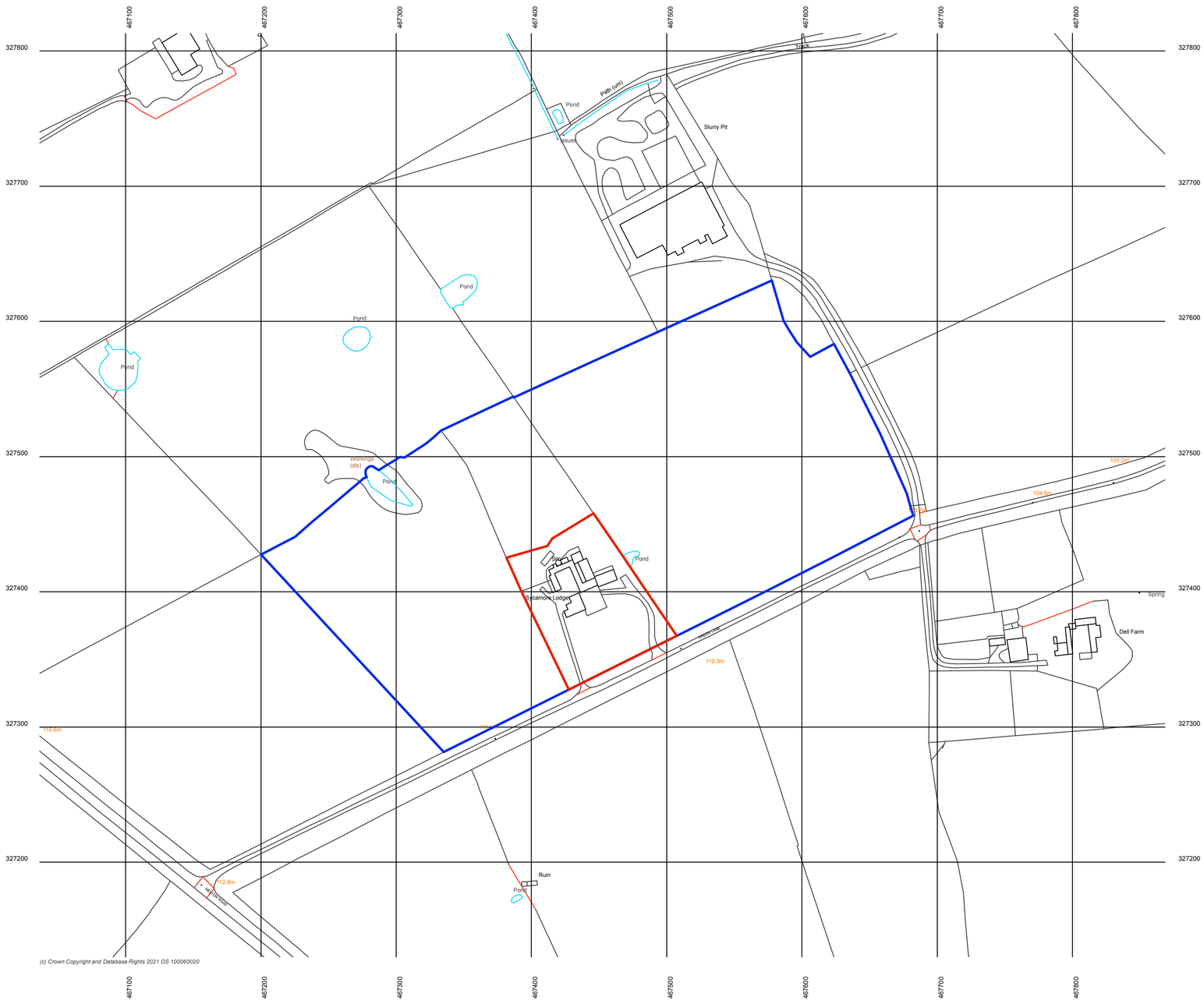
Project No. **230311N**

Date drawn: **09/10/23**

Scale: **NTS**

Figure 1 (1)

Client: **Roy & Rachael Allum**



N

0 50 150 250 M

REV.	DATE	DESCRIPTION	BY

AJA

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16-20 Bath Street, Nottingham NG1 1DF
T 0115 8418418 **E** design@ajaltd.co.uk

CLIENT
Roy & Rachael Allum

PROJECT
Sycamore Lodge

DRAWING
Site Location Plan

PROJECT NUMBER	SCALE @ A2	DATE	BY
3966	1:1250	Jan '22	JW

DRAWING NUMBER	REVISION	STATUS
01		Preliminary

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Print Size Check
0 10 mm

FIGURE 2
Topography Survey

EXISTING SITE PLAN

EXISTING BUILDINGS
906.6m2 total floor area approx

156.3m2
252.6m2
15.5m2
23.2m2
16.4m2
16.7m2
116.7m2
5.4m2
254.3m2
49.5m2

(Drawing Title)
Scale: 1:200

REV.	DATE	DESCRIPTION	BY
2			

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CLIENT
Roy & Rachael Allum

PROJECT
Sycamore Lodge

DRAWING
Topography Survey

PROJECT NUMBER	SCALE @ A1	DATE	BY
3966	1:200	March '22	CS

DRAWING NUMBER	REVISION	STATUS
02		Preliminary

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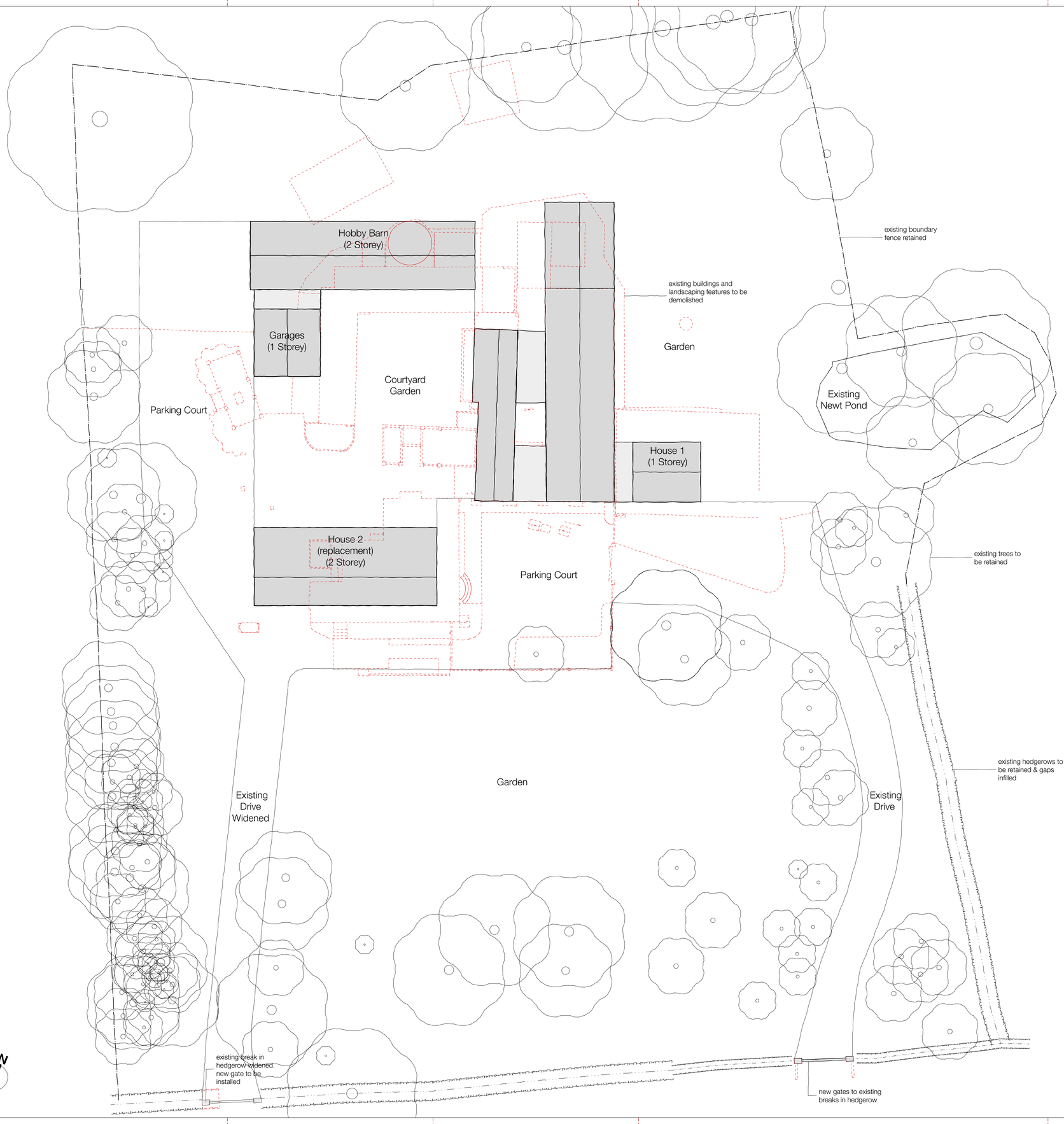
0 50 mm

FIGURE 3
Proposed Site Plan



Proposed Site Plan
1.200

0 2 4 6 8 10 M

N

REV.	DATE	DESCRIPTION	BY
D	21/06/23	House 2 moved	CS
C	16/06/23	House 2 moved	CS
B	01/06/23	Building positions revised	CS

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CLIENT
Roy & Rachael Allum

PROJECT
Sycamore Lodge

DRAWING
Proposed Site Plan

PROJECT NUMBER	SCALE @ A1	DATE	BY
3966	1:200	March '23	CS

DRAWING NUMBER	REVISION	STATUS
003	D	Pre-app

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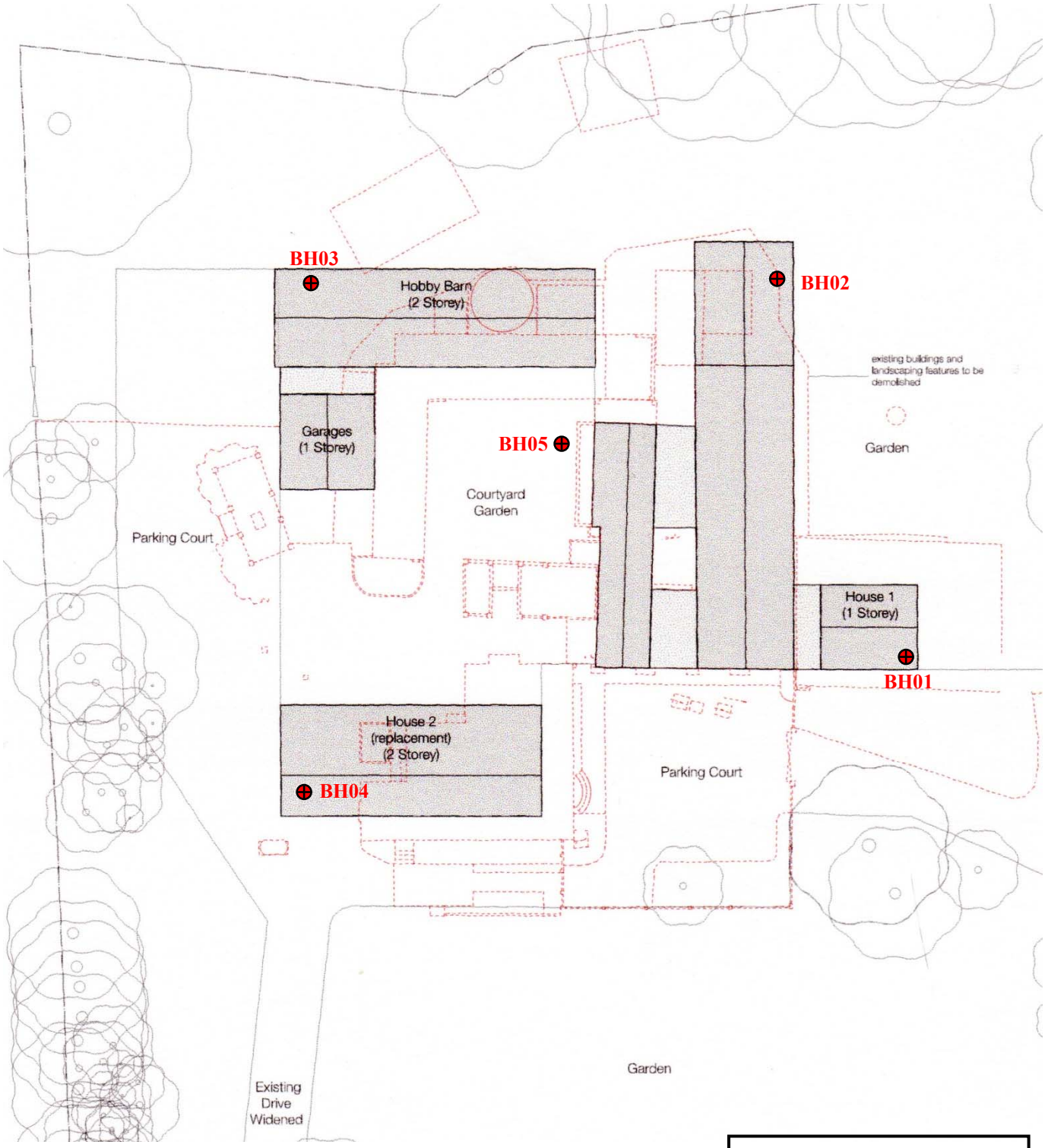
Print Size Check
0 10 mm

