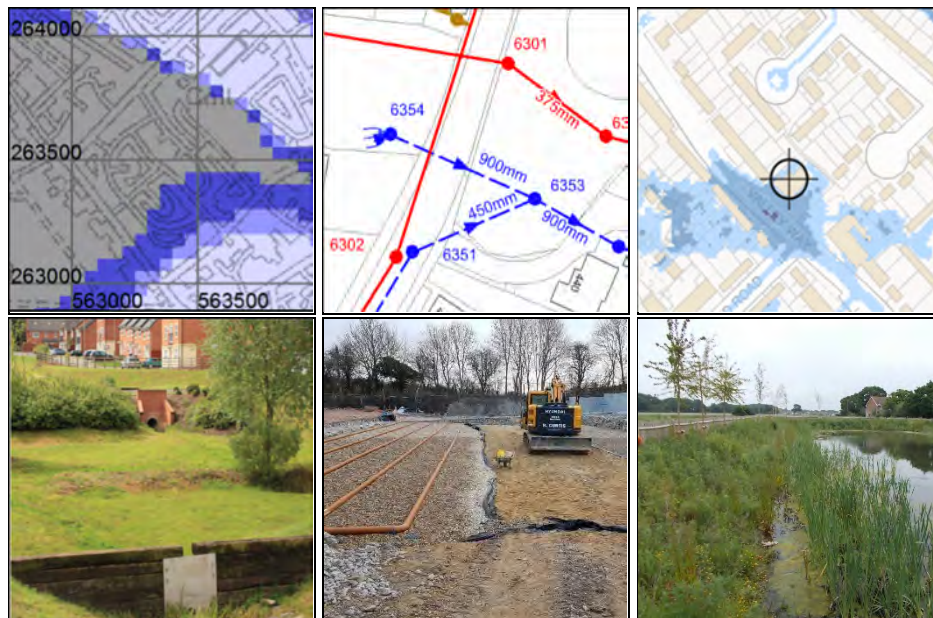




Drainage Strategy and Flood Risk Statement

Land at Home Farm, St John's Road Hedge End, Hants

Reference: 22066

Issue: **Date:**

1 17/4/2023

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A	Existing & Proposed Site Layouts
B	EA Flood Mappings, Soils Information & Local Sewer Plan
C	Surface Water Assessment
D	Conditions & Limitations

1. Introduction

- 1.1 Instructions were received from Wykeham Homes to set out the Drainage Strategy (DS) and provide a Flood Risk Statement for development of 8 dwellings on land at Home Farm, St John's Road, Hedge End, Hants.
- 1.2 This assessment has been undertaken by A P Traves BSc CEng MIStructE MCIHT.
- 1.3 The client's attention is drawn to the conditions and limitations contained in Appendix D.

2. Development Description & Location

- 2.1 The site comprises 0.455 Ha of grass paddock at the Home Farm, St John's Road, Hedge End, Hants (grid ref 448275 112100). The site extents are indicated on the annotated aerial photograph in Appendix A. The existing topography is shown on Encompass Surveys drawing ENC-290922-2458-S1 sheets 1 and 2 contained in Appendix A of this report.
- 2.2 It is proposed develop the site for 8 served by access off of Home Farm estate to the south. The proposed layout is identified on Pope Priestley Architects drawing number PP1433-101-P1 contained in Appendix A of this report.

3. Surface Water Discharge (Existing)

- 3.1 The existing car park comprises 0.455 Ha of grass paddock at the very head of a small natural valley line in the Clay geology falling north east towards Granada Road
- 3.2 A small part of the site at the extreme southern corner falls back towards the access off of the Home Farm estate.
- 3.3 Further commentary on the existing catchment is contained in the initial screening report and drainage concept dated 13 January 2023. A copy of this is contained in Appendix B
- 3.4 An IOH124 greenfield runoff assessment has been undertaken using the UKSUDs tool sheet run. (Refer to Appendix C) This indicates the following greenfield run-off rates for particular events:

Q ₁	2.17 l/sec
Q _{BAR(2)}	2.55 l/sec
Q ₃₀	5.87 l/sec
Q ₁₀₀	8.14 l/sec

4. Surface Water Strategy

- 4.1 Since production of the screening report and drainage concept dated 13th January 2023 the proposed site layout has been refined but the overall surface water drainage strategy remains the same, namely to provide water storage in Class B partially infiltrating porous pavement in the flatter area around the central courtyard in the site. This will take advantage of the little infiltration available and should be sufficient for infiltration of the numerous small rainfall events that occur. However for larger order rainfall events the attenuated storage function will mobilise and limit discharge to greenfield rates to the natural topographical flow path to the north east thus maintaining the existing natural behaviour downstream of the site. To ensure sufficient storage the very limited infiltration has been ignored and the discharge rate set to the natural site Q_{BAR} of 2.55 l/sec. The roofs and pavements of the main catchment amount to some 1,480m² attenuated within 515m² of class B porous pavement matrix. For a discharge limit of 2.55 l/sec 101.2m³ of storage is required and the 0.57m of CGA pavement matrix at 35% void over 515m² provides 102.7m³, ensuring sufficient storage will be available. The associated calculations are contained in Appendix C.

- 4.2 RWP discharge will be communicated to the CGA storage matrix by SEL Raintaina or similar diffuser units and exfiltrated to an SEL Cotroflow300 or similar flow control device. The attenuated discharge will be release in a shallow exfiltration trench at the base of the embankment on the north east side of the site onto the natural flow path down the valley line to the north east, replicating the existing flow path.
- 4.3 The soil character in the main site area is of significantly different permeability to that of the adjacent Knightsgate development in Home Farm estate to the south east. The no dig requirement on the initial section of the access into the site set on the same geology at higher level as the Knightsgate site to which it abuts indicates the same Type A infiltrating porous pavement (no dig) has been adopted for that part of the site. A calaculation for the entrance catchment is contained in Appendix C.
- 4.4 The proposed drainage layout is shown on drawing ACC22066-01 contained in Appendix C.
- 4.5 The change of use is generally low and very low pollution hazard levels (C753 Table 26.2) and does not require groundwater risk screening.
- 4.6 Simple index approach calculations are contained in Appendix C. These demonstrate that the proposed SUDS will provide the required level of mitigation index.
- 4.7 The surface water drainage system will be designed to accommodate a 1 in 100 year +45% climate change and +10% urban creep rainfall event. With respect to the Non-statutory Technical Standards for Sustainable Drainage Systems (NTS SuDS) the design accords with requirements S2, S4 and S7-9. Design and construction details will accord with Building Regulations and Sewers for Adoption, as appropriate, so according with S10-11 and S13-14. The design does not include pumping so S12 is not applicable.
- 4.8 Water butts should be installed to intercept roof water run-off. These will reduce the annual volume of surface water discharge but will not make a material contribution to regulation of critical run-off as these tend to be full during Winter months as there is minimal demand for irrigation in these months.
- 4.9 In summary source control will be provided by:
- Provision of porous pavement as outlined in paragraphs 4.1-4.3
 - Provision of water butts as outlined in paragraph 4.8
- 4.10 The existing exceedance flow path is north east from the site. The proposed development will maintain the north easterly flow path.
- 4.11 The surface water strategy mimics the existing run-off regime. There will therefore be no adverse impact on flood flow rates outside the site.
- 4.12 A schedule of O&M maintenance requirements for the SuDS infrastructure is also contained in Appendix C. The maintenance of plot specific drainage will be undertaken by the owners. The maintenance of shared assets will be undertaken by the estate management company.

5. Flood Source-Pathway-Receptor Assessments

- 5.1 The site is at an elevation of some 63-66 mAOD and is not susceptible to tidal flooding.
- 5.2 The EA flood mapping indicates that the site is wholly in Flood Zone (FZ) 1. The site is therefore at low risk of fluvial flooding (<0.1% AEP).
- 5.3 The EA mapping indicates the site is not at risk of reservoir flooding.

- 5.4 The EA mapping indicates the site is at very low (<0.1% AEP) surface water flood risk. A low risk surface water flood path is indicated to run from the base of the embankment on the north east edge of the site down the natural valley line to the north east consistent with the natural topography.
- 5.5 The site soils investigation confirms the site to be of low permeability silty Clay geology. The site is also the highest ground in the catchment at the head of the catchment. It is evident from this that the groundwater flood risk is low.
- 5.6 The critical flood source is surface water flooding and run-off within the site. The site surface water system will accord with the principles of CIRIA C753.
- 5.7 The new flood receptors of the development would be:
- Residential dwellings
 - Users of residential dwellings
- 5.8 The proposed development and existing site classifications to NPPF Annex 3 are as follows:
- | | |
|-----------------------------|-----------------|
| • Existing agricultural use | Less vulnerable |
| • Proposed residential use | More vulnerable |
- 5.9 Overall the development is considered to be a low flood risk.

6. Flood Probability

- 6.1 The EA flood zones shown on the outputs and included in Appendix B represent current best estimates of zone 2 and zone 3 flooding. It does not take account of potential climate change impacts. The flood zone definitions to Table 1 (NPPG Reference ID: 7-077-20220825) are as follows:

Zone 1	Low probability of flooding (<0.1% AEP)
Zone 2	Medium probability of tidal flooding (0.1-0.5% AEP)
	Medium probability of fluvial flooding (0.1-1% AEP)
Zone 3a	High probability of tidal flooding (>0.5% AEP)
	High probability of fluvial flooding (>1% AEP)
Zone 3b	Functional floodplain (>3.3% AEP probability of flooding)

The flood map does not differentiate between zones 3a and 3b.
 Zone 3b is only considered appropriate for water-compatible development.
 Zone 3a is additionally considered appropriate for less vulnerable uses.

- 6.2 The site is wholly in flood zone 1 (low risk) and is at low and very low risk of flooding from other sources.

7. Climate Change

- 7.1 The new climate change allowances for flood risk assessment GOV.UK 27 May 2022 update have been used. Climate change values for the site are:
- Peak rainfall intensity: east Hampshire 2123, 1%AEP +45%
- 7.2 Surface water drainage strategy is discussed in Chapter 4. The volumes and flows for this strategy have been derived in accordance with CIRIA C753 and include for climate change effects.

8. Flood Risk Management Measures

- 8.1 The source pathway receptor assessment is contained in Chapter 5.

- 8.2 Paragraph 5.6 identifies that surface water flooding and site surface run-off within the site is the governing flood source. The management of the storage and conveyance of these volumes and flows is provided for by the surface water strategy set out in Chapter 4. The strategy accords with CIRIA C753 SuDS Manual.
- 8.3 A minimum FFL + 0.15m standard DPC clearance above ground level should be provided.
- 8.4 The site levels and grades have been set to direct any exceedance flow onto the central axis of the access and courtyard and away from the dwellings and towards the natural valley line northeast of the site. A toe drain is also proposed at the foot of the embankment to the rear of the dwellings to intercept any runoff down the embankment.

9. Foul Water Strategy

- 9.1 A copy of the local sewer plan has been obtained from Southern Water and is contained in Appendix B.
- 9.2 The Knightsgate Home Farm estate to the immediate east is served by 150mm public sewer connection with 150mm spine extending back to the site access. The site will make connection to that network via the access road into the site. As the site is of lower elevation than the adjacent part of the Knightsgate development a small private package pump station will be required around the courtyard area. For the proposed 8 dwelling development a 100mm minimum sized connection is required and is met by the 150mm spine adjacent the site.
- 9.3 The proposed housing development will make connection to the public foul sewer via the Knightsgate Home Farm estate. The change in network foul water load is considered *de minimis*, but notwithstanding this the standing wastewater Infrastructure Charge (IC), which came into force from 1st April 2018, will be paid. Should any downstream reinforcement be required Southern Water will deliver this from the development ICs they will collect, this is however considered unlikely.