FIGURE 4
Exploratory Hole Location Plans



Key: **BH – Borehole** ⊕

(15th September 2023)

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Project: **Sycanore Lodge, Green Lane, Hickling Pastures, Notts.**

Title: **EXPLORATORY HOLE LOCATION PLAN**

Project No. **230311N**

Date drawn: **09/10/23**

Scale: **NTS**

Figure 4 (1)

Client: **Roy & Rachael Allum**

Existing Floor Plan with Proposed Extensions shown in red
1.100

Key: TH – Trial Hole
(15th September 2023)

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Project: **Sycanore Lodge, Green Lane, Hickling Pastures, Notts.**

Title: **EXPLORATORY HOLE LOCATION PLAN**

Project No. **230311N**

Date drawn: **09/10/23**

Scale: **NTS**
Figure 4 (2)

Client: **Roy & Rachael Allum**

APPENDIX I
Borehole Logs

BOREHOLE LOG

CASTLE ROCK GEOTECH

Geological, Geotechnical & Environmental Consultants
Nottingham, England.

Project: **Sycamore Lodge, Green Lane, Hickling Pastures, Notts.**

Client: **Roy & Rachael Allum**

Borehole No: **BH01**
Sheet 1of 1

Date: 15th September 2023
Method / Equipment: Windowless Sampling / Premier Compact 110 rig
Boring Diameter: 101mm to 70mm

Coordinates:
Ground Level:

Sampling Details		Water Level (m)	SPT N-value (seating / drive penetration)	Description of Strata	Depth (m) (thickness m)	Legend	Backfill
Depth (m)	Type/No.						
0.15 - 1.00	C1 (85% recovery)			**MADE GROUND**: Non-reinforced CONCRETE slab (150mm) over moderately compact sub-base of crushed concrete (gravel to cobble grade) in a brown grey sandy matrix.	(0.30) 0.30		
0.15 - 0.45	D1 (TJ)			**MADE GROUND**: Brownish grey sandy SUBSOIL with root hairs.	(0.15) 0.45		
1.00 - 1.45	SPT1		N=10 (S) (2,2/2,3,2,3)	Firm becoming firm to stiff grey mottled brown gravelly silty medium strength CLAY with rare pockets of brown yellow sand. Gravel is fine to coarse angular to sub-rounded of various lithologies, mainly chalk. **(Glacial Till – Oadby Member)**	(1.55)		
1.00 - 2.00	C2 (90% recovery)						
1.00 - 1.20	D2 (T)						
1.50 - 1.70	D3 (T)						
2.00 - 2.45	SPT2		N=18 (S) (2,2/3,5,4,6)	Stiff grey closely fissured gravelly silty high strength CLAY with occasional chalk cobbles. Gravel is fine to coarse angular to sub-rounded of various lithologies, mainly chalk. **(Glacial Till – Oadby Member)**	2.00		
2.00 - 3.00	C3 (100% recovery)						
2.80 - 3.00	D4 (T)						
3.00 - 3.45	SPT3		N=20 (S) (3,4/4,4,5,7)				
3.00 - 4.00	C4 (100% recovery)				(3.45)		
4.00 - 4.45	SPT4		N=18 (S) (3,3/3,4,5,6)				
4.00 - 5.00	C5 (100% recovery)						
4.00 - 4.20	D5 (T)						
5.00 - 5.45	SPT5		N=19 (S) (3,3/4,4,5,6)				
				End of borehole at 5.45m below existing ground level.	5.45		

SAMPLES / TESTS

D	Disturbed Sample (T plastic tub / J amber glass jar)
B	Bulk Sample
U	Undisturbed Sample (102mm)
W	Water Sample
SPT	Standard Penetration Test (S/C)
N=	No. of blows/300mm penetration in SPT/CPT
*	Sampler Sank (self weight)
▽	Water Strike
▼	Standing Water Level (S.W.L.)
NR	No Sample Recovery

REMARKS:

1. Hand shear vane (HSV) tests carried out at 0.80m – 90kN/m² and 1.80m – >130kN/m².
2. Groundwater not encountered, borehole dry on completion.
3. SPT 'N' – values are uncorrected.
4. Borehole backfilled with arisings on completion.

Scale: 1: 40
All dimensions in metres

Logged by: BF

Checked by: RWJP / RAL

***Project Ref*: 230311N**

BOREHOLE LOG

CASTLE ROCK GEOTECH

Geological, Geotechnical & Environmental Consultants
Nottingham, England.

Project: **Sycamore Lodge, Green Lane, Hickling Pastures, Notts.**

Client: **Roy & Rachael Allum**

Borehole No: **BH02**
Sheet 1of 1

Date: 15th September 2023
Method / Equipment: Windowless Sampling / Premier Compact 110 rig
Boring Diameter: 101mm to 77mm

Coordinates:
Ground Level:

Sampling Details		Water Level (m)	SPT N-value (seating / drive penetration)	Description of Strata	Depth (m) *(thickness m)*	Legend	Backfill
Depth (m)	Type/No.						
0.00 - 1.00	C1 (90% recovery)			**MADE GROUND**: Brown reworked sandy TOPSOIL with occasional brick and slate fragments (gravel to cobble grade) and root hairs. Polythene membrane at base.	*(0.30)* 0.30		
0.00 - 0.50	D1 (TJ)			Initially soft becoming firm and firm to stiff with depth greenish grey brown to grey brown mottled gravelly silty medium to high strength CLAY with rare pockets of brown yellow sand. Gravel is fine to coarse angular to sub-rounded of various lithologies, mainly chalk. **(Glacial Till – Oadby Member)**			
1.00 - 1.45	SPT1		N=10 (S) (1,2/2,2,3,3)				
1.00 - 2.00	C2 (100% recovery)				*(2.50)*		
1.00 - 1.20	D2 (T)						
1.30 - 1.50	D3 (T)						
2.00 - 2.45	SPT2		N=19 (S) (3,3/4,4,4,7)				
2.00 - 3.00	C3 (100% recovery)						
2.00 - 2.20	D4 (T)				2.80		
3.00 - 3.45	SPT3		N=19 (S) (3,4/4,4,4,7)	Stiff grey mottled brown becoming grey closely fissured gravelly silty high strength CLAY with occasional chalk cobbles. Gravel is fine to coarse angular to sub-rounded of various lithologies, mainly chalk. **(Glacial Till – Oadby Member)**			
3.00 - 4.00	C4 (100% recovery)				*(1.65)*		
4.00 - 4.45	SPT4		N=25 (S) (3,4/5,5,7,8)				
				End of borehole at 4.45m below existing ground level.	4.45		

SAMPLES / TESTS

D	Disturbed Sample (T plastic tub / J amber glass jar)
B	Bulk Sample
U	Undisturbed Sample (102mm)
W	Water Sample
SPT	Standard Penetration Test (S/C)
N=	No. of blows/300mm penetration in SPT/CPT
*	Sampler Sank (self weight)
▽	Water Strike
▼	Standing Water Level (S.W.L.)
NR	No Sample Recovery

REMARKS:

1. Hand shear vane (HSV) tests carried out at 0.80m – 75kN/m^2, 1.50m – 65kN/m^2 and 2.50m – >130kN/m^2.
2. Groundwater not encountered, borehole dry on completion.
3. SPT 'N' – values are uncorrected.
4. Borehole backfilled with arisings on completion.

Scale: 1: 40
All dimensions in metres

Logged by: BF

Checked by: RWJP / RAL

***Project Ref*: 230311N**

BOREHOLE LOG

CASTLE ROCK GEOTECH

Geological, Geotechnical & Environmental Consultants
Nottingham, England.

Project: **Sycamore Lodge, Green Lane, Hickling Pastures, Notts.**

Client: **Roy & Rachael Allum**

Borehole No: **BH03**
Sheet 1of 1

Date: 15th September 2023
Method / Equipment: Windowless Sampling / Premier Compact 110 rig
Boring Diameter: 101mm to 77mm

Coordinates:
Ground Level:

Sampling Details		Water Level (m)	SPT N-value (seating / drive penetration)	Description of Strata	Depth (m) *(thickness m)*	Legend	Backfill
Depth (m)	Type/No.						
0.00 - 1.00 0.10 - 0.65	C1 (85% recovery) D1 (TJ)			**MADE GROUND**: Brown reworked sandy TOPSOIL (0.10m) over brownish grey ashy sandy SUBSOIL with scattered brick, concrete fragments (gravel grade), rootlets and root hairs.	*(0.65)*		
					0.65		
1.00 - 1.45	SPT1		N=12 (S) (2,2/2,3,3,4)	**MADE GROUND**: Soft brown and light brown structureless slightly sandy silty CLAY with occasional gravel grade fragments of flint and chalk, and rootlets.	*(0.55)*		
1.00 - 2.00 1.00 - 1.20	C2 (65% recovery) D2 (T)				1.20		
				Firm grey and light grey brown yellow mottled gravelly silty medium strength CLAY. Gravel is fine to coarse angular to sub-rounded of various lithologies, mainly chalk. (**Glacial Till – Oadby Member**)	*(1.20)*		
2.00 - 2.45	SPT2		N=18 (S) (2,3/3,4,5,6)				
2.00 - 3.00 2.00 - 2.20 2.50 - 2.70	C3 (100% recovery) D3 (T) D4 (T)				2.40		
				Stiff grey mottled brown becoming grey closely fissured gravelly silty high strength CLAY. Gravel is fine to coarse angular to sub-rounded of various lithologies, mainly chalk. (**Glacial Till – Oadby Member**)	*(2.05)*		
3.00 - 3.45	SPT3		N=29 (S) (5,5/6,7,7,9)				
3.00 - 4.00	C4 (95% recovery)						
4.00 - 4.45	SPT4		N=24 (S) (3,3/4,5,6,9)				
					4.45		
				End of borehole at 4.45m below existing ground level.			

SAMPLES / TESTS

D	Disturbed Sample (T plastic tub / J amber glass jar)
B	Bulk Sample
U	Undisturbed Sample (102mm)
W	Water Sample
SPT	Standard Penetration Test (S/C)
N=	No. of blows/300mm penetration in SPT/CPT
*	Sampler Sank (self weight)
▽	Water Strike
▼	Standing Water Level (S.W.L.)
NR	No Sample Recovery

REMARKS:

1. Hand shear vane (HSV) tests carried out at 0.80m – 60kN/m², 1.80m – 90kN/m² , 2.50m – 85kN/m², 2.80m – 120kN/m² and 3.50m – >130kN/m².
2. Groundwater not encountered, borehole dry on completion.
3. SPT 'N' – values are uncorrected.
4. Borehole backfilled with arisings on completion.

Scale: 1: 40
All dimensions in metres

Logged by: BF

Checked by: RWJP / RAL

***Project Ref*: 230311N**

BOREHOLE LOG

CASTLE ROCK GEOTECH

Geological, Geotechnical & Environmental Consultants
Nottingham, England.

Project: **Sycamore Lodge, Green Lane, Hickling Pastures, Notts.**

Client: **Roy & Rachael Allum**

Borehole No: **BH04**
Sheet 1of 1

Date: 15th September 2023
Method / Equipment: Windowless Sampling / Premier Compact 110 rig
Boring Diameter: 101mm to 77mm

Coordinates:
Ground Level:

Sampling Details		Water Level (m)	SPT N-value (seating / drive penetration)	Description of Strata	Depth (m) *(thickness m)*	Legend	Backfill
Depth (m)	Type/No.						
0.00 - 1.00	C1 (55% recovery)			**MADE GROUND**: Asphalt surfacing over sub-base of crushed brick and limestone aggregate in a brown sandy clay matrix.	0.10 *(0.10)*		
0.50 - 1.00	D1 (TJ)			**MADE GROUND**: Soft to firm dark grey brown structureless silty low strength CLAY with scattered gravel grade concrete, limestone and flint fragments.	*(1.40)*		
1.00 - 1.45	SPT1		N=7 (S) (2,2/2,1,2,2)				
1.00 - 2.00	C2 (60% recovery)						
1.50 - 1.70	D2 (T)			Firm grey brown yellow mottled gravelly silty medium strength CLAY. Gravel is fine to coarse angular to sub-rounded of various lithologies, mainly chalk. (**Glacial Till – Oadby Member**)	1.50 *(1.30)*		
2.00 - 2.45	SPT2		N=14 (S) (2,2/3,3,4,4)				
2.00 - 3.00	C3 (100% recovery)						
2.50 - 2.70	D3 (T)				2.80 *(1.60)*		
3.00 - 3.45	SPT3		N=17 (S) (3,3/3,4,5,5)	Stiff grey mottled brown becoming grey closely fissured gravelly silty medium to high strength CLAY with occasional chalk cobbles. Gravel is fine to coarse angular to sub-rounded of various lithologies, mainly chalk. (**Glacial Till – Oadby Member**)			
3.00 - 4.00	C4 (100% recovery)						
3.00 - 3.20	D4 (T)						
4.00 - 4.40	SPT4		50/245 (S) (4,5/16,15,14,5/20)		4.40		
				End of borehole at 4.40m below existing ground level.			

SAMPLES / TESTS

D	Disturbed Sample (T plastic tub / J amber glass jar)
B	Bulk Sample
U	Undisturbed Sample (102mm)
W	Water Sample
SPT	Standard Penetration Test (S/C)
N=	No. of blows/300mm penetration in SPT/CPT
*	Sampler Sank (self weight)
▽	Water Strike
▼	Standing Water Level (S.W.L.)
NR	No Sample Recovery

REMARKS:

1. Hand shear vane (HSV) tests carried out at 1.50m – 90kN/m² and 2.50m – >130kN/m².
2. Groundwater not encountered, borehole dry on completion.
3. SPT 'N' – values are uncorrected.
4. Borehole backfilled with arisings on completion.

Scale: 1: 40
All dimensions in metres

Logged by: BF

Checked by: RWJP / RAL

***Project Ref*: 230311N**

BOREHOLE LOG

CASTLE ROCK GEOTECH

Geological, Geotechnical & Environmental Consultants
Nottingham, England.

Project: **Sycamore Lodge, Green Lane, Hickling Pastures, Notts.**

Client: **Roy & Rachael Allum**

Borehole No: **BH05**
Sheet 1of 1

Date: 15th September 2023
Method / Equipment: Windowless Sampling / Premier Compact 110 rig
Boring Diameter: 101mm to 77mm

Coordinates:
Ground Level:

Sampling Details		Water Level (m)	SPT N-value (seating / drive penetration)	Description of Strata	Depth (m) *(thickness m)*	Legend	Backfill
Depth (m)	Type/No.						
0.00 - 1.00	C1 (95% recovery)			**MADE GROUND**: Pea gravel surfacing over moderately compact sub-base mainly of crushed brick.	*(0.55)* 0.55		
0.80 - 1.00	D1 (TJ)			Firm greenish grey brown mottled gravelly silty medium strength CLAY with rare pockets of yellow sand. Gravel is fine to coarse angular to sub-rounded of various lithologies, mainly chalk. (**Glacial Till** – **Oadby Member**)			
1.00 - 1.45	SPT1		N=7 (S) (1,2/1,2,2,2)		*(1.15)*		
1.00 - 2.00	C2 (100% recovery)						
1.00 - 1.20	D2 (T)						
1.50 - 1.70	D3 (T)				1.70		
2.00 - 2.45	SPT2		N=11 (S) (2,2/2,2,3,4)	Firm becoming stiff grey mottled brown and grey with depth closely fissured gravelly silty medium to high strength CLAY. Gravel is fine to coarse angular to sub-rounded of various lithologies, mainly chalk. (**Glacial Till** – **Oadby Member**)			
2.00 - 3.00	C3 (100% recovery)						
2.50 - 2.70	D4 (T)						
3.00 - 3.45	SPT3		N=13 (S) (2,3/2,3,4,4)		*(2.75)*		
3.00 - 4.00	C4 (90% recovery)						
4.00 - 4.45	SPT4		N=21 (S) (3,3/4,4,6,7)		4.45		
				End of borehole at 4.45m below existing ground level.			

SAMPLES / TESTS

D	Disturbed Sample (T plastic tub / J amber glass jar)
B	Bulk Sample
U	Undisturbed Sample (102mm)
W	Water Sample
SPT	Standard Penetration Test (S/C)
N=	No. of blows/300mm penetration in SPT/CPT
*	Sampler Sank (self weight)
▽	Water Strike
▼	Standing Water Level (S.W.L.)
NR	No Sample Recovery

REMARKS:

1. Hand shear vane (HSV) tests carried out at 0.80m – 100kN/m², 1.50m – 105kN/m² and 2.50m – >130kN/m².
2. Groundwater not encountered, borehole dry on completion.
3. SPT 'N' – values are uncorrected.
4. Borehole backfilled with arisings on completion.

Scale: 1: 40
All dimensions in metres

Logged by: BF

Checked by: RWJP / RAL

***Project Ref*: 230311N**

APPENDIX II
Trial Hole Logs

TRIAL HOLE LOG

CASTLE ROCK GEOTECH
Geological, Geotechnical & Environmental Consultants
Nottingham, England.

Project: **Sycamore Lodge, Green Lane, Hickling Pastures, Notts.**

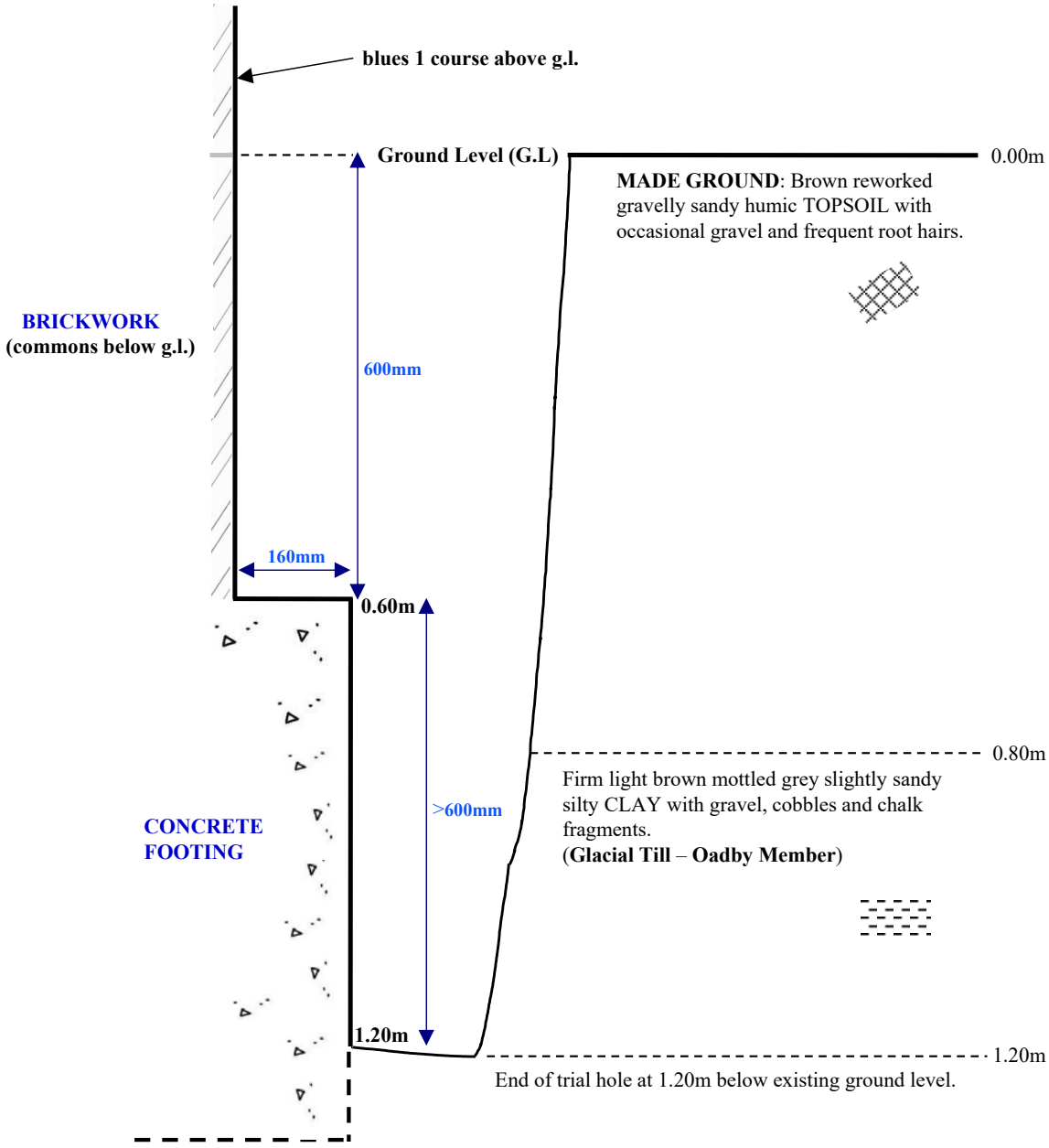
Client: **Roy and Rachael Allum**

Trial Hole No: **TH01**
Sheet 1of1

Date: 15th September 2023
Method / Equipment: Hand Excavation / Hand Tools

Coordinates:
Ground Level:

Trial Hole No. TH01



REMARKS:

1. Sidewalls stable throughout the excavation period.
2. Groundwater not encountered.
3. Trial hole backfilled with arisings on completion.

Scale: NTS

Logged by: RAL

Checked by: RWJP

***Project Ref*: 230311N**

TRIAL HOLE LOG

CASTLE ROCK GEOTECH
Geological, Geotechnical & Environmental Consultants
Nottingham, England.