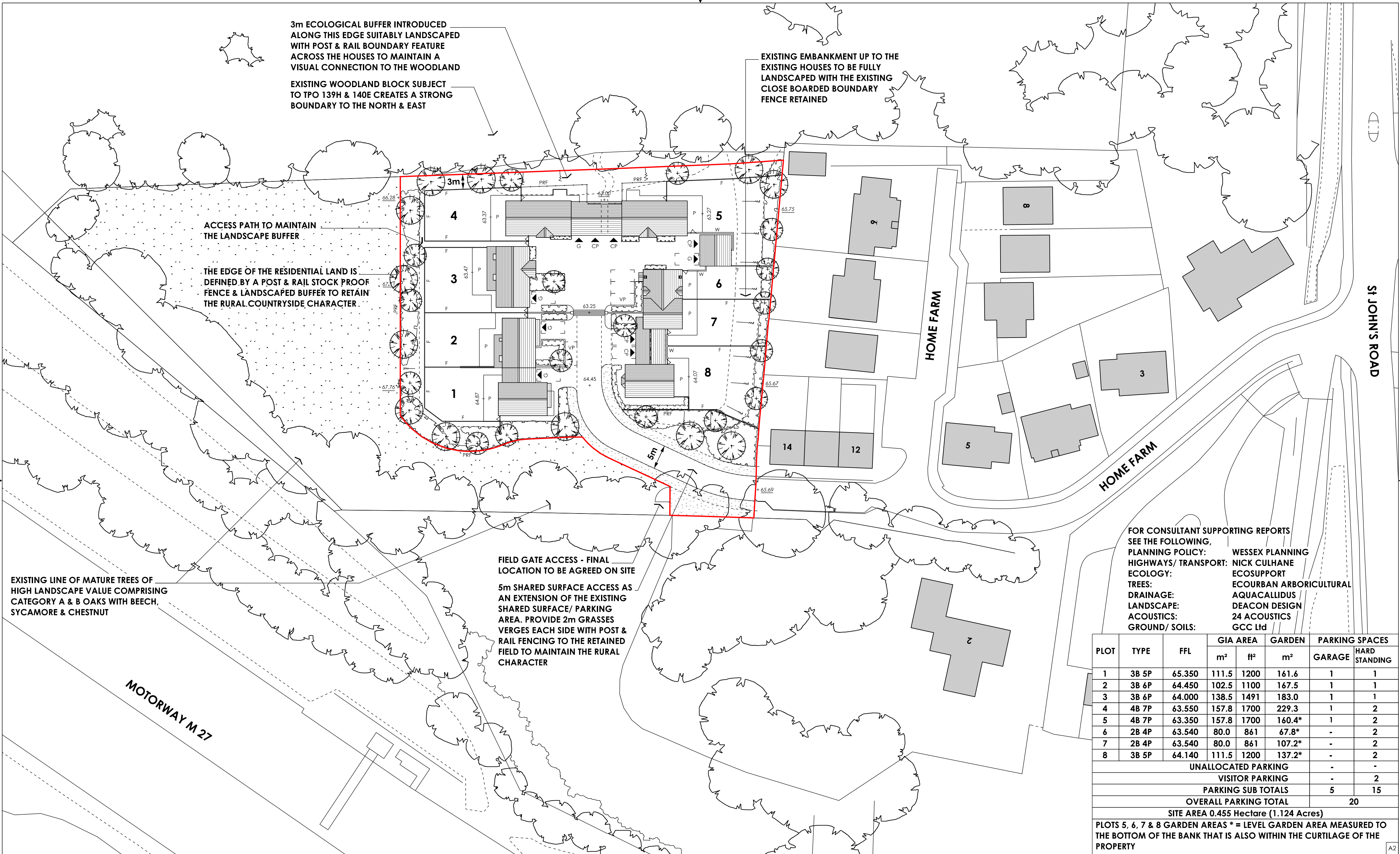
10. Off Site Impacts

- 10.1 The surface water strategy mimics the existing run-off regime. There will therefore be no adverse impact on flood flow rates outside the site.

11. Residual Risks

- 11.1 The proposed surface water strategy for the development provides for flood events up to 1:100 year 2023_{AD} + CC rainfall. The residual flood risk is therefore events in excess of 1:100 year 2032_{AD} + CC rainfall.

Appendix A



	PROPOSED HEDGE/ SHRUB PLANTING - SEE LANDSCAPE DESIGN FOR DETAILS	P	PATIO		TIMBER POST & RAIL FENCE WITH STOCK PROOF MESH		GARAGE INTERNAL DIMENSION MIN 6 x 3 m		POPE PRIESTLEY ARCHITECTS ARCHITECTURE TOWN PLANNING URBAN DESIGN 12A, VICARAGE FARM BUSINESS PARK, WINCHESTER ROAD, FAIR OAK, HAMPSHIRE SO50 7HD T: +44 (0)23 80335228 E: info@popepriestley.co.uk CONTRACTORS MUST CHECK ALL DIMENSIONS ON SITE. ONLY FIGURED DIMENSIONS ARE TO BE WORKED FROM. DISCREPANCIES MUST BE REPORTED TO THE ARCHITECT BEFORE PROCEEDING. DRAWING WAS PREPARED IN MICROSTATION FORMAT. DRAWINGS EXPORTED IN OTHER FORMATS MAY DIFFER. REFER TO ORIGINAL DRAWING FOR TRUE FORMAT. THIS DRAWING IS COPYRIGHT © POPE PRIESTLEY ARCHITECTS. NO PART OF THIS DRAWING IS TO BE REPRODUCED OR TRANSMITTED IN ANY FORM OR BY ANY MEANS, ELECTRONIC OR MECHANICAL, WITHOUT PERMISSION IN WRITING FROM POPE PRIESTLEY ARCHITECTS. IMPORTANT NOTE FOR USE OF THIS DRAWING: THE DRAWING HAS BEEN PRODUCED SPECIFICALLY FOR USE ON THIS PROJECT. POPE PRIESTLEY ARCHITECTS CANNOT BE HELD RESPONSIBLE FOR REUSE OF THIS INFORMATION BY OTHERS FOR ANY PURPOSE OTHER THAN FOR WHICH IT IS SPECIFICALLY INTENDED. THIS DRAWING REFLECTS STANDARDS AGREED FOR THE PROJECT AND CURRENT AT THE TIME OF PRODUCTION AND WILL NOT BE UPDATED IN ACCORDANCE WITH CHANGING LEGISLATION AND/ OR OTHER REQUIREMENTS.
	PROPOSED NEW TREE - SEE LANDSCAPE DESIGN FOR DETAILS		GATE		2m WIDE GRASSED SERVICE MARGIN		OPEN SIDED CAR PORT		
	EXISTING TREES		BRICK WALL	+ 63.95	EXISTING GROUND LEVEL		HARDSTANDING PARKING SPACE		
			1.8m TIMBER FENCE	+ 63.95	PROPOSED LEVEL		VISITOR PARKING SPACE		

SCALE BAR 10mm INTERVALS WHEN PRINTED AT TRUE SCALE

SCALE 1: 500

DATE 03.04.2023

AUTHOR JT

CHECK DP

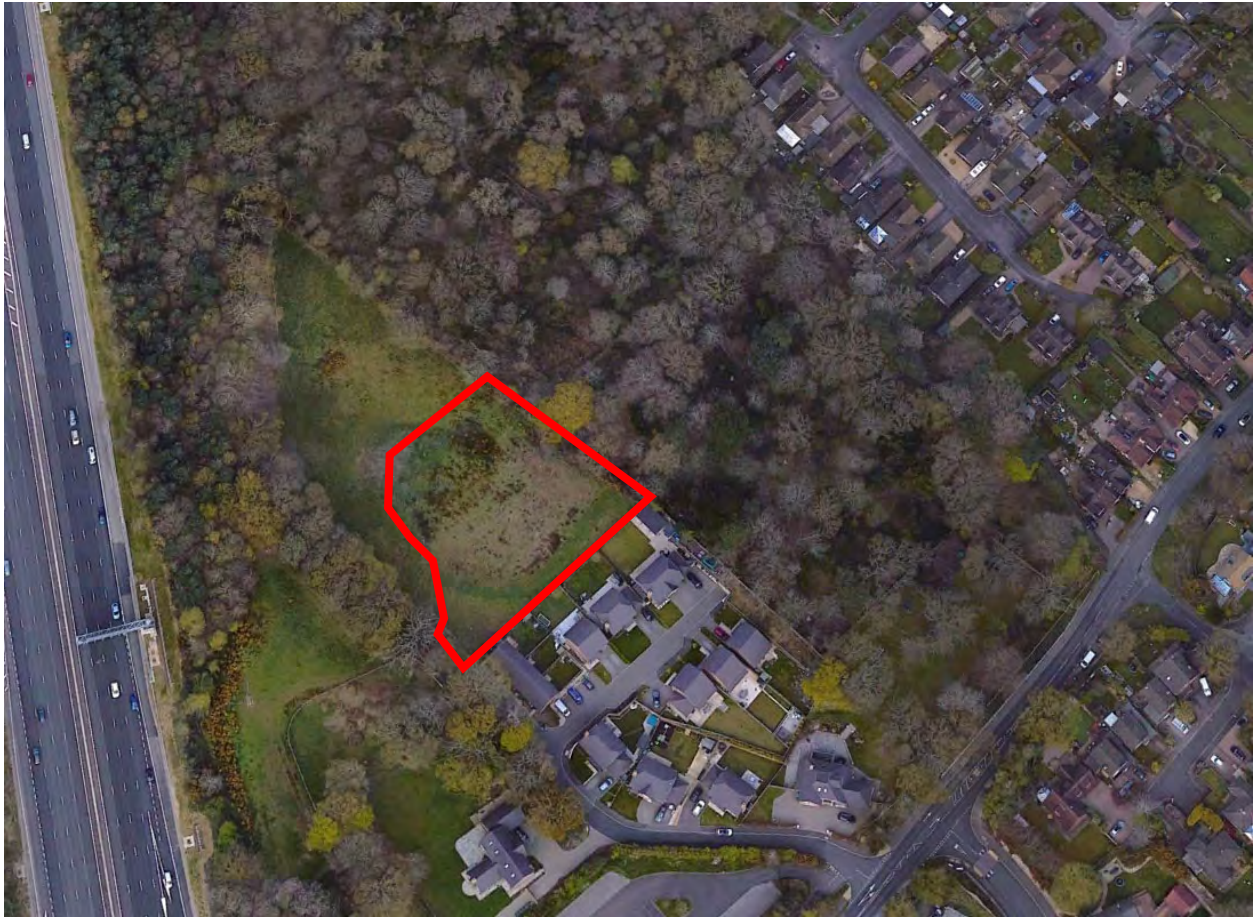
HOME FARM HEDGE END HAMPSHIRE SO30 4DF

SITE LAYOUT

DRAWING STATUS: PLANNING ISSUE

DRAWING NO: PP1433/ 101

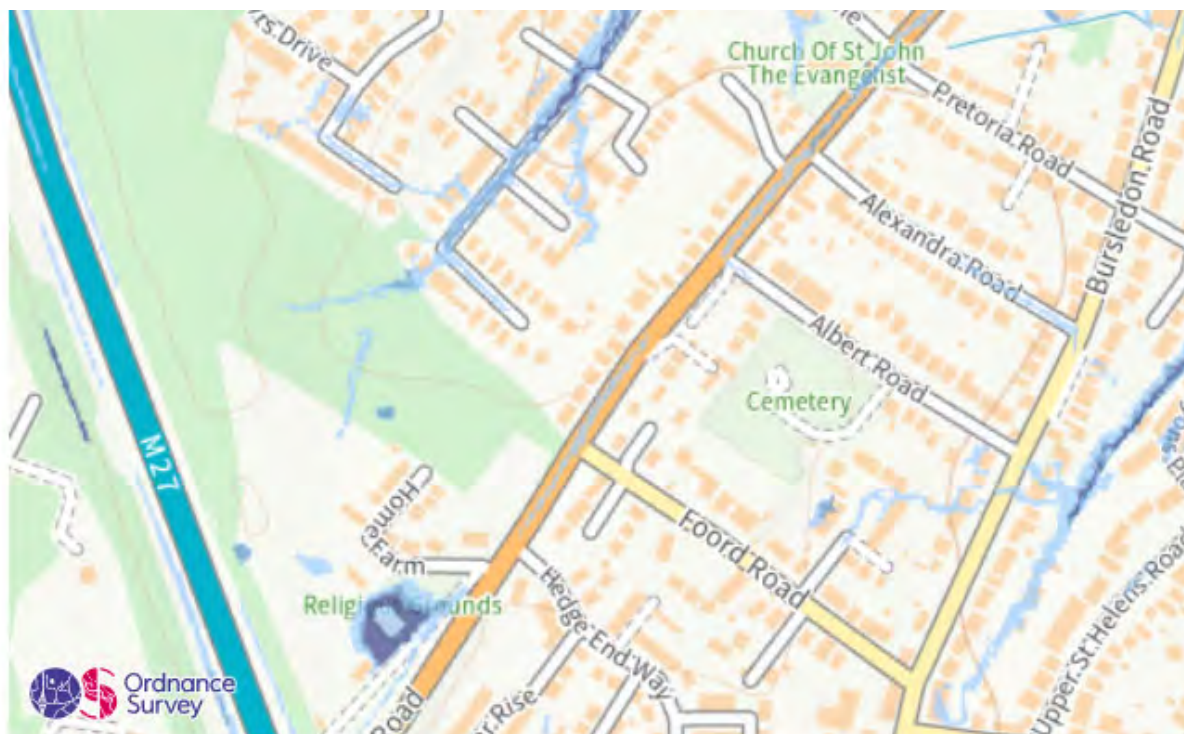
REVISION: P1



Aerial view of site

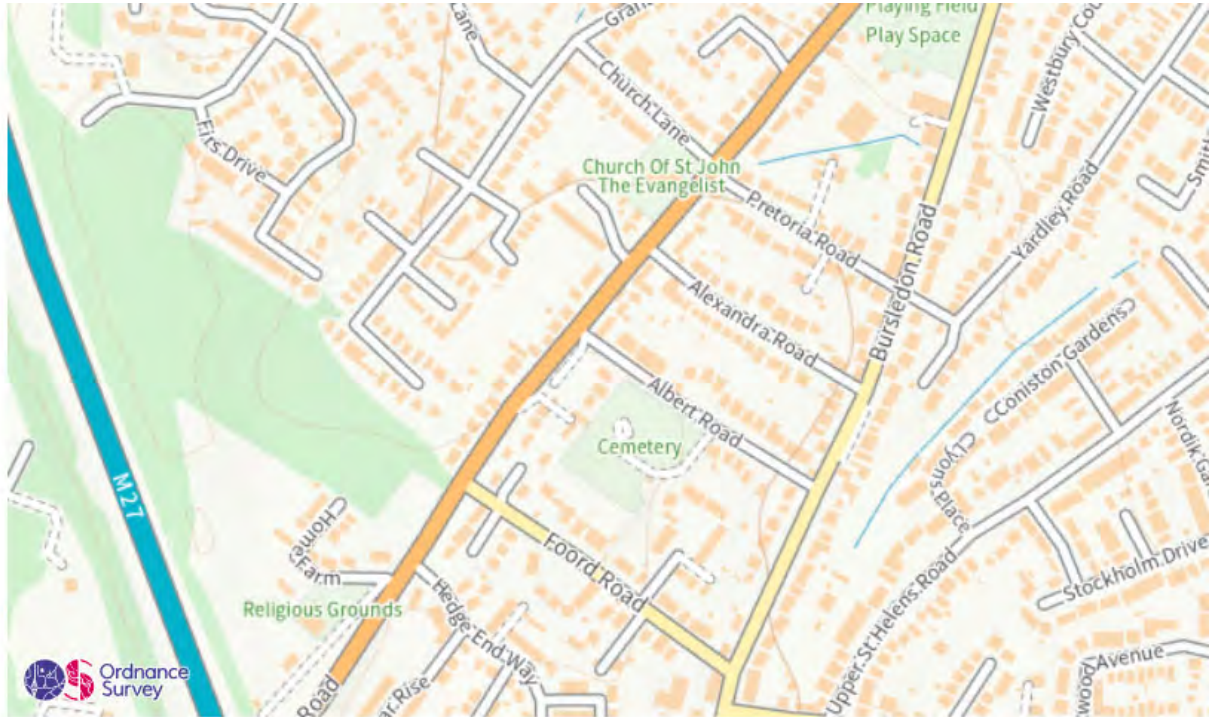
Appendix B





Extent of flooding from surface water

[High](#)
 [Medium](#)
 [Low](#)
 [Very low](#)
 Location you selected



Maximum extent of flooding from reservoirs:

● when river levels are normal
 ▨ when there is also flooding from rivers
 ⊕ Location you selected



Ground Condition Consultants

HOME FARM, HEDGE END

GROUND CONDITION ASSESSMENT

JANUARY 2023

Prepared for
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VERSION CONTROL

Project Name Home Farm – GCA

Project No. J22-077

Report No. J22-077-R04

Desk Top Study	
Prepared by: Antony Platt - Director	Reviewed by: Rasmus Palmgren - Director
Site Investigation Factual Report	
Prepared by: Antony Platt - Director	Reviewed by: Rasmus Palmgren - Director
Generic Quantitative Risk Assessment	
Prepared by: Antony Platt - Director	Reviewed by: Rasmus Palmgren - Director
Geotechnical Design Report	
Prepared by: David Fall – Geotechnical and Environmental Consulting Ltd	Reviewed by: Rasmus Palmgren - Director

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0. EXECUTIVE SUMMARY

Brief	The brief was to undertake a site investigation and assessment to identify any ground contamination issues and geotechnical conditions that may affect the proposed development.
Current Site Status	The site is located to the northwest of Home Farm, which in turn is located to the northwest of St John's Road, Hedge End, Hampshire, SO30 4DF (approx. grid ref: 448237, 112095). At the time of the walkover survey, the site comprised a grass covered field, generally sloping down from the northwest (approx. 73mAOD) to southeast (approx. 62mAOD) then rising again with a steep embankment along the southeast edge of the site (approx. 65.5mAOD), creating bowl type area in the eastern half of the site. Access to the site is via a track in the south of the site, off Home Farm.
Site History	The historical maps from 1868 to 2022 indicate that the site had comprised either open fields or woodland to the present day. The 2020 aerial image in the Groundsure report indicated earthworks to have taken place across the east of the study site. A comparison of the topographical surveys for the study site from 2015 and 2022 indicates that the site levels have been raised by up to approximately 2m across the east of the site. It therefore appears that the cut material from the adjacent residential development site, which included a former printworks, was spread across the eastern part of the study site, increasing the site levels and forming the bowl shape of this area of the site.
Geology	Reference to the British Geological Survey (BGS) Map extracts indicates the site to overlie bedrock geology of the Wittering Formation (clay, silt and sand) with superficial River Terrace Deposits (sand and gravel) overlying the Wittering formation in the northwest (higher elevation) of the site.
Hydrogeology	The Environment Agency Groundwater Vulnerability Map extracts indicate the site to be overlying a bedrock Secondary A Aquifer, interpreted as the Wittering Formation, with a superficial Secondary A Aquifer also underlying the north of the site, interpreted as the River Terrace Deposits.
Hydrology	The nearest identified surface water feature to the site is a pond located some 50m to the south of the site.
Investigation Scope	The site investigation works were undertaken by GCC on the 29th November 2022. The scope and rationale of the site investigation are presented below. • 5no. windowless sample boreholes (WS101-105) to a maximum depth of 5.45mbgl. • 2no. hand excavated trial pits (HP101-HP102) to a depth of 0.5mbgl • 3no. CBR tests by TRL DCP method
Conclusions and Recommendations (Contamination)	No potentially significant sources of contamination have been identified with regard to the proposed development. Therefore, the risk of impact to receptors in the context of the proposed development from contamination is considered to be very low. As such, further investigation, assessment and remediation are not considered necessary for this site. It should be noted that additional sources of contamination may become apparent during any future investigation and development of the site. A discovery strategy and appropriate PPE are recommended during any redevelopment of the site to address any as yet unidentified contamination that may be identified during the works.

Conclusions and
Recommendations
(Geotechnical)

The ground investigation has shown the site to be underlain by Topsoil / Made Ground over the Wittering Formation to the full depth of the ground investigation. The base of the Made Ground was recorded at depths of between 1.20 and 2.20mbgl, although thicker sequences may be present between exploratory hole locations. The Wittering Formation comprised a discontinuous superficial layer of fine-grained SILT/Clay, which was found to be of low strength and medium to high compressibility and as such is not considered an appropriate founding material. The underlying medium dense to dense fine SAND is suitable a founding stratum but would require foundation excavations of between 1.80 and 3.30mbgl based on the depths recorded during the ground investigation. Formation of foundations at these depths may be too restrictive and a piled foundation may prove a better option. However, a foundation design has been carried out for a trench fill foundation constructed within the coarse-grained WF.

ULS bearing resistance calculations have been carried out for the coarse-grained WF in accordance with Eurocode 7 and give a ULS bearing resistance of 457kN/m² under combination 2 factoring. Following the guidance presented in EC7, settlement analyses are not required or in other terms; the ULS bearing resistance is equal to the allowable bearing resistance.

Given the nature of the development foundation bearing pressures are likely to be considerably lower than the allowable bearing pressure and as resultant settlements will be below 25mm.

It is recommended that a suspended floor slab design is adopted due to the significant thickness of Made Ground.

Chemical testing of ground aggressivity has shown the ground to be consistent with Design Sulphate Classification DS-1 and an ACEC of AC-1s in the absence of any groundwater.

This sheet is intended to provide a summary only of the initial indicative assessment study of the site in relation to ground contamination. It does not provide a definitive engineering analysis for the purposes of costing or construction, and is subject to the limitation of the agreed brief.

1. INTRODUCTION

1.1 INSTRUCTION

Ground Condition Consultants Ltd. (GCC) was commissioned by Wykeham Homes in November 2022 to undertake a Ground Condition Assessment of a site at Home Farm, St Johns Road, Hedge End, SO30 4DF.

The brief was to undertake a site investigation and assessment to identify any ground contamination issues and geotechnical conditions that may affect the proposed development. This report provides an assessment of the identified and potential ground conditions of the site, with regard to the proposed works in accordance with the Land Contamination Risk Management (LCRM) guidance, published by the Environment Agency. In addition, the geotechnical sections of this report provide a detailed assessment of the materials present beneath the site and present characteristic parameters that should be used in design of all geotechnical facets of the proposed development.

This report is prepared in line with the agreed brief and is subject to the report conditions shown in Appendix 1.

1.2 LEGAL CONTEXT

Part IIA of the Environmental Protection Act 1990 (inserted by Section 57 of the Environment Act 1995) provides a regime for the control of specific threats to health or the environment from land contamination. In accordance with the Act and the statutory guidance document 'The Contaminated Land (England) Regulations 2000', the definition of contaminated land is intended to embody the concept of risk assessment. Within the meaning of the Act, land is only "contaminated land" where it appears to the Regulatory Authority, by reason of substances within or under the land, that:

- Significant harm is being caused, or there is a significant possibility of such harm being caused; or
- Pollution of controlled waters is being, or is likely to be, caused."

Inherent in this definition is the requirement for contamination risk assessment to be undertaken on a site-specific basis, as the potential for harm is determined by the site's end use and its specific environmental setting.

The guidance defines “risk” as the combination of:

- The probability, or frequency, of occurrence of a defined hazard (for example, exposure of a property to a substance with the potential to cause harm); and
- The magnitude (including the seriousness) of the consequences.

While Part IIA of the Environmental Protection Act provides a risk based approach to the identification and remediation of land where contamination poses an unacceptable risk to human health or the environment, the regime does not take into account future uses. New developments are therefore controlled by the planning regime, with reference to the National Planning Policy Framework (NPPF), rather than directly by Part IIA of the Environmental Protection Act.

The NPPF is based on the principal that the site should be suitable for its new use, taking account of ground conditions, including from natural hazards or former activities and states that “Where a site is affected by contamination or land stability issues, responsibility for securing a safe development rests with the developer and/or landowner”. The NPPF also links the planning and Part IIA regimes by stating that “after remediation, as a minimum, land should not be capable of being determined as contaminated land under Part IIA of the Environmental Protection Act 1990”. Key components of the Part IIA regime, such as the definition of Contaminated Land and the associated risk-based assessment approach, are therefore considered to also be applicable to the planning regime.

1.3 METHODOLOGY

This report has been prepared in accordance with published Environment Agency guidance (‘Land Contamination Risk Management (LCRM)’). LCRM provides the technical framework for structured decision making about land contamination and builds on previous work carried out under the Contaminated Land Research Programme (of the former Department of the Environment) and the Model Procedures for the Management of Land Contamination – Contaminated Land Report (CLR) 11. LCRM has adopted and refined the well recognised methodology and terminology that has been used in contaminated land risk assessment for a number of years.

1.3.1. Pollutant linkage concept

In the context of land contamination, there are three essential elements to any risk:

- A **contaminant source** – a substance that is in, on or under the land and has the potential to cause harm or to cause pollution of controlled waters.

- A **receptor** – in general terms, something that could be adversely affected by a contaminant, such as people, an ecological system, property, or a water body.
- A **pathway** – a route or means by which a receptor can be exposed to, or affected by, a contaminant.

Each of these elements can exist independently, but they create a risk only where they are linked together, so that a particular contaminant affects a particular receptor through a particular pathway. This kind of linked combination of contaminant–pathway–receptor is described as a pollutant linkage.

1.3.2. Conceptual model

An important thread throughout the overall process of risk assessment is the need to formulate and develop a **conceptual model** for the site, which supports the identification and assessment of pollutant linkages. A conceptual model represents the characteristics of the site in diagrammatic or written form that shows the possible relationships between contaminants, pathways and receptors (pollutant linkages).

1.3.3. Risk assessment

LCRM advocates a phased approach to risk assessment comprising the following in order, as necessary:

Preliminary Risk Assessment – a desk study consisting of a review of documentary, anecdotal and site walk over evidence.

Generic Quantitative Risk Assessment (GQRA) - comparison of contaminant concentrations obtained from site investigation with generic assessment criteria.

Detailed Quantitative Risk Assessment (DQRA) - comparison of contaminant concentrations obtained from site investigation with site-specific assessment criteria.

This document follows on from the Preliminary Risk Assessment reported in the GCC Ground Condition Desk Top Study (Ref: J22-077-R01, November 2022) and constitutes a Generic Quantitative Risk Assessment and also comprises a Ground Investigation Report and Geotechnical Design Report in accordance with Eurocodes. Key sections of the Desk Top Study report have been repeated in this document for ease of reference.

1.4 PROPOSED USE

It is currently understood that the site is to be redeveloped for residential use with private gardens.

A change in the site use from that currently proposed may result in the need for re-assessment of risk criteria and the conclusions and recommendations resulting from the risk assessment could therefore significantly change.

1.5 REPORT SCOPE AND LIMITATIONS

This report is based upon a review of readily available historical and current information and the recent site investigation data detailed herein. The report presents an interpretation of the borehole and laboratory data provided by the GCC site investigation undertaken on the 29th November 2022. In addition, this report outlines the basic ground conditions encountered in the exploratory holes and the results of any monitoring of ground installations.

This information has been collated, processed and used to provide an interpretation of the ground conditions, with recommendations on potential ground contamination risks and foundation design for the proposed development.

The recommendations and opinions expressed in this report are based on the strata observed in the exploratory holes, the results of the site and laboratory tests, and information obtained as part of the desk study or provided by others. GCC takes no responsibility for conditions that have not been revealed by the exploratory holes, or which occur between them.

Whilst every effort has been made to interpret the conditions between investigation locations, such information is only indicative and liability cannot be accepted for its accuracy. Information provided from other sources is taken in good faith and GCC cannot guarantee its accuracy.

The information contained in this report is intended for the use of Wykeham Homes and GCC can take no responsibility for the use of this information by any other party or for uses other than that described in this report.