Project: **Sycamore Lodge, Green Lane, Hickling Pastures, Notts.**

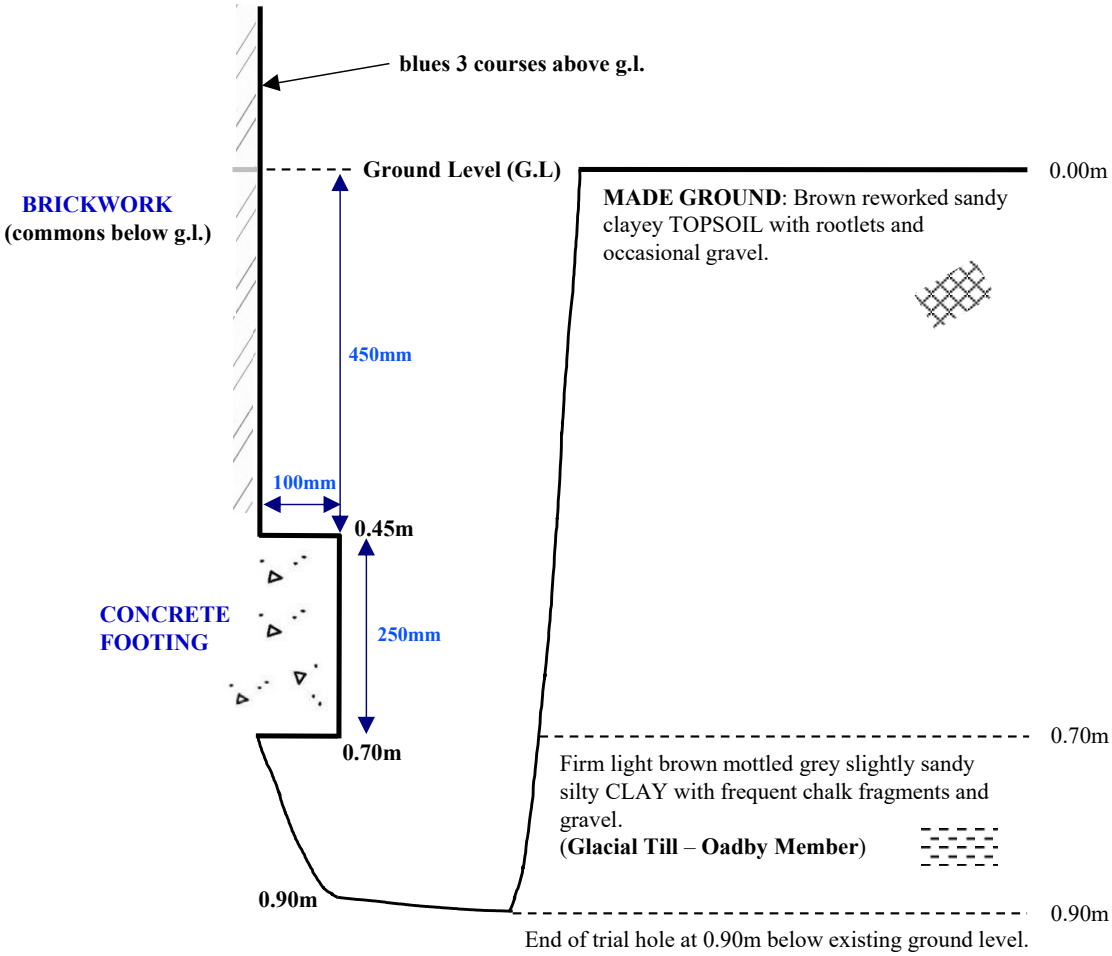
Client: **Roy and Rachael Allum**

Trial Hole No: **TH02**
Sheet 1of1

Date: 15th September 2023
Method / Equipment: Hand Excavation / Hand Tools

Coordinates:
Ground Level:

Trial Hole No. TH02



REMARKS:

1. Sidewalls stable throughout the excavation period.
2. Groundwater not encountered.
3. Trial hole backfilled with arisings on completion.

Scale: NTS

Logged by: RAL

Checked by: RWJP

***Project Ref*: 230311N**

TRIAL HOLE LOG

CASTLE ROCK GEOTECH
Geological, Geotechnical & Environmental Consultants
Nottingham, England.

Project: **Sycamore Lodge, Green Lane, Hickling Pastures, Notts.**

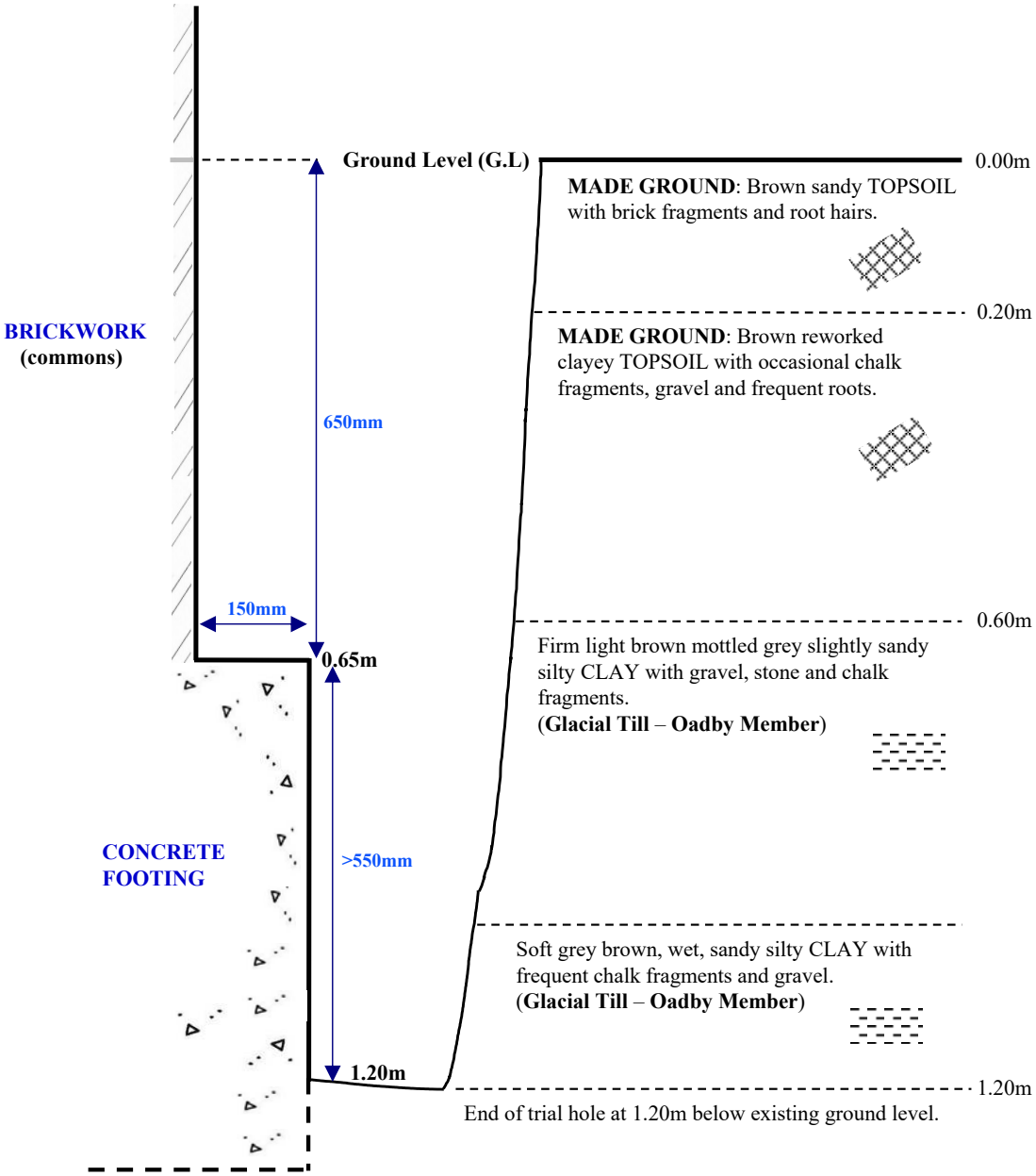
Client: **Roy and Rachael Allum**

Trial Hole No: **TH03**
Sheet 1of1

Date: 15th September 2023
Method / Equipment: Hand Excavation / Hand Tools

Coordinates:
Ground Level:

Trial Hole No. TH03



REMARKS:

1. Sidewalls stable throughout the excavation period.
2. Groundwater encountered at approx. 1.00m, standing at 1.05m on completion.
3. Trial hole backfilled with arisings on completion.

Scale: NTS

Logged by: RAL

Checked by: RWJP

***Project Ref*: 230311N**

TRIAL HOLE LOG

CASTLE ROCK GEOTECH

Geological, Geotechnical & Environmental Consultants
Nottingham, England.

Project: **Sycamore Lodge, Green Lane, Hickling Pastures, Notts.**

Client: **Roy & Rachael Allum**

Trial Hole No: **TH04**
Sheet 1of1

Date: 15th September 2023
Method / Equipment: Hand Excavation / Hand Tools

Coordinates:
Ground Level:

Sampling Details		Water Level (m)	Field Test	Description of Strata	Depth (m) *(thickness m)*	Legend	Backfill
Depth (m)	Type/No.						
				MADE GROUND: Non-reinforced CONCRETE slab (100mm) with a polythene membrane at base, over 'dense' brick rubble fill including whole bricks in a brown sandy matrix.	*(0.30)*		
					0.30		
				Firm dark greenish grey and brown mottled sandy silty CLAY with rare gravel and cobbles. (**Glacial Till** – **Oadby Member**)	*(0.30)*		
					0.60		
				End of trial hole at 0.60m below existing ground level.			

REMARKS:
1. Concrete floor slab broken out using a hydraulic breaker.
2. Groundwater not encountered.
3. Trial hole backfilled with arisings on completion.
4. Strength description in apostrophes is qualitative and based on engineering judgement.

Scale: 1:20
All dimensions in metres

Logged by: RAL

Checked by: RWJP

***Project Ref*: 230311N**

KEY: Sample Type: D - Disturbed (T - 500ml plastic tub, J - 250ml amber glass jar, / B – Bulk Disturbed)
In-situ Tests: Shear Strength (kN/m^2) - HSV = Hand Shear Vane (uncorrected) / * o.s. = off scale (>130 kN/m^2)
PP = Pocket Penetrometer (readings in kg/cm^2) / CIH = Clegg Impact Hammer
California Bearing Ratio (CBR) = Soil Assessment Cone Penetrometer (SACP) 0 - 15% / CBR = TRL DCP

TRIAL HOLE LOG

CASTLE ROCK GEOTECH

Geological, Geotechnical & Environmental Consultants
Nottingham, England.

Project: **Sycamore Lodge, Green Lane, Hickling Pastures, Notts.**

Client: **Roy & Rachael Allum**

Trial Hole No: **TH05**
Sheet 1of1

Date: 15th September 2023
Method / Equipment: Hand Excavation / Hand Tools

Coordinates:
Ground Level:

Sampling Details		Water Level (m)	Field Test	Description of Strata	Depth (m) *(thickness m)*	Legend	Backfill
Depth (m)	Type/No.						
				MADE GROUND: Non-reinforced CONCRETE slab (100mm) with a polythene membrane at base, over 'dense' brick rubble fill including whole bricks in a brown sandy matrix.	*(0.30)* 0.30		
				Soft to firm dark greenish grey and brown mottled sandy silty CLAY with rare gravel. (**Glacial Till – Oadby Member**)	*(0.10)* 0.40		
				End of trial hole at 0.40m below existing ground level.			

REMARKS:
1. Concrete floor slab broken out using a hydraulic breaker.
2. Groundwater not encountered.
3. Trial hole backfilled with arisings on completion.
4. Strength description in apostrophes is qualitative and based on engineering judgement.

Scale: 1:20
All dimensions in metres

Logged by: RAL

Checked by: RWJP

***Project Ref*: 230311N**

KEY: Sample Type: D - Disturbed (T - 500ml plastic tub, J - 250ml amber glass jar, / B – Bulk Disturbed)
In-situ Tests: Shear Strength (kN/m^2) - HSV = Hand Shear Vane (uncorrected) / * o.s. = off scale (>130 kN/m^2)
PP = Pocket Penetrometer (readings in kg/cm^2) / CIH = Clegg Impact Hammer
California Bearing Ratio (CBR) = Soil Assessment Cone Penetrometer (SACP) 0 - 15% / CBR = TRL DCP

TRIAL HOLE LOG

CASTLE ROCK GEOTECH

Geological, Geotechnical & Environmental Consultants
Nottingham, England.