2. PRELIMINARY RISK ASSESSMENT

2.1 SITE LOCATION AND DESCRIPTION

The site is located to the northwest of Home Farm, which in turn is located to the northwest of St John's Road, Hedge End, Hampshire, SO30 4DF (approx. grid ref: 448237, 112095). At the time of the walkover survey, the site comprised a grass covered field, generally sloping down from the northwest (approx. 73mAOD) to southeast (approx. 62mAOD) then rising again with a steep embankment along the southeast edge of the site (approx. 65.5mAOD), creating bowl type area in the eastern half of the site. Access to the site is via a track in the south of the site, off Home Farm.

The site is bounded to the northeast, northwest and southwest by wooded areas with the M27 motorway approximately 40m beyond to the west. The southeast boundary of the site is formed by a fence line separating the site from a recently constructed residential development that fronts the new road of Home Farm.

2.2 SITE HISTORY

The historical maps from 1868 to 2022 indicate that the site had comprised either open fields or woodland to the present day. The M27 motorway was constructed in the 1970s at a lower elevation than the site and the woodland to west of the site appears to have grown on the slopes constructed down to the motorway from the site boundary.

The 2020 aerial image in the Groundsure report indicated earthworks to have taken place across the east of the study site and the grass had not grown back across the affected area. A comparison of the topographical surveys for the study site from 2015 and 2022 indicate that the site levels have been raised by up to approximately 2m across the east of the site.

The residential development to the southeast of the site is understood to have been constructed in approximately 2019. A review of documents held on the planning portal for the adjacent development, including topographical surveys, indicates that the original ground profile was reduced by approximately 1-3m to form the development platform for the new houses. This also involved the removal of a former printworks building and associated hard standing.

It therefore appears that the cut material from the adjacent residential development site was spread across the eastern part of the study site, increasing the site levels and forming the bowl shape of this area of the site. As the former printworks from the adjacent land was removed as part of the earthworks, there is a significant potential for remnants of the former building and hardstanding, including any associated contaminants, to have been deposited on the study site along with the natural soil that was cut.

It is unknown if the cut material deposited on site was placed to an engineering specification but it is considered unlikely.

2.3 DOCUMENTATED GROUND CONDITIONS

Ground conditions recorded in readily available sources are summarised below.

2.3.1. Geology

Reference to the British Geological Survey (BGS) Map extracts (see Desk Top Study) indicates the site to overlie bedrock geology of the Wittering Formation (clay, silt and sand) with superficial River Terrace Deposits (sand and gravel) overlying the Wittering formation in the northwest (higher elevation) of the site.

The trial pit logs from the ground investigation for the adjacent residential development (2017) indicate that the Wittering Formation encountered close to the study site comprised pale grey and orange sandy very silty Clay.

Topographical survey records indicate that approximately 2m of Made Ground/reworked natural soil may be present beneath the east of the site.

2.3.2. Hydrogeology

The Environment Agency Groundwater Vulnerability Map extracts (see Desk Top Study) indicate the site to be overlying a bedrock Secondary A Aquifer, interpreted as the Wittering Formation, with a superficial Secondary A Aquifer also underlying the north of the site, interpreted as the River Terrace Deposits.

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

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

2.3.3. Hydrology

The nearest identified surface water feature to the site is a pond located some 50m to the south of the site.

2.3.4. Radon

Radon is a naturally occurring radioactive gas which may be harmful to human health. Radon is generally released into the atmosphere in areas underlain by granite and limestone. Harmful concentrations of radon may build up if it becomes trapped in an enclosed space such as a building.

BGS/Public Health England data presented within the Groundsure Report indicates that the percentage of houses exceeding the Action Levels for Radon in this area is less than 1%. Therefore, the property is not in a Radon Affected Area, as defined by the Health Protection Agency (HPA), and radon protection measures are not necessary in new dwellings or extensions.

2.4 ENVIRONMENTAL DATA SEARCH

A search of an environmental database was undertaken together with information from various other organisations as part of the desk study and is summarised in the following sections. The following summary is generally limited to locations within 250m of the site boundaries unless it is considered that installations or activities beyond that range could potentially have an impact on the site or be affected by the redevelopment of the site.

Table 2.1. Data search results

Discharge consents	There are no recorded active surface water discharge consents within 250m of the site.
Pollution incidents	There are no recorded pollution incidents to controlled waters within 250m of the site.
Water abstractions	There are no water abstractions within 500m of the site
Fuel Stations	There are no recorded fuel stations within 250m of the site.
Landfill Sites	There are no landfills located within 250m of the site.

2.5 MINING AND NATURAL GROUND HAZARDS

2.5.1. Mining

The site is located in an area where mining is not likely to have taken place.

2.5.2. Natural Ground Hazards

The following ground hazards were identified:

Compressible ground stability hazards – Negligible hazard

BGS Notes: Compressible strata are not thought to occur. While this classification may apply to the natural strata, it may not apply to the Made Ground recorded beneath the site.

Collapsible ground stability hazards – Very Low hazard

BGS Notes: Deposits with potential to collapse when loaded and saturated are unlikely to be present.

Ground dissolution stability hazards – Negligible hazard

BGS Notes: Soluble rocks are either not thought to be present within the ground, or not prone to dissolution. Dissolution features are unlikely to be present.

Landslide ground stability hazard – Very Low hazard

BGS Notes: Slope instability problems are not likely to occur but consideration to potential problems of adjacent areas impacting on the site should always be considered.

Shrinking or swelling clay ground stability hazard – Moderate hazard

BGS Notes: Ground conditions predominantly high plasticity.

Running sand ground stability hazards – Very Low hazard

BGS Notes: Running sand conditions are unlikely. No identified constraints on land use due to running conditions unless water table rises rapidly.

2.6 DEPARTMENT OF ENVIRONMENT – INDUSTRY PROFILES

The Department of the Environment Industry Profiles do not cover the past or current uses of the site.

2.7 CONCLUSIONS OF PRELIMINARY RISK ASSESSMENT

The conceptual model, based on information obtained as part of the preliminary risk assessment, identified the following potential contaminant sources:

- Potential for reduced quality Made Ground to be present beneath the east of the site, including asbestos, from the raising of the ground levels in the east of the site.
- Potential for ground gas generation from Made Ground beneath the east of the site.

It should be noted that additional sources of contamination may become apparent during any future investigation and development of the site.

The risks to the health of future site users from contamination, in the context of the proposed redevelopment of the site, have been assessed to be **very low to low/moderate** in relation to the proposed use of the site and risks to controlled waters. It is therefore recommended that these risks are investigated further.

3. FIELDWORK SUMMARY OF SCOPE AND RATIONALE

3.1 RATIONALE AND SUMMARY OF SCOPE

The site investigation works were undertaken by GCC on the 29th November 2022. The scope and rationale of the site investigation are presented below.

- 5no. windowless sample boreholes (WS101-105) to a maximum depth of 5.45mbgl.
- 2no. hand excavated trial pits (HP101-HP102) to a maximum depth of 0.5mbgl.
- 3no. CBR tests by TRL DCP method.
- 2no. machine excavated trial pits for infiltration testing purposes (reported under separate cover)

Table 3.1. Exploratory hole location rationale

Location	Rationale	Max depth (mbgl)
WS101-WS110	Windowless sample boreholes positioned across the site, in the vicinity of the proposed buildings to investigate the nature and stratigraphy of the subsurface materials and allow collection of representative samples for chemical and geotechnical laboratory analysis.	5.45
HP101-HP102	Hand excavated trial pits positioned in the garden areas of the proposed development, to investigate the nature and stratigraphy of the subsurface materials and allow collection of representative samples for chemical laboratory analysis.	0.50
SA101-SA102	Machine excavated trial pits for infiltration testing purposes.	3.35

The layout of the exploratory hole positions is presented in Figure 2.

3.2 SAMPLING

Soil sampling of the near surface materials was undertaken to assess the contamination risks to human health and controlled waters. Soil samples were also taken from various depths in the boreholes for geotechnical testing purposes.

3.3 SITE INVESTIGATION STANDARDS

Methods employed during the site investigation were generally undertaken in accordance with BS10175, BS EN 1997-2 and BS5930.

4. GROUND CONDITIONS ENCOUNTERED

4.1 SOIL CONDITIONS

Ground conditions encountered during the site investigation were broadly in agreement with those presented in the published literature and comprised Topsoil and Made Ground overlying Wittering Formation. Variations in strata thicknesses are summarised in Table 4.1 and engineering logs are presented in Appendix 2.

Table 4.1. Summary of encountered ground conditions

Location	Topsoil/Made Ground		Wittering Formation	
	From (mbgl)	Thickness (m)	From (mbgl)	Thickness (m)
WS101	GL	1.10	1.10	>4.25
WS102	GL	1.40	1.40	>1.80
WS103	GL	2.20	2.20	>3.25
WS104	GL	1.90	1.90	>2.55
WS105	GL	2.00	2.00	>1.60
HP101	GL	>0.50	N/E	
HP102	GL	>0.50	N/E	
SA101	GL	2.30	2.30	>1.05
SA102	GL	0.80	0.80	>0.80

4.1.1. Topsoil/Made Ground

Topsoil/Made Ground was encountered in all of the investigation locations across the site. The only locations where these material were present without anthropogenic inclusions was HP102, where the Topsoil extended to greater than 0.5mbgl.

Made Ground was encountered in the remainder of the locations and comprised reworked Wittering Formation Silt and Clay with occasions brick fragments and organic matter and pockets of Sand. This Made Ground attained a maximum proven thickness of 2.2m (WS103) and is anticipated to taper towards the peripheries of the development area.

4.1.2. Wittering Formation

The Wittering Formation was encountered beneath the Topsoil or Made Ground in all of the boreholes at between 1.1mbgl and 2.3mbgl with a proven thickness of greater than 4.25m, forming the basal stratum in all of these locations. This Formation was not encountered in the hand excavated trial pits.

The Wittering Formation comprised medium dense to very dense orange brown, yellow and grey thinly laminated Sand, locally overlain by 0.4-1.4m of dark brown and orange brown sandy Silt/Clay.

The Sand of the Wittering Formation formed the basal layer of the investigation and resulted in refusal in the majority of the windowless sample borehole locations.

4.2 EXCAVATION STABILITY

The excavations for infiltration testing remained stable throughout the testing period.

4.3 OBSTRUCTIONS

No obstructions were encountered within the boreholes, although several boreholes refused within the Wittering Formation.

4.4 GROUNDWATER CONDITIONS

Groundwater was not encountered in any of the investigation locations and the monitoring wells in all 5no boreholes were monitored to be dry on the 6th December 2022. However, groundwater was recorded on the 6th January at between ground level and 5.11mbgl, indicating highly variable conditions and possibly pockets of perched groundwater.

4.5 VISUAL/OLFACTORY EVIDENCE OF CONTAMINATION

No visual or olfactory evidence of contamination was encountered during the investigation.

5. GENERIC RISK ASSESSMENT

5.1 CONTAMINATION ASSESSMENT METHODOLOGY

In order to assess the human health and environmental risks posed by potential contaminants within the underlying soils and groundwater, GCC undertook an initial screen of the laboratory results from the recent investigation using generic assessment criteria. Generic assessment criteria (GAC) are conservative contaminant concentration values used for comparison purposes to assess the risk associated with contaminant concentrations found on site and are derived using non-site-specific information

5.1.1. Soils

In order to assess the soil analyses results with regard to potential human health risks, GCC has adopted the LQM/CIEH Suitable 4 Use Levels (S4ULs), generic assessment criteria (GACs) derived in accordance with the UK framework set out in the most recent CLR (Contaminated Land Report) documents using the Contaminated Land Exposure Assessment (CLEA) Model.

S4ULs have been published for an extensive suite of contaminants, with assessment criteria derived for each contaminant for four different land use scenarios namely:

- Residential with homegrown produce;
- Residential without homegrown produce
- Allotments; and
- Commercial and industrial.

A full list of the GACs together with an indication of the method used for their derivation is provided in Appendix 3. GACs applicable to residential with homegrown produce end use have been used for the assessment of the site. Contaminant concentrations below the GACs are considered not to warrant further risk assessment. However, concentrations of contaminants above the GACs may require further consideration through statistical analysis, if appropriate, or further detailed assessment using site specific data.

In regard to human health risks by direct contact exposure, contamination is generally assumed to be at or within 1m of the surface. It is considered that at depths greater than 1m, 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. Therefore, data from the top 1.0 to 1.5m is used for assessment of risks to human health via direct contact pathways, dependant on proposed future site levels.

This document does not constitute a Site Assessment Report (SAR) as outlined in the UKWIR Guidance for the Selection of Water Supply Pipes to be Used in Brownfield Sites (Ref: 10/WM/03/21, 2010). As such, the full generic suite of testing recommended in the UKWIR guidance may not have been undertaken for this site and may be required by some water companies. However, consideration has been given to the 'threshold' concentrations presented in Table 3.1 of the UKWIR guidance, where they are applicable to the analysis undertaken, to provide an indication of the potential risks to buried water supply pipes.

5.1.2. Ground Gas

The criteria used to assess the ground gas monitoring results, where monitored, have been taken from the following guidance documents:

- Assessing risks posed by ground gases to buildings, CIRIA Report C665, 2007
- Code of practice for the characterisation and remediation from ground gas in affected developments, British Standard BS 8576, 2013
- A Pragmatic Approach to Ground Gas Risk Assessment, CL:AIRE Research Bulletin RB17, 2012

The frequency and period of monitoring is assessed based on the gas generation potential of the source material and the sensitivity of the development, in accordance with Figure 6 of BS8576 and Table 5.5 of CIRIA C665. As BS8576 promotes a risk based approach to ground gas assessment, it recognises that ground gas monitoring might not be necessary if a viable pollutant linkages is not present, e.g. if a 'credible' source with significant ground gas generation potential and/or a 'credible' migration pathway are not present.

The Characteristic Situation for a monitoring location is determined using the worst case gas screening value for methane or carbon dioxide from all of the monitoring rounds at that location. Following the precautionary principal, the most stringent of the Characteristic Situations for the monitoring locations within the Site is generally used to classify the site as a whole.

5.2 SOIL ASSESSMENT

5.2.1. General

A total of 10no. soil samples collected during the site investigation of soil that could potentially be reused on site at or near surface during the proposed development works or at depths where hydrocarbon odours were noted were submitted to a UKAS accredited laboratory for analysis for a suite of heavy metals, phenols, speciated polycyclic aromatic hydrocarbons (PAHs), fractionated total petroleum hydrocarbons (TPH), BTEX compounds and several inorganic parameters. The results of the laboratory analyses are summarised in Appendix 4, in which they are compared to the relevant generic assessment criteria. A full set of all the laboratory test certificates is presented as Appendix 5.

The range of potentially hazardous contaminants present on the site can be wide and varied and the suite has been chosen to reflect both commonly found contaminants and others indicated by research to have a significant risk of being present. It is, however, possible that others may exist for which analyses have not been carried out or which were outside the scope of completed exploratory holes.

The decision to recommend acceptability or a requirement for remediation is based on the evaluation of a number of factors which when combined present a statutory or non-statutory risk that may require remedial action.

5.2.2. Heavy metals

The heavy metals included in the analysis of the samples from across the site were identified at concentrations below the relevant GACs. Therefore, heavy metals are not considered to represent a significant source of contamination with regard to future site users.

5.2.3. Petroleum hydrocarbons

Total petroleum hydrocarbon (TPH) concentrations were recorded to be well below GACs in the soil samples across the site and predominantly below the laboratory detection limits.

Concentrations of TPH C11-C40 fractions also did not exceed the UKWIR 'threshold' values for mineral oil. TPH is therefore not considered to represent a significant source of contamination to proposed water supply pipes. However, the designers of the water supply pipes for this site should review the data in this report to inform their decision-making process.

5.2.4. Polycyclic aromatic hydrocarbons (PAHs)

Polycyclic aromatic hydrocarbon (PAH) compound concentrations were recorded to be well below the relevant GACs and the laboratory detection limits in all the soil samples across the site. Therefore, PAHs are not considered to represent a significant source of contamination with regard to human health or environmental receptors.

5.2.5. BTEX compounds and MTBE

BTEX compounds and MTBE were not identified at concentrations in excess of the laboratory detection limits and were well below the relevant GACs in all of the samples from across the site. Therefore, BTEX compounds and MTBE are not considered to represent a significant source of contamination with regard to human health.

Concentrations of BTEX and MTBE were not recorded to exceed the UKWIR 'threshold' values. BTEX and MTBE are therefore not considered to represent a significant source of contamination to proposed water supply pipes.

5.2.6. Inorganics

The concentrations of free cyanide fell below laboratory detection limits in all of the soil samples analysed.

The pH of the soil samples analysed was within the 5-9 range, indicating neutral soils.

5.2.7. Asbestos

No asbestos containing materials or debris were identified in any of the soil samples tested or observed in the soil during the investigation. However, as with all previously developed sites, the potential exists for asbestos to be encountered during future redevelopment works.

5.3 STATISTICAL ANALYSIS

Statistical analysis on the test results from this site was not considered to be appropriate.

5.4 GROUND GAS ASSESSMENT

5.4.1. Conceptual Model – Made Ground

The Desk Top Study element of this assessment identified the Made Ground material on the site as a potential source of significant ground gas generation that might impact the site. The intrusive investigation went on to confirm the presence of a moderately thick layer of imported Made Ground on site (up to 2.2m) and that this Made Ground underlying the site has an Total Organic Carbon content of between 0.22% w/w and 2.7% w/w.

5.4.2. Data Selection

The forensic logging approach described in RB17 advises separating: 1. fines of less than 10mm; 2. coarse inert particles of greater than 10mm (gravel, concrete, brick etc); 3. Metal, glass ceramic and other inert materials; 4. Degradable materials including wood, vegetable matter, cloth, leather, paper, card etc.

While it is noted that forensic logging of the Made Ground on this site has not been undertaken in strict accordance with RB17, it should be noted that the Made Ground under assessment in this report comprises reworked natural slightly sandy clay and silt with occasional brick fragments and organic matter.

Large gravel, brick and concrete fragments do not fit in the sample containers for chemical testing so total organic carbon (TOC) analysis on the sampled soil will be somewhat biased towards the TOC content of the finer soil particles that fit in the sample containers, which gives a conservative assessment for Made Ground with a high content of coarse gravel and brick and an accurate assessment of Made Ground with few coarse constituents.

Stones that are included in the sample containers and exceed 10mm are screened out by the laboratory and quantified to allow the TOC content of the sample material received to be determined. The percentage of stones exceeding 10mm is noted in the chemical test certificates and the chemical concentrations presented are corrected by the laboratory to account for this stone content.

It is therefore considered that the TOC content of the Made Ground samples submitted for analysis is a conservative content in relation to the in-situ material i.e. the TOC content of the in-situ Made Ground would be lower percentage of the overall soil mass as a result of the larger gravel and brick fragments that were not contained within the chemical sample containers.

As such, the laboratory TOC content of the samples tested from this site is considered to be a reasonably conservative value to use in the RB17 assessment approach.

5.4.3. TOC Content Distribution

The total organic carbon (TOC) contents of the Made Ground samples from across the site varied from 0.22% to 2.7% w/w with an average TOC content of 0.94% w/w.

When reviewing the TOC content of the Made Ground deposits, the TOC is likely to be related to organic matter within the original natural soil, which is likely to have a low gas generation potential.

5.4.4. CL:AIRE RB17 Assessment

Reference to Table 1 of CL:AIRE Research Bulletin RB17, on the basis of Made Ground deposits in place for less than 20 years and with an average thickness of less than 3.0m, indicates that the average TOC content of the Made Ground are generally indicative of a classification of Characteristic Situation 1 gas regime.

Therefore, based on the conceptual site model and with reference to BS8576 and CL:AIRE Research Bulletin RB17, ground gas protection measures are unlikely to be necessary for the proposed building as there is not likely to be a viable ground gas pollutant linkage present in relation to the proposed development.

5.4.5. Initial Gas Monitoring

Ground gas monitoring was undertaken on the 14th December 2022 during low atmospheric pressure conditions. No measurable ground gas flows and no measurable methane concentrations were recorded. A maximum concentration of carbon dioxide was recorded in WS105 at 3.6% v/v.

The combined ground gas flow rates and carbon dioxide concentrations indicate a Characteristic Situation 1/NHBC Green gas regime. The recorded gas concentrations also did not exceed the recommended limiting factor concentrations (1% v/v methane and 5% v/v carbon dioxide). The ground gas monitoring data therefore indicate that gas protection measures are not required for the development.

5.4.6. Ground Gas Assessment Conclusions

While only one round of ground gas monitoring has been undertaken, the ground gas monitoring data available, together with the conceptual site model and RB17 assessment approach, indicates that a Characteristic Situation 1/NBHBC Green ground gas regime is considered appropriate for the site with no ground gas protection measures recommended for the proposed development.

6. CONCEPTUAL SITE MODEL

6.1 SOURCES

The conceptual model, based on information obtained as part of the preliminary risk assessment and subsequent generic quantitative risk assessment, has not identified any significant contaminant sources.

It should be noted that additional sources of contamination may become apparent during any future investigation and development of the site.

6.2 PATHWAYS AND RECEPTORS

As no potentially significant sources of contamination have been identified, no potentially viable pollutant linkages are considered to be present with regard to the proposed development. Further discussion of pathways and receptors and risk assessment is therefore not considered to be appropriate.

7. MATERIAL PROPERTIES

7.1 INTRODUCTION

The geotechnical assessment and the subsequent foundation design recommendations will use the findings of the ground investigation and the results of the in-situ and geotechnical testing carried out in the boreholes and on representative samples of the materials encountered.

7.2 GEOTECHNICAL TESTS

A programme of geotechnical laboratory testing was carried out on representative samples collected from the strata encountered during the ground investigation.

Details of the specific procedure used in each case are shown below in Table 7.1 and the geotechnical test certificates are presented in Appendix 6.

Table 7.1. Summary of geotechnical testing

Test	Standard (BS1377:1990) unless otherwise indicated	No.
Classification Tests		
Atterberg Limits	Part 2, Clauses 4.5 & 5.0	1
Particle Size Distribution – Wet Sieve	Part 2, Clause 9.2	5
Particle size Distribution – Sedimentation	Part 2, Clause 9.5	3
Total Shear Strength Tests		
Unconsolidated Undrained Triaxial Compression Test	Part 7, Clause 8.4	1
Chemical Tests		
Sulphate Content 2:1 soil water extract	Part 3, Clause 5.3	3
pH value	Part 3, Clause 9.0	3
BRE SD1	Various	2

7.3 GEOTECHNICAL PARAMETERS

This section discusses the key geotechnical characteristics values of each encountered stratum as determined from field observations, in-situ and laboratory geotechnical testing.

7.3.1. Topsoil/Made Ground

A superficial layer of Topsoil comprising <0.10m soft brown to dark brown sandy gravelly Silt with rootlets was present from ground surface in the five (5no.) WS boreholes. In the two (2no.) hand excavated inspection pits >0.50m of Topsoil / Subsoil was recorded.

Made Ground was encountered immediately below the Topsoil and persisted to depths of between 1.10 and 2.20m. The Made Ground was described as a soft to firm melange of light grey and brown sandy gravelly Silt/Clay with red brick fragments and organic materials

No geotechnical laboratory testing was undertaken on these materials as all foundations will be constructed below these potentially highly variable strata.

7.3.2. Wittering Formation

Wittering Formation (WF) was encountered beneath the Made Ground in the WS boreholes at depths of between 1.10 to 2.20mbgl and formed the basal unit of the ground investigation. The WF comprised a discontinuous fine-grained layer comprising 0.40 to 1.40m of dark brown and orange brown sandy SILT/CLAY over medium dense to very dense orange brown, yellow and grey thinly laminated SAND. The sand of the WF was sufficiently dense at 3no. locations to cause the early termination of the WS boreholes.

In-Situ Testing

Standard penetration testing (SPT) was undertaken throughout the WF. The resultant N-values are presented on the engineering logs and in Table 7.2.

Table 7.2. Results of the standard penetration testing – Wittering Formation

BH No.	Depth (mbgl)	SPT N Value	Description	BH No.	Depth (mbgl)	SPT N Value	Description
WS101	2.00	14	sandy SILT	WS103	4.00	62	fine to medium SAND
	3.00	60	fine SAND		5.00	39	
	3.90	51		WS104	2.00	4	gravelly SILT
	4.90	46			3.00	27	silty fine SAND
WS102	2.00	39	fine to medium SAND		4.00	68	
	2.60	84		WS105	2.00	6	silty fine SAND
WS103	2.00	7	fine to medium SAND		3.00	62	
	3.00	33					

The SPTs returned a range of N-values of between 4 and >50 with a mean average of 34. All the SPT N data has been plotted against depth and presented as Figure 3 of this report. Close inspection of Figure 3 reveals that N-values are generally considerably lower at 2.00mbgl than those undertaken at greater depths. It is possible that these lower values are associated with a finer grained material although not all the engineering logs reflect this.

Based on the distribution of N-values presented in Figure 3, it is recommended that two characteristic N-values are adopted for the Wittering Formation; an N-value of 7 in the top 2.00mbgl and N = 40 for the WF below 2.00mbgl.

Classification Testing

Consistency Limits

1no. representative sample of the WF underwent Atterberg limits testing to determine its consistency limits. The result of this analysis is presented in Table 7.3 and the laboratory test certificates are in Appendix 6.

Table 7.3. Results of the Atterberg limits testing – Wittering Formation

Location	Depth (mbgl)	Natural Water Content, w (%)	Liquid Limit w_L (%)	Plastic Limit w_P (%)	Plasticity Index I_P (%)	Corrected Plasticity Index (%)
WS104	2.50-3.00	30	57	25	32	32

The results of the Atterberg limits test gives a plasticity index of 32% and a corresponding liquid limit of 57% which is indicative of a high plasticity clay. Correction, to account for the >425 μ m content does not affect the value of the plasticity index, which is therefore consistent with medium volume change potential.

Based on the results of the Atterberg limits testing a characteristic plasticity index (i_{pk}) of 35% has been attributed to the WF, which should be considered as having medium volume change potential.

Particle Size Distribution

Five (5no.) samples of the WF underwent particle size distribution analysis using the wet sieve method with 3no. of these samples undergoing follow on sedimentation analysis. The results are presented in the Table 7.4 and the laboratory test certificates and grading envelopes are located in Appendix 6.

Table 7.4. Granulometric composition – Wittering Formation

Sample Location	Depth (mbgl)	Laboratory Description	Particle Size Content				
			Clay	Silt	Sand	Gravel	V.Coarse
WS101	3.00-3.50	clayey SAND	13	14	72	1	0
WS102	2.00-2.50	clayey SAND	16		84	1	0
WS103	2.70-4.00	clayey SAND	8	10	81	1	0
WS104	3.00-4.00	clayey SAND	17		33	0	0
WS105	2.00	clayey SAND	9	10	80	1	0

The results of the particle size distribution analyses show the coarse-grained WF to be sand dominated with less than 27% fines.