Project: **Sycamore Lodge, Green Lane, Hickling Pastures, Notts.**

Client: **Roy & Rachael Allum**

Trial Hole No: **TH06**
Sheet 1of1

Date: 15th September 2023
Method / Equipment: Hand Excavation / Hand Tools

Coordinates:
Ground Level:

Sampling Details		Water Level (m)	Field Test	Description of Strata	Depth (m) *(thickness m)*	Legend	Backfill
Depth (m)	Type/No.						
				MADE GROUND: Non-reinforced CONCRETE slab (100mm, no polythene membrane at base), over 'dense' brick rubble fill including whole bricks in a brown sandy clay matrix.	*(0.25)* 0.25		
				Soft greenish grey brown mottled sandy silty CLAY with rare gravel. (**Glacial Till – Oadby Member**)	*(0.15)* 0.40		
				End of trial hole at 0.40m below existing ground level.			

REMARKS:
1. Concrete floor slab broken out using a hydraulic breaker.
2. Groundwater not encountered.
3. Trial hole backfilled with arisings on completion.
4. Strength description in apostrophes is qualitative and based on engineering judgement.

Scale: 1:20
All dimensions in metres

Logged by: RAL

Checked by: RWJP

***Project Ref*: 230311N**

KEY: Sample Type: D - Disturbed (T - 500ml plastic tub, J - 250ml amber glass jar, / B – Bulk Disturbed)
In-situ Tests: Shear Strength (kN/m^2) - HSV = Hand Shear Vane (uncorrected) / * o.s. = off scale (>130 kN/m^2)
PP = Pocket Penetrometer (readings in kg/cm^2) / CIH = Clegg Impact Hammer
California Bearing Ratio (CBR) = Soil Assessment Cone Penetrometer (SACP) 0 - 15% / CBR = TRL DCP

TRIAL HOLE LOG

CASTLE ROCK GEOTECH

Geological, Geotechnical & Environmental Consultants
Nottingham, England.

Project: **Sycamore Lodge, Green Lane, Hickling Pastures, Notts.**

Client: **Roy & Rachael Allum**

Trial Hole No: **TH07**
Sheet 1of1

Date: 15th September 2023
Method / Equipment: Hand Excavation / Hand Tools

Coordinates:
Ground Level:

Sampling Details		Water Level (m)	Field Test	Description of Strata	Depth (m) *(thickness m)*	Legend	Backfill
Depth (m)	Type/No.						
				MADE GROUND: Non-reinforced CONCRETE slab (120mm) with a polythene membrane at base, over 'dense' brick rubble fill including whole bricks in a brown sandy matrix.	*(0.30)*		
				Firm brown and light brown sandy silty CLAY with rare gravel. (**Glacial Till** – **Oadby Member**)	0.30 *(0.10)*		
				End of trial hole at 0.40m below existing ground level.	0.40		

REMARKS:
1. Concrete floor slab broken out using a hydraulic breaker.
2. Groundwater not encountered.
3. Trial hole backfilled with arisings on completion.
4. Strength description in apostrophes is qualitative and based on engineering judgement.

Scale: 1:20
All dimensions in metres

Logged by: RAL

Checked by: RWJP

***Project Ref*: 230311N**

KEY: Sample Type: D - Disturbed (T - 500ml plastic tub, J - 250ml amber glass jar, / B – Bulk Disturbed)
In-situ Tests: Shear Strength (kN/m^2) - HSV = Hand Shear Vane (uncorrected) / * o.s. = off scale (>130 kN/m^2)
PP = Pocket Penetrometer (readings in kg/cm^2) / CIH = Clegg Impact Hammer
California Bearing Ratio (CBR) = Soil Assessment Cone Penetrometer (SACP) 0 - 15% / CBR = TRL DCP

TRIAL HOLE LOG

CASTLE ROCK GEOTECH
Geological, Geotechnical & Environmental Consultants
Nottingham, England.

Project: **Sycamore Lodge, Green Lane, Hickling Pastures, Notts.**

Client: **Roy & Rachael Allum**

Trial Hole No: **TH08**
Sheet 1of1

Date: 15th September 2023
Method / Equipment: Hand Excavation / Hand Tools

Coordinates:
Ground Level:

Sampling Details		Water Level (m)	Field Test	Description of Strata	Depth (m) *(thickness m)*	Legend	Backfill
Depth (m)	Type/No.						
				MADE GROUND: Non-reinforced CONCRETE slab (100mm) with a polythene membrane at base, over 'dense' brick rubble fill including whole bricks in a brown sandy matrix.	*(0.30)*		
					0.30		
				Firm brown sandy silty CLAY with rare gravel. (**Glacial Till** – **Oadby Member**)	*(0.15)*		
					0.45		
				End of trial hole at 0.45m below existing ground level.			

REMARKS:
1. Concrete floor slab broken out using a hydraulic breaker.
2. Groundwater not encountered.
3. Trial hole backfilled with arisings on completion.
4. Strength description in apostrophes is qualitative and based on engineering judgement.

Scale: 1:20
All dimensions in metres

Logged by: RAL

Checked by: RWJP

***Project Ref*: 230311N**

KEY: Sample Type: D - Disturbed (T - 500ml plastic tub, J - 250ml amber glass jar, / B – Bulk Disturbed)
In-situ Tests: Shear Strength (kN/m^2) - HSV = Hand Shear Vane (uncorrected) / * o.s. = off scale (>130 kN/m^2)
PP = Pocket Penetrometer (readings in kg/cm^2) / CIH = Clegg Impact Hammer
California Bearing Ratio (CBR) = Soil Assessment Cone Penetrometer (SACP) 0 - 15% / CBR = TRL DCP

TRIAL HOLE LOG

CASTLE ROCK GEOTECH

Geological, Geotechnical & Environmental Consultants
Nottingham, England.

Project: **Sycamore Lodge, Green Lane, Hickling Pastures, Notts.**

Client: **Roy & Rachael Allum**

Trial Hole No: **TH09**
Sheet 1of1

Date: 15th September 2023
Method / Equipment: Hand Excavation / Hand Tools

Coordinates:
Ground Level:

Sampling Details		Water Level (m)	Field Test	Description of Strata	Depth (m) *(thickness m)*	Legend	Backfill
Depth (m)	Type/No.						
				MADE GROUND: Non-reinforced CONCRETE slab (120mm) with a polythene membrane at base, over 'dense' brick rubble fill including whole bricks in a brown sandy matrix.	*(0.30)* 0.30		
				Firm brown sandy silty CLAY with rare gravel. (**Glacial Till** – **Oadby Member**)	*(0.20)* 0.50		
				End of trial hole at 0.50m below existing ground level.			

REMARKS:
1. Concrete floor slab broken out using a hydraulic breaker.
2. Groundwater not encountered.
3. Trial hole backfilled with arisings on completion.
4. Strength description in apostrophes is qualitative and based on engineering judgement.

Scale: 1:20
All dimensions in metres

Logged by: RAL

Checked by: RWJP

***Project Ref*: 230311N**

KEY: Sample Type: D - Disturbed (T - 500ml plastic tub, J - 250ml amber glass jar, / B – Bulk Disturbed)
In-situ Tests: Shear Strength (kN/m^2) - HSV = Hand Shear Vane (uncorrected) / * o.s. = off scale (>130 kN/m^2)
PP = Pocket Penetrometer (readings in kg/cm^2) / CIH = Clegg Impact Hammer
California Bearing Ratio (CBR) = Soil Assessment Cone Penetrometer (SACP) 0 - 15% / CBR = TRL DCP

APPENDIX III
Soil Analytical Test Results

Unit A2
Windmill Road
Ponswood Industrial Estate
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East Sussex
TN38 9BY
Telephone: (01424) 718618

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info@elab-uk.co.uk

THE ENVIRONMENTAL LABORATORY LTD

Analytical Report Number:	23-50168
Issue:	1
Date of Issue:	27/09/2023
Contact:	Robert Price
Customer Details:	Castle Rock Geotech 22A Morley Road Nottingham NG3 6LL
Quotation No:	Q22-03460
Order No:	230311N/rwjp
Customer Reference:	230311N
Date Received:	19/09/2023
Date Approved:	27/09/2023
Details:	Sycamore Lodge, Hickling Pastures
Approved by:	

Tim Reeve, Quality Officer

Any comments, opinions or interpretations expressed herein are outside the scope of UKAS accreditation (Accreditation Number 2683

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Sample Summary

Report No.: 23-50168, issue number 1

Elab No.	Client's Ref.	Date Sampled	Date Scheduled	Description	Deviations
339733	BH01 D1 0.15 - 0.45	15/09/2023	19/09/2023	Sandy silty loam	
339734	BH03 D1 0.10 - 0.65	15/09/2023	19/09/2023	Silty loam	
339735	BH04 D2 0.50 - 1.00	15/09/2023	19/09/2023	Silty clayey loam	

Results Summary

Report No.: 23-50168, issue number 1

			ELAB Reference	339733	339734	339735
			Customer Reference	D1	D1	D2
			Sample ID			
			Sample Type	SOIL	SOIL	SOIL
			Sample Location	BH01	BH03	BH04
			Sample Depth (m)	0.15 - 0.45	0.10 - 0.65	0.50 - 1.00
			Sampling Date	15/09/2023	15/09/2023	15/09/2023
Determinand	**Codes**	**Units**	**LOD**			
Soil sample preparation parameters						
Moisture Content	N	%	0.1	21.5	12.5	13.7
Material removed	N	%	0.1	34.2	29.7	18.7
Description of Inert material removed	N		0	Stones	Stones	Stones
Metals						
Arsenic	M	mg/kg	1	21.8	23.5	11.2
Beryllium	U	mg/kg	1	1.1	1.1	< 1.0
Cadmium	M	mg/kg	0.5	< 0.5	0.5	< 0.5
Chromium (III)	N	mg/kg	5	31.3	38.7	16.4
Copper	M	mg/kg	5	31.1	46.4	15.3
Lead	M	mg/kg	5	57.2	76.8	10.9
Mercury	M	mg/kg	0.5	< 0.5	< 0.5	< 0.5
Nickel	M	mg/kg	5	28.6	36.3	23.9
Selenium	M	mg/kg	1	< 1.0	< 1.0	< 1.0
Vanadium	M	mg/kg	5	49.1	58.9	23.3
Zinc	M	mg/kg	5	220	205	49.6
Anions						
Water Soluble Sulphate	M	g/l	0.02	0.09	0.04	0.12
Inorganics						
Elemental Sulphur	M	mg/kg	20	< 20	< 20	< 20
Free Cyanide	N	mg/kg	1	< 1.0	< 1.0	< 1.0
Hexavalent Chromium	N	mg/kg	0.8	< 0.8	< 0.8	< 0.8
Total Sulphide	N	mg/kg	2	< 2	< 2	< 2
Total Cyanide	M	mg/kg	1	2.3	1.9	1.6
Water Soluble Boron	N	mg/kg	0.5	1.4	1.4	0.7
Miscellaneous						
pH	M	pH units	0.1	9.4	8.2	8.6
Soil Organic Matter	U	%	0.1	3.7	3.0	2.7
Phenols						
Total Phenols	N	mg/kg	6	< 6	< 6	< 6
Polyaromatic hydrocarbons						
Naphthalene	N	mg/kg	0.1	< 0.1	< 0.1	< 0.1
Acenaphthylene	N	mg/kg	0.1	< 0.1	< 0.1	< 0.1
Acenaphthene	N	mg/kg	0.1	< 0.1	< 0.1	< 0.1
Fluorene	N	mg/kg	0.1	< 0.1	< 0.1	< 0.1
Phenanthrene	N	mg/kg	0.1	< 0.1	< 0.1	< 0.1
Anthracene	N	mg/kg	0.1	< 0.1	< 0.1	< 0.1
Fluoranthene	N	mg/kg	0.1	< 0.1	< 0.1	< 0.1
Pyrene	N	mg/kg	0.1	< 0.1	< 0.1	< 0.1
Benzo(a)anthracene	N	mg/kg	0.1	< 0.1	< 0.1	< 0.1
Chrysene	N	mg/kg	0.1	< 0.1	< 0.1	< 0.1
Benzo(b)fluoranthene	N	mg/kg	0.1	< 0.1	< 0.1	< 0.1
Benzo(k)fluoranthene	N	mg/kg	0.1	< 0.1	< 0.1	< 0.1
Benzo(a)pyrene	N	mg/kg	0.1	< 0.1	< 0.1	< 0.1
Indeno(1,2,3-cd)pyrene	N	mg/kg	0.1	< 0.1	< 0.1	< 0.1
Dibenzo(a,h)anthracene	N	mg/kg	0.1	< 0.1	< 0.1	< 0.1
Benzo[g,h,i]perylene	N	mg/kg	0.1	< 0.1	< 0.1	< 0.1
Total PAH(16)	N	mg/kg	0.4	< 0.4	< 0.4	< 0.4