Shear Strength Parameters

The determination of shear strength of the fine- and coarse-grained WF will be undertaken separately in the following sections of this Report.

Fine-grained Wittering Formation – Undrained Shear Strength

One (1no.) representative samples of the WF underwent laboratory unconsolidated undrained triaxial compression testing to determine its undrained shear strength. The result is presented in Table 7.5 and the laboratory test certificates are located in Appendix 6.

Table 7.5. Results of the UU Triaxial Compression Testing – Wittering Formation

Location	Depth (mbgl)	Bulk Density (Mg/m ³)	Cell Pressure (kN/m ²)	Undrained Shear Strength c_u (kN/m ²)
WS104	2.50-3.00	1.88	55	37

The result of the UU triaxial testing gives a c_{uk} value of 37kN/m², which is consistent with a low undrained shear strength.

The laboratory test results have been augmented with c_{uk} values derived from the widely accepted empirical relationship: with SPT N; where:

$$c_u = f_1 \times \text{SPN}$$

Where f_1 is a correlation factor based on the characteristic plasticity index.

Using a correlation factor of 5 and the characteristic SPT N of 7 gives a characteristic undrained shear strength (c_{uk}) of 35kN/m², which is similar to the laboratory test result and therefore should be adopted as the characteristic value.

Fine-grained SGM - Drained (Effective) Shear Strength

The widely accepted relationship between drained shear strength and plasticity index for remoulded clays has been used to determine the effective shear strength parameters, where:

$$\phi'_k = 42 - (12.5 \text{ Log } I_{pk})$$

Taking the characteristic plasticity index of 35% will give a characteristic effective angle of shearing resistance (ϕ'_k) of 23°.

In terms of effective stress, the shear strength of a fine-grained soil can be considered as frictional, such that $c'_k = 0\text{kN/m}^2$.

Coarse-Grained Wittering Formation - Shear Strength

Using the procedure documented in BS8004 (2015); where the characteristic constant volume or critical angle of friction is given by:

$$\phi_{cv,k} = 30 + \phi'_{ang} + \phi'_{psd}$$

Where ϕ'_{ang} = contribution to $\phi'_{cv,k}$ from the angularity of the particles

ϕ'_{psd} = contribution to $\phi'_{cv,k}$ from soil's particle size distribution

and the characteristic peak angle of friction is given by:

$$\phi_{pk,k} = \phi_{cv,k} + \phi_{dil}$$

Where ϕ_{dil} is the contribution to $\phi_{pk,k}$ from soil dilatancy

After normalisation of the SPT N-values to account for overburden pressure and hammer energy, a characteristic $(N_1)_{60}$ of 41 is considered appropriate for the coarse-grained WF. This correlates to a density index (I_D) of 82% (Table F1, BS EN 1997-2). With reference to Table 1, BS 8004: 2015 a peak angle of shearing resistance ($\phi_{pk,k}$) of 36° is obtained.

Other Geotechnical Parameters – Fine-Grained Wittering Formation

Modulus of Deformation (E_{uk})

Bjerrum (1975) gives a lower bound E_{uk}/c_{uk} ratio of 500 for normally consolidated clay giving an E_{uk} of 18MN/m²

CIRIA R 143 suggests that the drained modulus (E'_k) should be taken as $0.75E_{uk}$. Therefore, an E'_k of 13MN/m² has been attributed to the WF.

Modulus of Volume Compressibility

The modulus of volume compressibility (m_v) has been determined from the empirical relationship with the plasticity index (I_P) and published data for similar materials giving an m_{vk} of 0.29m²/MN, which is indicative of a material of medium to high compressibility.

Other Geotechnical Parameters – Coarse-Grained Wittering Formation

Modulus of Deformation

The determination of the modulus of deformation for square and long strip foundations can be obtained by multiplying the static cone resistance by a factor of 2.5 or 3.5 respectively. Where only SPT data is available the static cone resistance can be determined by multiplying the N-value by an empirical factor. For fine sand, a value of 4 is recommended. The determination of the deformation modulus is presented in Table 7.6

Table 7.6 Deformation Modulus for the coarse-grained Wittering Formation

Foundation Configuration	Characteristic SPT N Value	Equivalent Static Cone Resistance (kg/cm ²)	Static Cone Resistance (MN/m ²)	Deformation Modulus E_d (MN/m ²)
Strip	40	160	16	55
Pad				40

7.4 AGGRESSIVE GROUND SOIL CHEMISTRY

Chemical testing was carried out on Five (5no.) representative samples of the materials encountered beneath the site in accordance with Box C10, BRE Special Digest 1. The results are summarised in Tables 7.7 and 7.8.

Table 7.7. Summary of the results of chemical testing for concrete classification

Location	Depth (mbgl)	Stratum	pH	SO ₄ (g/l)
WS101	0.50-1.00	Made Ground	7.2	0.14
WS103	2.70-4.00	WF	6.1	0.0075
WS104	1.00	Made Ground	7.9	0.053

Table 7.8. Results of the BRE SD1 testing

BH	Depth (mbgl)	Stratum	pH	Total Sulphate AS (% SO ₄)	Total Potential Sulphate TPS (%)	Oxidisable (Sulphate) (%)
WS101	2.00	WF	5.2	0.025	0.039	0.014
WS102	1.00	Made Ground	5.3	0.034	0.051	0.015

The amounts of oxidisable sulphides have been determined following the procedure documented in Paragraph C5.1.2 of BRE SD1. The results indicate that pyrite is unlikely to be present in significant amounts within materials encountered beneath the site.

For foundation concrete Tables C1 and C2 of BRE SD1 gives a Design Sulphate Classification of DS-1 and an Aggressive Chemical Environment for Concrete (ACEC) Class of AC-1s in the absence of any groundwater.

7.5 CHARACTERISTIC GEOTECHNICAL PARAMETERS

Based on the laboratory test results, in-situ testing and subsequent analysis a range of characteristic geotechnical parameters, which should be used in all geotechnical and foundation design calculations are presented in Table 7.9.

Table 7.9. Characteristic geotechnical parameters

Stratum	Geotechnical Parameter			Notes	Characteristic Value	
Made Ground	Not provided as material will be removed prior to construction					
Wittering Formation (fine-grained)	Unit Weight γ			BS8004 2015	19kN/m ²	
	Shear Strength	Undrained	C_{uk}	Relationship with SPT N	35kN/m ²	
			ϕ_{uk}		0	
		Drained	C'_{k}	Relationship with I_{pk}	0kN/m ²	
			ϕ'_{k}		23°	
	Modulus of Deformation	Undrained	E_{uk}	500 x C_{uk}	18MN/m ²	
		Drained	E'_{k}	CIRIA R-143	13MN/m ²	
	Modulus of /Volume Compressibility			m_{vk}	Stroud 1974	0.29m ² /MN
Wittering Formation (coarse-grained)	Unit Weight γ			CIRIA C574	18kN/m ³	
	Shear Strength		C_k	BS8004 2015	0kN/m ²	
			ϕ_k		36°	
	Modulus of Deformation			Relationship with q_c	Strip	55MN/m ²
					Pad	40MN/m ²

8. FOUNDATION AND GROUND ENGINEERING

8.1 INTRODUCTION

The geotechnical assessment below relates to the details of the proposed development. It is currently understood that the site is to be redeveloped for residential use.

5no. windowless sample boreholes and 2no. hand dug pits were carried out across the site. The ground conditions encountered are presented in Table 4.1 and in brief comprise Topsoil / Made Ground overlying Wittering Formation (WF) to the full depth of the ground investigation. The depth of the base of the Made Ground was recorded at between 1.10 and 2.20mbgl but it is possible that thicker sequences of Made Ground may be present in other areas of the site.

The WF was identified beneath the Topsoil / Made Ground and generally consisted of a discontinuous superficial layer comprising 0.40 to 1.40m of soft to firm dark brown and orange brown sandy SILT/CLAY over medium dense to very dense orange brown, yellow and grey thinly laminated SAND

Groundwater was not encountered during the ground investigation or in the 5no. monitoring wells on the 6th December 2022.

8.2 SHALLOW FOUNDATIONS

Given the proposed development a shallow foundation is considered appropriate for the site under consideration although the depth of the required foundations may be restrictive.

8.2.1. Depth of Foundations

All foundations should be constructed beneath the Topsoil / Made Ground within the underlying WF.

The fine-grained WF is not considered an appropriate founding material due to its low strength and medium to high compressibility. Furthermore, if foundations should cross between the fine and coarse-grained materials differential settlement will occur.

Based on the results of the ground investigation, in order to construct the foundations entirely within the coarse-grained WF will require excavations of between 1.80 and 3.30mbgl with a mean depth to the coarse-grained WF of 2.35m.

Formation of trench fill foundations at these depths can be restrictive both technically and economically and a piled foundation may offer a more cost effective foundation solution for the development under consideration. However, a foundation design has been carried out assuming trench fill foundations constructed within the coarse-grained WF.

8.2.2. Allowable Bearing Resistance

Bearing resistance analysis has been carried out in order to check the Ultimate Limit State bearing resistance of the coarse-grained WF. All ULS bearing resistance calculations have been carried out in accordance with Eurocode 7.

In the bearing resistance analysis, a minimum foundation depth of 1.00m has been used as this will return the lowest ULS bearing resistance. In the absence of any groundwater, corrections to the bearing resistance are not considered necessary.

Table 8.1 Ground model used in the bearing resistance calculations

Ground Model	Stratum	Thickness (m)	Foundation Depth	Shear Strength Parameters			
				Total		Effective	
				c_{uk}	ϕ_{uk}	c'_k	ϕ'_k
GM1	Topsoil / Made Ground	1.00	1.00mbgl	Not Used			
	Coarse-grained WF	>4.00		Granular		0	36°
Groundwater not present across the site							

The UK has implemented Design Approach 1 (DA1) of BS EN1997-1:2004 (Eurocode 7: Geotechnical Design), which requires two design combinations to be satisfied:

Combination 1 (C1): A1 "+" M1 "+" R1

Combination 2 (C2): A2 "+" M2 "+" R1

Where A, M and R refer to groups of partial factors relating to actions, materials and resistance respectively.

Table 8.2 Partial factors applied to the bearing resistance analysis

	Combination 1			Combination 2		
	A1	M1	R1	A2	M2	R1
Tangent of the Angle of Shearing Resistance ($\tan \phi$)		1.00			1.25	
Cohesion Intercept (c')		1.00			1.25	
Undrained Cohesion c_u		1.00			1.40	
Permanent Action	1.35			1.00		1.00
Variable Action	1.50			1.30		
Resistance						1.00

The summary of the bearing checks is presented in Table 8.3 and the geotechnical calculation sheets are located in Appendix 7.

Table 8.3 Summary of ULS bearing capacity checks

EC7 Calculation Method	Foundation type and dimensions	Foundation Material	Design Approach 1	Bearing Resistance (kN/m^2)
ULS Bearing Resistance (kN/m^2)	0.60m Wide Strip	coarse-grained WF	C1	986
			C2	457

The ultimate limit state bearing resistances presented in Table 8.3 represent the maximum load that can be supported by the foundation without failure occurring within the soil mass. Table 8.3 indicates that the application of combination 2 factoring provides the limiting value of 457kN/m^2 . Eurocode 7 does not require settlement analyses to be carried out on foundations constructed on coarse-grained granular materials; or, the ultimate bearing resistance (q_u) is equal to the allowable bearing resistance (q_a). Therefore, adoption of an allowable bearing pressure of 457kN/m^2 will ensure that settlements remain below 25mm.

8.3 GROUND FLOOR SLABS

Due to significant thickness of Made Ground, a suspended floor slab design should be adopted.

8.4 EXCAVATION STABILITY

Both the Made Ground and fine-grained WF were cohesive in their nature and therefore are likely to remain stable in the short term as evidenced in the infiltration test pits.

It is recommended, in line with good engineering practice, that foundations are left open for the minimum amount of time before placement of foundation concrete. If it becomes evident that foundation bases will remain exposed for an extended period of time it is recommended that the excavation is left short and only progressed to finished level immediately prior to concrete placement.

8.5 CALIFORNIAN BEARING RATIO

The Californian Bearing Ratio (CBR) of the materials beneath the site was determined using a TRRL probe. The results are presented in Table 8.4 and field test sheets are located in Appendix 9.

Table 8.4. Results of TRL Probe CBR Calculations

Location	Depth (mm)		
	Calculated CBR (%)		
CBR1	0 - 400	400-600	600-827
	6	6	14
CBR2	0 - 400	400-600	600-858
	5	7	4
CBR3	0 - 860	400 - 600	600 - 850
	1.5	Not recorded	

The results of the CBR determination return a range of CBR values of between 1.5 and 14%. The CBR value of 1.5% is evidence of soft spots within the Made Ground. It is therefore recommended that either, a CBR of 1% is adopted across the entire site, which would inevitably lead to an overdesign in many areas of the site; or a preliminary design CBR of 4% is used but further CBR testing is carried on the prepared subgrade at design level.

8.6 CHEMICAL ATTACK ON BURIED CONCRETE

Laboratory chemical testing of pH and sulphate concentrations has indicated a Design Sulphate Classification of DS-1 in accordance with BRE Special Digest 1. Given the soil conditions encountered and the absence of any groundwater an ACEC of AC-1s is recommended.

9. CONCLUSIONS AND RECOMMENDATIONS

9.1 CONTAMINATION

No potentially significant sources of contamination have been identified with regard to the proposed development. Therefore, the risk of impact to receptors in the context of the proposed development from contamination is considered to be **very low**. As such, further investigation, assessment and remediation are not considered necessary for this site.

It should be noted that additional sources of contamination may become apparent during any future investigation and development of the site.

A discovery strategy and appropriate PPE are recommended during any redevelopment of the site to address any as yet unidentified contamination that may be identified during the works.

9.2 GEOTECHNICAL

The ground investigation has shown the site to be underlain by Topsoil / Made Ground over Wittering Formation (WF), which formed the basal unit of the ground investigation. The Topsoil / Made Ground was identified in all exploratory holes and persisted to a maximum depth of 2.20mbgl. The WF comprised a discontinuous superficial layer of soft to firm SILT/CLAY of low strength and medium to high compressibility over dense to very dense fine to medium SAND.

If a shallow foundation solution is adopted, foundation bases should be constructed beneath the Made Ground and the fine-grained WF to bear upon the sand of the coarse-grained WF. Based on the depths recorded during the ground investigation, this will require foundation excavations between 1.80 and 3.30mbgl with a mean depth of 2.35mbgl and the adoption of a trench fill foundation. If these depths are considered too restrictive, consideration should be given to the use of a piled foundation. However, the design of a deeper foundation would require a further intrusive ground investigation to determine the ground conditions to greater depth.

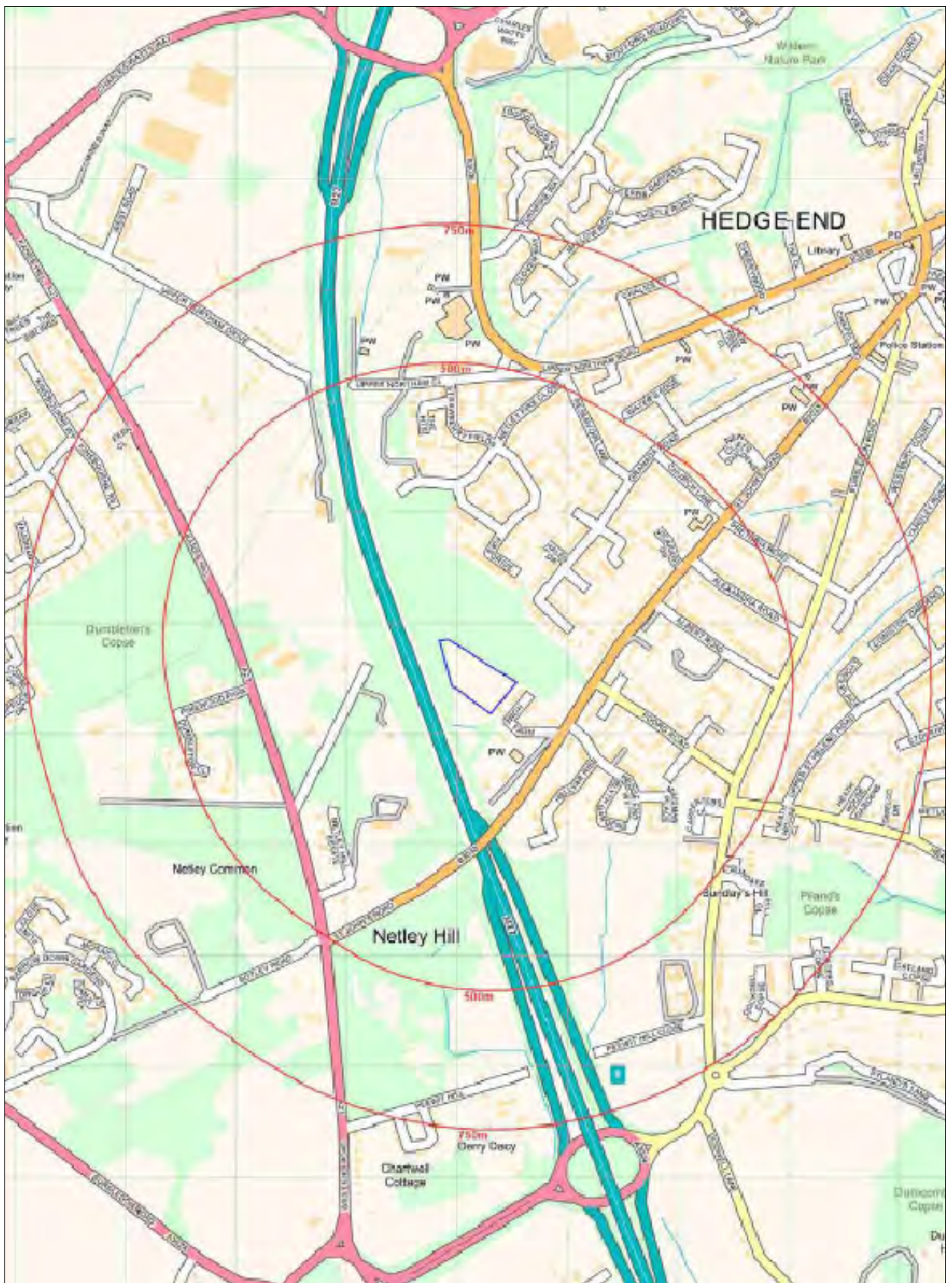
ULS bearing resistance calculations have been carried out for the coarse-grained WF in accordance with Eurocode 7 and give a ULS bearing resistance of 457kN/m² under combination 2 factoring. Following the guidance presented in EC7, serviceability limit state settlement analyses are not required in coarse-grained materials. Therefore, the ultimate limit state bearing resistance (q_u) = allowable bearing resistance (q_a) = 457kN/m².

Given the nature of the proposed development, bearing pressures will be considerably lower than the allowable bearing resistance and as a result of this settlements will remain below 25mm.

It is recommended that a suspended floor slab design is adopted due to significant thickness of Made Ground present across the site.

Chemical testing of ground aggressivity has shown the ground to be consistent with Design Sulphate Classification DS-1 and an ACEC of AC-1s in the absence of any groundwater.

FIGURE 1: SITE LOCATION PLAN



Ground Condition Consultants Ltd
10 Wakegrave Close Southampton SO19 9RY
Telephone 07971 450113
ask@groundcc.co.uk www.groundcc.co.uk

client
WYKEHAM HOMES
site
HOME FARM, HEDGE END
title
SITE LOCATION PLAN

scale	NTS	drawn by	AP	checked by	RP
date	17 NOV 2022	job no	J22-077		
drawing number	FIGURE 1			rev.	-

FIGURE 2: INVESTIGATION LOCATION PLAN



Ground Condition Consultants Ltd
10 Waldegrave Close Southampton SO19 9RY
Telephone 07971 450113
ask@groundcc.co.uk www.groundcc.co.uk

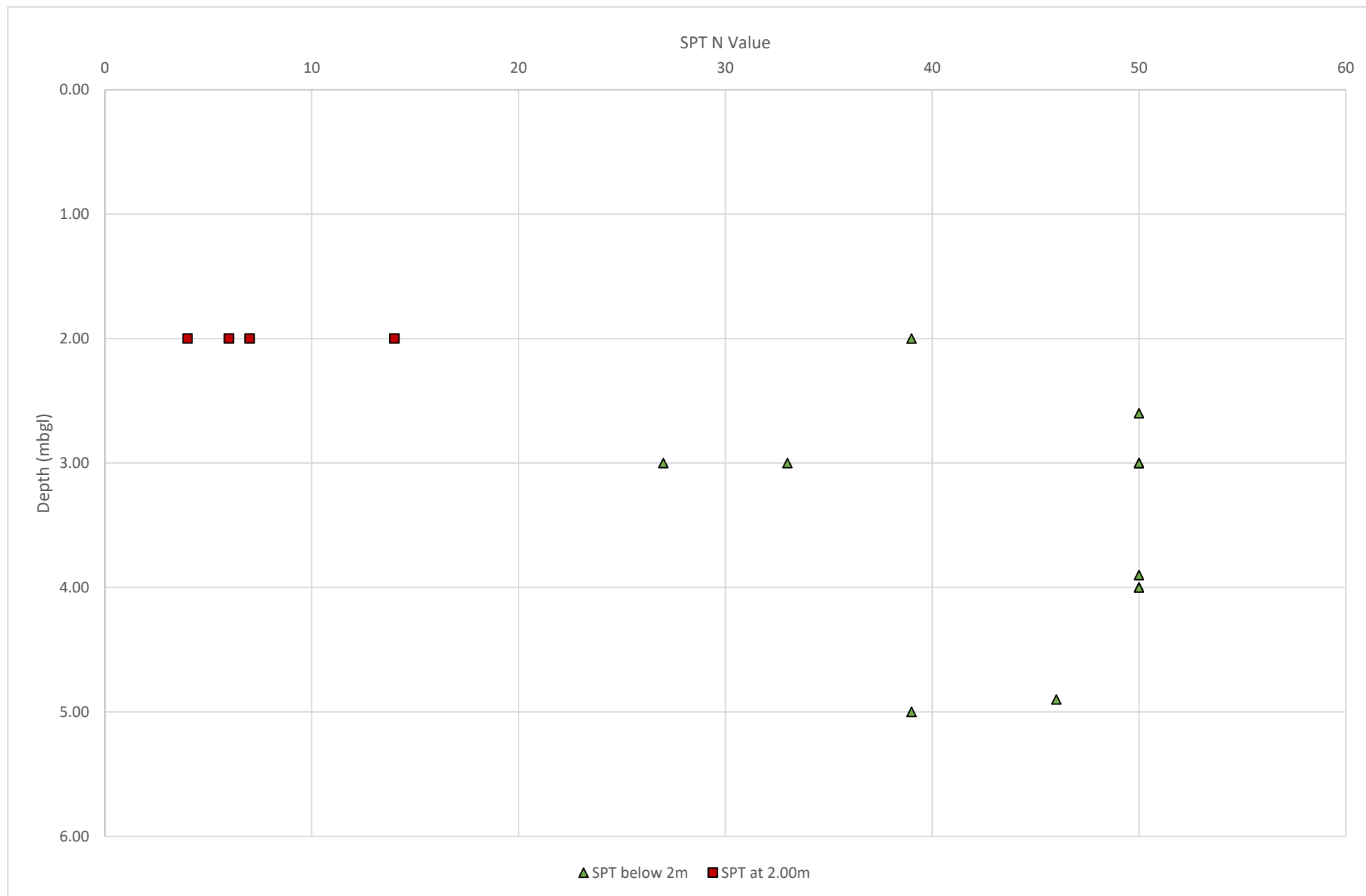
client
WYKEHAM HOMES

site
HOME FARM, HEDGE END

title
SITE INVESTIGATION PLAN

scale	NTS	drawn by	DP	checked by	RP
date	06 DEC 2022	job no	J22-077		
drawing number	FIGURE 2			rev.	2

FIGURE 3: STANDARD PENETRATION N V DEPTH



APPENDIX 1: REPORT CONDITIONS

This report is produced solely for the benefit of **Wykeham Homes** and no liability is accepted for any reliance placed on it by any other party unless specifically agreed in writing otherwise.

This report refers, within the limitations stated, to the condition of the Site at the time of the inspections. No warranty is given as to the possibility of future changes in the condition of the Site.

This report is based on a visual Site inspection, study of readily accessible referenced historical records, information supplied by those parties noted in the text and preliminary discussions with local and Statutory Authorities. Some of the opinions are based on unconfirmed data and information and are presented in good faith without exhaustive clarification. Where ground contamination is suspected but no physical Site test results are available to confirm this, the report must be regarded as initial advice only, and further assessment should be undertaken prior to detailed activities related to the Site. Where test results undertaken by others have been made available these can only be regarded as a limited sample. The possibility of the presence of contaminants, not revealed by this research cannot be discounted.

Whilst confident in the findings detailed within this report because there are no exact UK definitions of these matters, being subject to risk analysis, we are unable to give categorical assurances that they will be accepted by Authorities or Funds etc. without question, as such bodies may have unpublished, often more stringent objectives. This report is prepared for the proposed uses stated in the report and should not be used in a different context without reference to Ground Condition Consultants Ltd. In time improved practices or amended legislation may necessitate a re-assessment.

The report is necessarily limited to those aspects of land contamination specifically reported on and no liability is accepted for any other aspect especially concerning gradual or sudden pollution incidents that may occur. The opinions expressed cannot be absolute due to the limitations of time and resources within the context of the agreed brief and the possibility of unrecorded previous use and abuse of the Site and adjacent Sites. The report concentrates on the Site as defined in the report and provides an opinion on surrounding Sites. If migrating pollution or contamination (past or present) exists this can only practically be better assessed following extensive on and off Site intrusive investigations and monitoring.