Results Summary

Report No.: 23-50168, issue number 1

			ELAB Reference	339733	339734	339735
			Customer Reference	D1	D1	D2
			Sample ID			
			Sample Type	SOIL	SOIL	SOIL
			Sample Location	BH01	BH03	BH04
			Sample Depth (m)	0.15 - 0.45	0.10 - 0.65	0.50 - 1.00
			Sampling Date	15/09/2023	15/09/2023	15/09/2023
Determinand	**Codes**	**Units**	**LOD**			
BTEX						
Benzene	M	ug/kg	10	< 10.0	< 10.0	< 10.0
Toluene	M	ug/kg	10	< 10.0	< 10.0	< 10.0
Ethylbenzene	M	ug/kg	10	< 10.0	< 10.0	< 10.0
Xylenes	M	ug/kg	10	< 10.0	< 10.0	< 10.0
MTBE	N	ug/kg	10	< 10.0	< 10.0	< 10.0
TPH CWG						
>C5-C6 Aliphatic (HS_1D_MS)	N	mg/kg	0.01	< 0.01	< 0.01	< 0.01
>C6-C8 Aliphatic (HS_1D_MS)	N	mg/kg	0.01	< 0.01	< 0.01	< 0.01
>C8-C10 Aliphatic (EH_CU_1D_AL)	N	mg/kg	1	< 1.0	< 1.0	< 1.0
>C10-C12 Aliphatic (EH_CU_1D_AL)	N	mg/kg	1	< 1.0	< 1.0	< 1.0
>C12-C16 Aliphatic (EH_CU_1D_AL)	N	mg/kg	1	< 1.0	< 1.0	< 1.0
>C16-C21 Aliphatic (EH_CU_1D_AL)	N	mg/kg	1	< 1.0	< 1.0	< 1.0
>C21-C35 Aliphatic (EH_CU_1D_AL)	N	mg/kg	1	4.2	< 1.0	1.8
>C35-C40 Aliphatic (EH_CU_1D_AL)	N	mg/kg	1	< 1.0	< 1.0	< 1.0
Total (>C5-C40) Aliphatic (HS_1D_MS+EH_CU_1D_AL)	N	mg/kg	1	4.2	< 1.0	1.8
>C5-C7 Aromatic (HS_1D_MS)	N	mg/kg	0.01	< 0.01	< 0.01	< 0.01
>C7-C8 Aromatic (HS_1D_MS)	N	mg/kg	0.01	< 0.01	< 0.01	< 0.01
>C8-C10 Aromatic (EH_CU_1D_AR)	N	mg/kg	1	< 1.0	< 1.0	< 1.0
>C10-C12 Aromatic (EH_CU_1D_AR)	N	mg/kg	1	< 1.0	< 1.0	< 1.0
>C12-C16 Aromatic (EH_CU_1D_AR)	N	mg/kg	1	< 1.0	< 1.0	< 1.0
>C16-C21 Aromatic (EH_CU_1D_AR)	N	mg/kg	1	< 1.0	< 1.0	< 1.0
>C21-C35 Aromatic (EH_CU_1D_AR)	N	mg/kg	1	3.6	< 1.0	1.7
>C35-C40 Aromatic (EH_CU_1D_AR)	N	mg/kg	1	< 1.0	< 1.0	< 1.0
Total (>C5-C40) Aromatic (HS_1D_MS+EH_CU_1D_AR)	N	mg/kg	1	3.6	< 1.0	1.7
Total (>C5-C40) Ali/Aro (HS_1D_MS+EH_CU_1D_Total)	N	mg/kg	1	7.8	< 1.0	3.4

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Results Summary

Report No.: 23-50168, issue number 1

Asbestos Results

Analytical result only applies to the sample as submitted by the client. Any comments, opinions or interpretations (marked #) in this report are outside UKAS accreditation (Accreditation No2683). They are subjective comments only which must be verified by the client.

Elab No	Depth (m)	Clients Reference	Description of Sample Matrix #	Asbestos Identification	Gravimetric Analysis Total (%)	Gravimetric Analysis by ACM Type (%)	Free Fibre Analysis (%)	Total Asbestos (%)
339733	0.15 - 0.45	BH01 D1	Brown Sandy Soil, Stones, Concrete	No asbestos detected	n/t	n/t	n/t	n/t
339734	0.10 - 0.65	BH03 D1	Brown Sandy Soil, Stones, Brick	No asbestos detected	n/t	n/t	n/t	n/t
339735	0.50 - 1.00	BH04 D2	Brown Soil, Stones	No asbestos detected	n/t	n/t	n/t	n/t

Method Summary

Report No.: 23-50168, issue number 1

Parameter	Codes	Analysis Undertaken On	Date Tested	Method Number	Technique
Soil					
Free cyanide	N	As submitted sample	25/09/2023	107	Colorimetry
Sulphide	N	As submitted sample	21/09/2023	109	Colorimetry
Hexavalent chromium	N	As submitted sample	27/09/2023	110	Colorimetry
pH	M	Air dried sample	21/09/2023	113	Electromeric
Aqua regia extractable metals	M	Air dried sample	21/09/2023	300	ICPMS
Phenols in solids	N	As submitted sample	21/09/2023	121	HPLC
Elemental Sulphur	M	Air dried sample	21/09/2023	122	HPLC
PAH (GC-FID)	N	As submitted sample	21/09/2023	133	GC-FID
Water soluble anions	M	Air dried sample	21/09/2023	172	Ion Chromatography
Low range Aliphatic hydrocarbons soil	N	As submitted sample	22/09/2023	181	GC-MS
Low range Aromatic hydrocarbons soil	N	As submitted sample	22/09/2023	181	GC-MS
BTEX in solids	M	As submitted sample	22/09/2023	181A	GC-MS
Water soluble boron	N	Air dried sample	21/09/2023	202	Colorimetry
Total cyanide	M	As submitted sample	25/09/2023	204	Colorimetry
Aliphatic hydrocarbons in soil	Rock	As submitted sample	21/09/2023	214	GC-FID
Aliphatic/Aromatic hydrocarbons in soil	N	As submitted sample	25/09/2023	214	GC-FID
Aromatic hydrocarbons in soil	N	As submitted sample	25/09/2023	214	GC-FID
Asbestos identification	U	Air dried sample	26/09/2023	281	Microscopy
Soil organic matter	U	Air dried sample	21/09/2023	BS1377:P3	Titrimetry

Tests marked N are not UKAS accredited

Report Information

Report No.: 23-50168, issue number 1

Key

U	hold UKAS accreditation
M	hold MCERTS and UKAS accreditation
N	do not currently hold UKAS accreditation
^	MCERTS accreditation not applicable for sample matrix
*	UKAS accreditation not applicable for sample matrix
S	Subcontracted to approved laboratory UKAS Accredited for the test
SM	Subcontracted to approved laboratory MCERTS/UKAS Accredited for the test
NS	Subcontracted to approved laboratory. UKAS accreditation is not applicable.
I/S	Insufficient Sample
U/S	Unsuitable sample
n/t	Not tested
<	means "less than"
>	means "greater than"
LOD	LOD refers to limit of detection, except in the case of pH soils and pH waters where it means limit of discrimination.
	Soil sample results are expressed on an air dried basis (dried at < 30°C), and are uncorrected for inert material removed.
	The results relate only to the sample received.
	PCB congener results may include any coeluting PCBs
	Uncertainty of measurement for the determinands tested are available upon request
	Unless otherwise stated, sample information has been provided by the client. This may affect the validity of the results.

Deviation Codes

a	No date of sampling supplied
b	No time of sampling supplied (Waters Only)
c	Sample not received in appropriate containers
d	Sample not received in cooled condition
e	The container has been incorrectly filled
f	Sample age exceeds stability time (sampling to receipt)
g	Sample age exceeds stability time (sampling to analysis)

Where a sample has a deviation code, the applicable test result may be invalid.

Sample Retention and Disposal

All soil samples will be retained for a period of one month
All water samples will be retained for 7 days following the date of the test report
Charges may apply to extended sample storage

TPH Classification - HWOL Acronym System

HS	Headspace analysis
EH	Extractable Hydrocarbons - i.e. everything extracted by the solvent
CU	Clean-up - e.g. by florisil, silica gel
1D	GC - Single coil gas chromatography
Total	Aliphatics & Aromatics
AL	Aliphatics only
AR	Aromatics only
2D	GC-GC - Double coil gas chromatography
#1	EH_Total but with humics mathematically subtracted
#2	EH_Total but with fatty acids mathematically subtracted
_	Operator - underscore to separate acronyms (exception for +)
+	Operator to indicate cumulative e.g. EH+HS_Total or EH_CU+HS_Total
MS	Mass Spectrometry

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THE ENVIRONMENTAL LABORATORY LTD

Analytical Report Number:	23-50166
Issue:	1
Date of Issue:	26/09/2023
Contact:	Robert Price
Customer Details:	Castle Rock Geotech 22A Morley Road Nottingham NG3 6LL
Quotation No:	Q22-03460
Order No:	230311N/rwjp
Customer Reference:	230311N
Date Received:	19/09/2023
Date Approved:	26/09/2023
Details:	Sycamore Lodge, Hickling Pastures
Approved by:	

Tim Reeve, Quality Officer

Any comments, opinions or interpretations expressed herein are outside the scope of UKAS accreditation (Accreditation Number 2683

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Sample Summary

Report No.: 23-50166, issue number 1

Elab No.	Client's Ref.	Date Sampled	Date Scheduled	Description	Deviations
339721	BH01 D2 1.00 - 1.20	15/09/2023	19/09/2023	Clayey loam	
339722	BH02 D2 1.00 - 1.20	15/09/2023	19/09/2023	Clayey loam	
339723	BH02 D4 2.00 - 2.20	15/09/2023	19/09/2023	Clayey loam	
339724	BH03 D2 1.00 - 1.20	15/09/2023	19/09/2023	Silty clayey loam	
339725	BH03 D4 2.50 - 2.70	15/09/2023	19/09/2023	Clayey loam	
339726	BH04 D2 1.50 - 1.70	15/09/2023	19/09/2023	Silty clayey loam	
339727	BH04 D4 3.00 - 3.20	15/09/2023	19/09/2023	Clayey loam	
339728	BH05 D2 1.00 - 1.20	15/09/2023	19/09/2023	Clayey loam	

Results Summary

Report No.: 23-50166, issue number 1

				ELAB Reference	339721	339722	339723	339724	339725	339726	339727	339728
				Customer Reference	D2	D2	D4	D2	D4	D2	D4	D2
				Sample ID								
				Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
				Sample Location	BH01	BH02	BH02	BH03	BH03	BH04	BH04	BH05
				Sample Depth (m)	1.00 - 1.20	1.00 - 1.20	2.00 - 2.20	1.00 - 1.20	2.50 - 2.70	1.50 - 1.70	3.00 - 3.20	1.00 - 1.20
				Sampling Date	15/09/2023	15/09/2023	15/09/2023	15/09/2023	15/09/2023	15/09/2023	15/09/2023	15/09/2023
Determinand	**Codes**	**Units**	**LOD**									
Soil sample preparation parameters												
Moisture Content	N	%	0.1		12.7	14.6	14.5	15.0	12.8	16.3	12.9	14.0
Material removed	N	%	0.1		8.9	23.1	25.1	22.1	21.7	23.7	13.5	17.4
Description of Inert material removed	N		0		Stones	Stones	Stones	Stones	Stones	Stones	Stones	Stones
Anions												
Water Soluble Sulphate	M	g/l	0.02		0.14	0.04	0.05	0.03	2.87	0.17	0.27	0.11
Miscellaneous												
pH	M	pH units	0.1		8.5	8.8	8.8	8.7	8.0	8.6	8.5	8.6

Method Summary

Report No.: 23-50166, issue number 1

Parameter	Codes	Analysis Undertaken On	Date Tested	Method Number	Technique
Soil					
pH	M	Air dried sample	21/09/2023	113	Electromeric
Water soluble anions	M	Air dried sample	21/09/2023	172	Ion Chromatography

Report Information

Report No.: 23-50166, issue number 1

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U/S	Unsuitable sample
n/t	Not tested
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	The results relate only to the sample received.
	PCB congener results may include any coeluting PCBs
	Uncertainty of measurement for the determinands tested are available upon request
	Unless otherwise stated, sample information has been provided by the client. This may affect the validity of the results.

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TPH Classification - HWOL Acronym System

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EH	Extractable Hydrocarbons - i.e. everything extracted by the solvent
CU	Clean-up - e.g. by florisil, silica gel
1D	GC - Single coil gas chromatography
Total	Aliphatics & Aromatics
AL	Aliphatics only
AR	Aromatics only
2D	GC-GC - Double coil gas chromatography
#1	EH_Total but with humics mathematically subtracted
#2	EH_Total but with fatty acids mathematically subtracted
_	Operator - underscore to separate acronyms (exception for +)
+	Operator to indicate cumulative e.g. EH+HS_Total or EH_CU+HS_Total
MS	Mass Spectrometry

APPENDIX IV
Geotechnical Laboratory Test Results

LABORATORY REPORT

Contract Number: PSL23/8010

Report Date: 05 October 2023

Client's Reference: 230311N

Client Name: Castle Rock Geotech

22A Morley Road
Mapperley
Nottingham
NG3 6LL

For the attention of: Rick Lowe/Rob Price

Project Name: Sycamore Lodge, Hickling Pastures

Date Received: 20/9/2023
Date Commenced: 20/9/2023
Date Completed: 05/10/2023

Notes: **Opinions and Interpretations are outside the UKAS Accreditation**

A copy of the Laboratory Schedule of accredited tests as issued by UKAS is attached to this report. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced other than in full, without the prior written approval of the laboratory.

Checked and Approved Signatories:

A Watkins (Director)	R Berriman (Quality Manager)	S Royle (Laboratory Manager)
L Knight (Assistant Laboratory Manager)	S Eyre (Senior Technician)	M Fennell (Senior Technician)

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Doncaster,
DN4 0AR
Tel: 01302 768098
Email: rberriman@prosoils.co.uk
awatkins@prosoils.co.uk

SUMMARY OF LABORATORY SOIL DESCRIPTIONS

Hole Number	Sample Number	Sample Type	Top Depth m	Base Depth m	Description of Sample
BH01	3	D	1.50	1.70	Brown mottled grey slightly gravelly sandy CLAY.
BH02	3	D	1.30	1.50	Dark grey slightly gravelly sandy CLAY.
BH03	3	D	2.00	2.20	Grey mottled brown slightly gravelly sandy CLAY.
BH04	3	D	2.50	2.70	Brown mottled grey slightly gravelly sandy CLAY.
BH05	1	D	0.80	1.00	Brown mottled grey slightly gravelly sandy CLAY.
BH05	3	D	1.50	1.70	Brown mottled grey slightly gravelly sandy CLAY.

UKAS TESTING 4043

PSL PROFESSIONAL SOILS LABORATORY A PHENNA GROUP COMPANY

Sycamore Lodge, Hickling Pastures

Contract No: PSL23/8010

Client Ref: 230311N

SUMMARY OF SOIL CLASSIFICATION TESTS

(BS1377 : PART 2 : 1990)

Hole Number	Sample Number	Sample Type	Top Depth m	Base Depth m	Moisture Content % Clause 3.2	Linear Shrinkage % Clause 6.5	Particle Density Mg/m^3 Clause 8.2	Liquid Limit % Clause 4.3/4	Plastic Limit % Clause 5.3	Plasticity Index % Clause 5.4	Passing .425mm %	Remarks
BH01	3	D	1.50	1.70	18			47	22	25	95	Intermediate Plasticity CI
BH02	3	D	1.30	1.50	18			43	21	22	95	Intermediate Plasticity CI
BH03	3	D	2.00	2.20	18			45	22	23	95	Intermediate Plasticity CI
BH04	3	D	2.50	2.70	17			46	22	24	95	Intermediate Plasticity CI
BH05	1	D	0.80	1.00	21			48	22	26	95	Intermediate Plasticity CI
BH05	3	D	1.50	1.70	20			42	20	22	95	Intermediate Plasticity CI

SYMBOLS : **NP : Non Plastic** *** : Liquid Limit and Plastic Limit Wet Sieved.**

UKAS TESTING 4043

PSL PROFESSIONAL SOILS LABORATORY A PHENNA GROUP COMPANY

Sycamore Lodge, Hickling Pastures

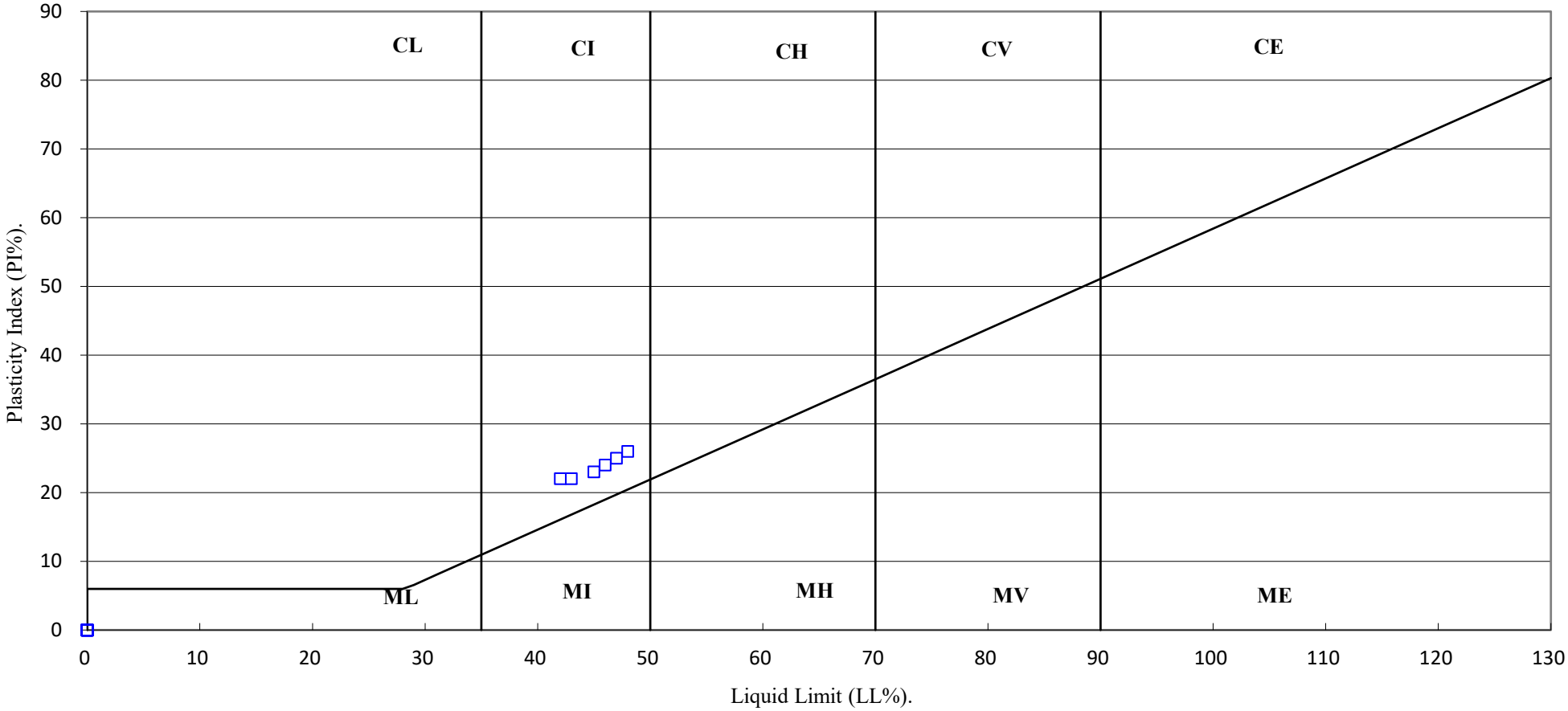
Contract No:

PSL23/8010

Client Ref:

230311N

PLASTICITY CHART FOR CASAGRANDE CLASSIFICATION.



UKAS TESTING 4043 / PSL PROFESSIONAL SOILS LABORATORY A PHENNA GROUP COMPANY	Sycamore Lodge, Hickling Pastures	Contract No: PSL23/8010 Client Ref: 230311N

APPENDIX V
Site Photographs / Plates

APPENDIX V – SITE PHOTOGRAPHS / PLATES

CASTLE ROCK GEOTECH
Geological, Geotechnical & Environmental Consultants
Nottingham, England.

Project: **Sycamore Lodge, Green Lane, Hickling Pastures, Notts.**

Client: **Roy & Rachael Allum**

***Plate 1*: The arisings from borehole BH01, G.L. to 5.00m**

***Plate 2*: The arisings from borehole BH02, G.L. to 4.00m**

APPENDIX V – SITE PHOTOGRAPHS / PLATES

CASTLE ROCK GEOTECH
Geological, Geotechnical & Environmental Consultants
Nottingham, England.

Project: **Sycamore Lodge, Green Lane, Hickling Pastures, Notts.**

Client: **Roy & Rachael Allum**

***Plate 3*: The arisings from borehole BH03, G.L. to 4.00m**

***Plate 4*: The arisings from borehole BH04, G.L. to 4.00m**

APPENDIX V – SITE PHOTOGRAPHS / PLATES

***Plate 5*: The arisings from borehole BH04, G.L. to 4.00m**

***Plate 6*: The Premier 110 window sampling rig on borehole BH04**

APPENDIX V – SITE PHOTOGRAPHS / PLATES

***Plate 7*: Trial hole TH01 on completion**

***Plate 8*: Trial hole TH02 on completion**

APPENDIX V – SITE PHOTOGRAPHS / PLATES

***Plate 9*: The arisings from trial hole TH02**

***Plate 10*: Trial hole TH03 on completion**

APPENDIX V – SITE PHOTOGRAPHS / PLATES

***Plate 11*: The arisings from trial hole TH03**

***Plate 12*: Trial hole TH04 on completion**

APPENDIX V – SITE PHOTOGRAPHS / PLATES

***Plate 13*: The arisings from trial hole TH04**

***Plate 14*: Trial hole TH05 on completion**

APPENDIX V – SITE PHOTOGRAPHS / PLATES

***Plate 15*: Trial hole TH06 on completion**

***Plate 16*: The arisings from trial hole TH06**

APPENDIX V – SITE PHOTOGRAPHS / PLATES

***Plate 17*: Trial hole TH07 on completion**

***Plate 18*: The arisings from trial hole TH07**

APPENDIX V – SITE PHOTOGRAPHS / PLATES

***Plate 19*: Trial hole TH08 on completion**

***Plate 20*: Trial hole TH09 on completion**

APPENDIX V – SITE PHOTOGRAPHS / PLATES

***Plate 21*: The arisings from trial hole TH09**

APPENDIX VI
Tier 1 GAC Screening Thresholds

	TIER 1 ASSESSMENT CRITERIA		
LAND USE	Residential with Plant Uptake		
CONTAMINANT	**1%**	**2.50%**	**6%**
[a] Arsenic	37	37	37
[a] Cadmium	22	22	22
[b] Chromium III	910	910	910
[a] Chromium VI	21	21	21
[a] Lead	200	200	200
[b/c] Mercury	40	40	40
[b] Selenium	250	250	250
[b] Nickel	180	180	180
[b] Phenols	280	550	1100
[b] Copper	2400	2400	2400
[b] Zinc	3700	3700	3700
[d] Cyanide	34	34	34
[a] Benzene	0.20	0.33	0.87
[b] Toluene	130	290	660
[b] Ethylbenzene	47	110	260
[b] *o* - xylene	60	140	330
[b] *m* - xylene	59	140	320
[b] *p* - xylene	56	130	310
Non Genotoxic PAHs			
[b] Acenaphthene	210	510	1100
[b] Acenaphthylene	170	420	920
[b] Anthracene	2400	5400	11000
[b] Fluoranthene	280	560	890
[b] Fluorene	170	400	860
[b] Naphthalene	2.3	5.6	13
[b] Phenanthrene	95	220	440
[b] Pyrene	620	1200	2000
Genotoxic PAHs			
[a/e] Benzo(a)pyrene	5	5	5
ALIPHATIC HYDROCARBONS			
[b] C5-C6	42	78	160
[b] C6-C8	100	230	530
[b] C8-C10	27	65	150
[b] C10-C12	130	330	760
[b] C12-C16	1100	2400	4300
[b] C16-35	65000	92000	110000
AROMATIC HYDROCARBONS			
[b] C5-7 (benzene)	70	140	300
[b] C7-8 (toluene)	130	290	660
[b] C8-C10	34	83	190
[b] C10-C12	74	180	380
[b] C12-C16	140	330	660
[b] C16-C21	260	540	930
[b] C21-C35	1100	1500	1700

Notes

a C4SL - SP1010 (2014) - Benzene and Benzo(a)pyrene values for 1% and 2.5% SOM have been calculated using default C4SL parameters in CLEA v1.07

b LQM/CIEH S4UL values (2015).

c S4UL for inorganic Hg used.

d Atkins ATRISKsoil Value

e Benzo(a)pyrene is a surrogate marker for the 8 genotoxic PAHs (Benzo(a)pyrene, Benzo(a)anthracene, Benzo(b)fluoranthene, Benzo(ghi)perylene, Benzo(k)fluoranthene, Chrysene, Dibenzo(ah)anthracene, Ideno(1,2,3-cd)pyrene)

APPENDIX VII
Risk Assessment Rationale

RISK ASSESSMENT RATIONALE

The method for risk evaluation is a qualitative method taken from the UK CIRIA report C552 (*Contaminated Land Risk Assessment: A Guide to Good Practice, 2001*), document. It involves the classification of the:

- Magnitude of the potential **consequence** (severity) of risk occurring (Table RA-1); and
- Magnitude of the **probability** (likelihood) of the risk occurring (Table RA-2).

#

Classification of Consequence

#

The severity can be classified using a similar system also based on CIRIA C552. The terms and definitions relating to severity are:

Table RA-1: Classification of Consequence

Classification	Definition	Examples
Severe	Short term (acute) risk to human health likely to result in "significant harm" as defined by the Environment Protection Act 1990, Part IIA. Short term risk of pollution of sensitive water resource. Catastrophic damage to buildings/property. A short term risk to a particular ecosystem, or organism forming part of such ecosystem.	• High concentrations of cyanide on the surface of an informal recreation area. • Major spillage of contaminants from site into Controlled Waters. • Explosion, causing building collapse.
Medium	Chronic damage to Human Health. Pollution of sensitive water resources. A significant change in an ecosystem or organism forming a part of such ecosystem.	• Concentrations of a contaminant from site exceeds the generic or site specific assessment criteria for either human health or Controlled Waters. • Leaching of contaminants from a site into a Principal or Secondary A Aquifer. • Death of a species within a designated nature reserve. • Lesser toxic and asphyxiate effects.
Mild	Pollution of non-sensitive water resources. Significant damage to crops, buildings, structures and services. Damage to sensitive buildings / structures/services or the environment.	• Pollution of non-classified groundwater. • Damage to building rendering it unsafe to occupy.
Minor	Harm, although not necessarily significant harm, which may result in a financial loss or expenditure to resolve. Non-permanent health effects to human health. Easily reparable damage to buildings, structures and services.	• The presence of contaminants at such concentrations that PPE is required during site works. • The loss of plants in a landscaping scheme. • Discolouration of concrete.

Classification of Probability

The likelihood of an event can be classified on a four-point system using the following terms and definitions based on CIRIA C552:
#
Table RA-2: Classification of Probability

Classification	Definition
High Likelihood	There is a pollutant linkage and an event that appears very likely in the short term and almost inevitable over the long term or there is already clear evidence of harm or pollution.
Moderate Likelihood	There is a pollutant linkage and all the elements are present and in the right place which means it is probable that an event will occur. Circumstances are such that an event is not inevitable, but possible in the short term and likely over the long term.
Low Likelihood	There is a pollutant linkage circumstances are possible under which an event could occur. However, it is by no means certain that even over a longer period such an event would take place and is less likely in the shorter term.
Unlikely	There is a pollutant linkage, but circumstances are such that it is improbable that an event will occur, even in the very long term.

Risk Matrix

Once the likelihood of an event occurring and its severity have been classified, a risk category can be assigned from the Table below:

Table RA-3: Consequence against Probability

		Consequences			
		Severe (Sv)	Medium (Md)	Mild (Mi)	Minor (Mr)
Probability	High (Hi)	Very high Risk	High Risk	Moderate Risk	Moderate / Low Risk
	Likely (Li)	High Risk	Moderate Risk	Moderate / Low Risk	Low Risk
	Low likelihood (Lw)	Moderate Risk	Moderate / Low Risk	Low Risk	Very Low Risk
	Unlikely (Ul)	Moderate / Low Risk	Low Risk	Very Low Risk	Very Low Risk

Risk Descriptions

Definitions of these risk categories modified by CRG are as shown below with an assessment of the further work that might be required. Professional judgement is used to estimate the combination of probability and consequence of harm posed by any pollutant linkages identified.

Table RA-4: Description of the classified risks and likely action required

Risk Rating	*Description*
Very High	There is a high probability that severe harm could arise to a designated receptor from an identified source, or there is evidence that severe harm to a designated receptor is currently happening. Contaminants very likely to represent an unacceptable risk to identified targets. Site probably not suitable for proposed use without mitigation. Enforcement action possible. Urgent action required.
High	Harm is likely to arise to a designated receptor from an identified source. Contaminants likely to represent an unacceptable risk to identified targets. Site probably not suitable for proposed use without mitigation. Action required in the medium term.
Moderate	It is possible that harm could arise to a designated receptor from an identified hazard. However, it is either relatively unlikely that any such harm would be severe, or if any harm were to occur it is more likely that the harm would be relatively mild. Investigation (if not already undertaken) is normally required to clarify the risk and to determine the potential liability. Some remedial works may be required in the longer-term.
Moderate / Low	It is possible that harm could arise to a receptor. However, a combination of likelihood and consequence results in a risk that is above Low but is not of sufficient concern to be classified. as Moderate. It can be driven by cases where there is an acute risk which carries a severe consequence, but where the exposure is unlikely. Such harm would at worse normally be mild. The risk is unlikely to present a substantial liability. Some limited further investigation may be required to clarify the risk and any associated liability. If subsequent remediation works are necessary, they are likely to be limited in extent.
Low	It is possible that harm could arise to a designated receptor from an identified source, but it is likely that this harm, if realised, would at worst normally be mild.
Very Low / Negligible	There is a low possibility that harm could arise to a receptor. In an event of such being realised is not likely to be severe. If contamination sources are present, they are considered to be minor in nature and extent. Site suitable for proposed use without mitigation. No further action required.

APPENDIX VIII
Notes on Limitations

NOTES ON LIMITATIONS

PHASE I DESK STUDY & PHASE II GROUND INVESTIGATION

PHASE I DESK STUDY:-

The Phase I Desk Study report comprise a review of information available from a number of sources/parties (potentially also including the Client) together with a walk over of the site (where applicable and included within the quotation/tender). The opinions given in the Phase I Desk Study are based on the information available from third parties/sources that has been obtained within the available timeframe. Castle Rock Geotech assumes all third party information to be true and correct and therefore cannot accept liability for the accuracy of such information supplied.

Should additional information become available that may affect the comments and opinions made within the Phase I Desk Study, Castle Rock Geotech reserves the right to review such information and make modifications to comments/opinions as appropriate.

It should be borne in mind that a Phase I Desk Study collates available information to generate a Conceptual Model of the site. The actual geotechnical and environmental considerations can only be fully quantified by intrusive investigation works to confirm the accuracy of the Conceptual Site Model.

PHASE II GROUND INVESTIGATION:-

Castle Rock Geotech has prepared this report solely for the use of the Client and / or his agent and is not suitable for any other circumstances than for the purpose for which it was prepared. This report has been prepared for the titled project only and should any third party wish to use or rely upon the contents of the report, written approval from Castle Rock Geotech must be sought.

Castle Rock Geotech (CRG) accepts no responsibility or liability

a) for the consequences of this document being used for the purpose other than that for which it was commissioned and for this document to any other party other than the person by whom it was commissioned.

The data essentially comprised a study of available documented information from various sources together with discussions with relevant authorities and other interested parties. The information reviewed is not exhaustive and has been accepted in good faith as providing representative and true data pertaining to site conditions. If additional information becomes available which might impact our environmental conclusions, we request the opportunity to review the information, reassess the potential concerns and modify our opinion if warranted.

Unless otherwise stated, CRG will not undertake any desk study searches or risk assessments for potential unexploded ordnance, and we therefore cannot be held liable for any delays or costs incurred either directly or indirectly as a result of the identification of unexploded ordnance risks on the site, or for losses incurred either directly or indirectly as a result of accidental detonations of ordnance on site during investigations and / or subsequent development works.

This report does not consider ecological impacts (e.g. bats) or botanical risks (e.g. Japanese Knotweed). It is recommended that these be considered as part of the assessment of development constraints for the site.

The investigation has been carried out in order to provide information concerning the ground and groundwater conditions to allow a reasonable risk assessment to be made. Castle Rock Geotech undertakes to exercise all reasonable skill, care and due diligence in the exercise of the investigation with respect to sampling techniques, sample storage and report interpretation.

The assessments and judgement given in this report are directed by both the finite data on which they are based and the proposed works to which they are addressed. Data acquisition is subject to the limitations of the methods of investigation used. Exploratory holes undertaken during fieldwork investigate a small volume of ground in relation to the size of the site and as such can only provide an indication of site conditions. There may be conditions pertaining to the site and the proposed development, which have not been disclosed by the investigations.

NOTES ON LIMITATIONS

PHASE I DESK STUDY & PHASE II GROUND INVESTIGATION

The findings and opinions are relevant to the dates of our site works and should not be relied upon to represent conditions at substantially later dates. Conditions at the site will change over time due to natural variations and anthropogenic activities. Groundwater, surface water and soil gas conditions should be anticipated to change with diurnal, seasonal and meteorological variations.

The opinions expressed in this report regarding any contamination are based on simple statistical analysis and comparison with available guidance values. No liability can be accepted for the retrospective effects of any changes or amendments to these values.

Castle Rock Geotech cannot and does not guarantee the authenticity or reliability of the information it has relied upon. New information, improved practices or changes in legislation may necessitate an alteration to the report in whole or in part after its submission. Therefore, with any changes to the proposed development, or should the development proceed after the expiry of one year from the date of the report, the report should be referred back to Castle Rock Geotech for re-assessment and, if necessary, re-appraisal.

Castle Rock Geotech cannot be held responsible for structural failures caused by the location of foundations of any form of structure within the influence of exploratory holes.

CASTLE ROCK GEOTECH

SITE INVESTIGATIONS
Geotechnical, Geological &
Environmental Consultants

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