APPENDIX 2: ENGINEERING LOGS

BOREHOLE LOG WS101

PROJECT NUMBER J22-077
PROJECT NAME Home Farm
CLIENT Wykeham Homes
ADDRESS Southampton
DATE 29/11/2022

DRILLING COMPANY Oakland SI
DRILLING METHOD Dynamic Sampling
DRILLING RIG Terrier
LOGGED BY DP

CASING None

COMMENTS Groundwater not encountered. Location terminated at 5.35m

Samples	SPT N	Water	Depth (m)	Graphic Log	Material Description	Well Installation
			0.2		Soft dark brown sandy slightly gravelly SILT with rootlets. Gravel is fine to medium sub angular to sub rounded flint. (TOPSOIL)	
ES - 0.30-0.50			0.4		Soft locally firm melange of grey and light brown sandy slightly gravelly SILT/CLAY with occasional red brick fragments, organic remains and pockets of silty fine to medium sand. Gravel is fine to medium occasionally coarse sub angular to rounded flint. (MADE GROUND)	
B - 0.50-1.00			0.6			
			0.8			
D - 1.00	N = 5		1			
ES - 1.10-1.30	(1,1/1,1,1,2)		1.2		Very soft dark brown sandy slightly gravelly organic SILT with frequent organic debris. Sand is fine. (RELIC TOPSOIL)	
			1.4		Very soft to soft brown sandy SILT with occasional roots. Sand is fine. (WITTERING FORMATION)	
			1.6			
			1.8			
D - 2.00	N = 14		2		Soft orange brown sandy SILT. Silt is fine. (WITTERING FORMATION)	
	(2,2/2,3,4,5)		2.2			
			2.4			
B - 2.50-3.00			2.6		Medium dense to dense orange brown thinly laminated fine SAND and silty fine sand. (WITTERING FORMATION)	
			2.8			
D - 3.00	N = 60		3		Dense to very dense yellow to grey and pale brown fine SAND. (WITTERING FORMATION)	
B - 3.00-3.90	(7,10/13,15,15,17)		3.2			
			3.4			
			3.6			
			3.8			
D - 3.90	N = 51		4			
	(9,11/11,11,13,16)		4.2			
			4.4			
			4.6			
			4.8			
D - 4.90	N = 46		5			
	(7,9/11,10,11,14)		5.2			
			5.4		Location terminated at 5.35m.	

BOREHOLE LOG WS102

PROJECT NUMBER J22-077	DRILLING COMPANY Oakland SI
PROJECT NAME Home Farm	DRILLING METHOD Dynamic Sampling
CLIENT Wykeham Homes	DRILLING RIG Terrier
ADDRESS Southamton	LOGGED BY DP
DATE 29/11/2022	

CASING None

COMMENTS Groundwater not encountered. Location terminated at 3.20m

Samples	SPT N	Water	Depth (m)	Graphic Log	Material Description	Well Installation
ES - 0.10-0.30			0.2		Soft dark brown sandy slightly gravelly SILT with rootlets. Gravel is fine to medium sub angular to sub rounded flint. (TOPSOIL)	
			0.4		Soft melange of grey and light brown sandy slightly gravelly SILT/CLAY with occasional red brick fragments, organic remains and pockets of silty fine to medium sand. Gravel is fine to medium occasionally coarse sub angular to rounded flint. (MADE GROUND)	
U - 0.50-1.0			0.6			
			0.8			
D - 1.00	N = 4 (1,1/1,1,1,1)		1			
			1.2			
			1.4		Soft dark brown slightly sandy slightly gravelly SILT with common organic material (RELIC TOPSOIL)	
ES - 1.50-1.60			1.6		Soft to firm sandy slightly gravelly SILT/CLAY. Gravel is fine to medium sub angular to rounded flint. (WITTERING FORMATION)	
			1.8			
D - 2.00			2		Dense to very dense orange brown to yellow brown slightly silty fine to medium SAND. Locally thinly laminated.	
B - 2.00-2.60	N = 39 (2,5/7,9,11,12)		2.2			
			2.4			
			2.6			
D - 2.60	N = 84 (8,13/,15,19,25,23)		2.8			
			3			
			3.2		Location terminated at 3.20m.	
			3.4			
			3.6			
			3.8			
			4			
			4.2			
			4.4			
			4.6			
			4.8			
			5			
			5.2			
			5.4			

BOREHOLE LOG WS103

PROJECT NUMBER J22-077
PROJECT NAME Home Farm
CLIENT Wykeham Homes
ADDRESS Southampton
DATE 29/11/2022

DRILLING COMPANY Oakland SI
DRILLING METHOD Dynamic Sampling
DRILLING RIG Terrier
LOGGED BY DP

CASING None

COMMENTS Groundwater not encountered. Location terminated at 5.45m

Samples	SPT N	Water	Depth (m)	Graphic Log	Material Description	Well Installation
ES - 0.00-0.05			0.2		Soft dark brown sandy slightly gravelly SILT with rootlets. Gravel is fine to medium sub angular to sub rounded flint. (TOPSOIL)	
			0.4		Soft to firm melange of grey and light brown sandy slightly gravelly SILT/CLAY with occasional red brick fragments, organic remains and pockets of silty fine to medium sand. Gravel is fine to medium occasionally coarse sub angular to rounded flint. (MADE GROUND)	
			0.6			
			0.8			
D - 1.00	N = 4 (1,1/1,1,1,1)		1			
			1.2			
			1.4			
U - 1.50-2.00			1.6			
			1.8			
			2			
D - 2.00	N = 7 (2,1/1,1,2,3)		2.2		Loose dark grey brown silty fine to medium SAND (RELIC TOPSOIL)	
			2.4		Loose orange brown silty fine to medium SAND (WITTERING FORMATION)	
			2.6			
B - 2.70-4.00			2.8		Dense to very dense orange brown to yellow grey fine to medium SAND with occasional thin laminations. (WITTERING FORMATION)	
			3			
D - 3.00	N = 33 (4,6/6,8,9,10)		3.2			
			3.4			
			3.6			
			3.8			
			4			
D - 4.00	N = 62 (7,11/15,17,17,18)		4.2			
			4.4			
			4.6			
			4.8			
			5			
D - 5.00	N = 39 (7,9/9,10,10,10)		5.2			
			5.4			
					Location terminated at 5.45m.	

BOREHOLE LOG WS104

PROJECT NUMBER J22-077	DRILLING COMPANY Oakland SI
PROJECT NAME Home Farm	DRILLING METHOD Dynamic Sampling
CLIENT Wykeham Homes	DRILLING RIG Terrier
ADDRESS Southamton	LOGGED BY DP
DATE 29/11/2022	

CASING None

COMMENTS Groundwater not encountered. Location terminated at 4.45m

Samples	SPT N	Water	Depth (m)	Graphic Log	Material Description	Well Installation
			0.2		Soft brown to dark brown sandy gravelly SILT with rootlets. Gravel is fine to medium sub angular to sub rounded flint. (TOPSOIL)	
ES - 0.40-0.50			0.4		Very soft to soft brown to light brown melange of sandy gravelly SILT/CLAY and silty gravelly fine sand. Gravel is fine to medium sub angular to sub rounded flint and occasional red brick and concrete fragments. (MADE GROUND)	
			0.6			
			0.8			
D - 1.00	N = 2 (0,0/0,1,0,1)		1			
			1.2			
			1.4			
			1.6			
ES - 1.80-1.90			1.8		Loose to very loose light bluish grey and orange silty fine SAND (MADE GROUND)	
			2			
D - 2.00	N = 4 (0,1/0,1,1,2)		2.2		Very soft dark brown sandy slightly gravelly SILT. Gravel is fine to medium sub angular to rounded flint. Frequent plant remains and organic materials. (RELIC TOPSOIL)	
			2.4			
U - 2.50-3.00			2.6		Firm orange brown sandy SILT/CLAY (WITTERING FORMATION)	
			2.8			
D - 3.00	N = 27 (2,3/4,6,8,9)		3			
			3.2			
B - 3.30-4.00			3.4		Dense to very dense orange brown to yellow brown slightly silty fine SAND (WITTERING FORMATION)	
			3.6			
			3.8			
			4			
	N = 68 (7,13/16,16,17,19)		4.2			
			4.4			
			4.6		Location terminated at 4.45m.	
			4.8			
			5			
			5.2			
			5.4			

BOREHOLE LOG WS105

PROJECT NUMBER J22-077
PROJECT NAME Home Farm
CLIENT Wykeham Homes
ADDRESS Southamton
DATE 29/11/2022

DRILLING COMPANY Oakland SI
DRILLING METHOD Dynamic Sampling
DRILLING RIG Terrier
LOGGED BY DP

CASING None

COMMENTS Groundwater not encountered. Location terminated at 3.60m

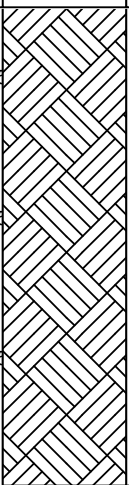
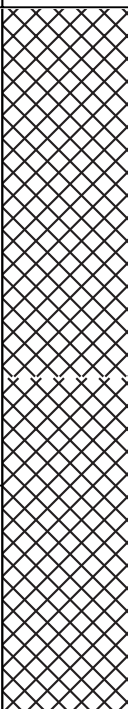
Samples	SPT N	Water	Depth (m)	Graphic Log	Material Description	Well Installation
			0.2		Soft brown to dark brown sandy gravelly SILT with rootlets. Gravel is fine to medium sub angular to sub rounded flint. (TOPSOIL)	
ES - 0.30-0.40			0.4		Soft grey brown and orange brown melange of sandy slightly gravelly SILT and silty sand. Gravel is fine to medium sub angular to sub rounded flint. Geotextile scrap noted at 0.40m. Occasional pockets of dark brown sandy gravelly SILT and occasional fragments of red brick. Rare concrete fragments. (MADE GROUND)	
			0.6			
			0.8			
D - 1.00	N = 2 (0,0/1,0,1,0)		1			
			1.2			
			1.4			
			1.6			
			1.8			
D - 2.00	N = 6 (1,1/2,2,1,1)		2		Loose yellow grey fine SAND (WITTERING FORMATION)	
			2.2			
			2.4		Loose orange brown silty fine SAND (WITTERING FORMATION)	
			2.6			
B - 2.80-3.60			2.8			
D - 3.00	N = 62 (6,10/10,15,16,21)		3		Very dense yellow grey to orange brown laminated silty and slightly silty fine SAND. (WITTERING FORMATION)	
			3.2			
			3.4			
			3.6		Location terminated at 3.60m.	
			3.8			
			4			
			4.2			
			4.4			
			4.6			
			4.8			
			5			
			5.2			
			5.4			

TRIAL PIT LOG HP101

PROJECT NUMBER J22-077	EXCAVATION TYPE Hand Tools
PROJECT NAME Home Farm	LOGGED BY DP
CLIENT Wykeham Homes	
ADDRESS Southamton	
DATE 29/11/2022	

STABILITY Good

COMMENTS Backfilled with arisings

Samples	Test	Water	Depth (m)	Graphic Log	Material Description	BACKFILL
ES - 0.40-0.50			0.05		Soft brown to dark brown sandy slightly gravelly SILT with rootlets. Gravel is fine to medium sub angular to sub rounded flint. (TOPSOIL)	
			0.1			
			0.15			
			0.2			
			0.25			
			0.3			
			0.35			
			0.4			
			0.45			
			0.5			
			0.55			
			0.6			
			0.65			
			0.7			
			0.75			
			0.8			
			0.85			
			0.9			
			0.95			
					Location terminated at 0.50m.	

TRIAL PIT LOG HP102

PROJECT NUMBER J22-077	EXCAVATION TYPE Hand Tools
PROJECT NAME Home Farm	LOGGED BY DP
CLIENT Wykeham Homes	
ADDRESS Southamton	
DATE 29/11/2022	

STABILITY Good

COMMENTS Backfilled with arisings

Samples	Test	Water	Depth (m)	Graphic Log	Material Description	BACKFILL
			0.05		Soft brown to dark brown sandy slightly gravelly SILT with rootlets. Gravel is fine to medium sub angular to sub rounded flint. (TOPSOIL)	
			0.1			
			0.15			
ES - 0.20-0.30			0.2			
			0.25			
			0.3			
			0.35			
			0.4			
			0.45			
			0.5			
			0.55		Location terminated at 0.50m.	
			0.6			
			0.65			
			0.7			
			0.75			
			0.8			
			0.85			
			0.9			
			0.95			

APPENDIX 3: GENERIC ASSESSMENT CRITERIA

SOIL - HUMAN HEALTH SCREENING VALUES

Status	End Use	Issue No	Issue Date
ISSUE	Residential with Homegrown Produce	1	June 2015

Determinand	Units	SOIL ORGANIC MATTER			SOURCE
		1%	2.5%	6%	
pH		<5, >9			
Asbestos	%	Presence			
HEAVY METALS/METALLOIDS					
Arsenic	mg/kg	37			S4UL
Cadmium	mg/kg	11			S4UL
Chromium (III)	mg/kg	910			S4UL
Chromium (VI)	mg/kg	6			S4UL
Lead	mg/kg	200			C4SL
Mercury (Elemental)	mg/kg	1.2			S4UL
Mercury (Inorganic)	mg/kg	40			S4UL
Mercury (Methyl)	mg/kg	11			S4UL
Nickel	mg/kg	130			S4UL
Selenium	mg/kg	250			S4UL
Beryllium	mg/kg	1.7			S4UL
Boron	mg/kg	290			S4UL
Vanadium	mg/kg	410			S4UL
Copper	mg/kg	2,400			S4UL
Zinc	mg/kg	3,700			S4UL
GENERAL INORGANICS					
Easily Liberatable Cyanide (free)	mg/kg	36			Acute effects infant 1 dose 3g soil
US EPA PRIORITY PAHs					
Acenaphthene	mg/kg	210	510	1100	S4UL
Acenaphthylene	mg/kg	170	420	920	S4UL
Anthracene	mg/kg	2,400	5,400	11000	S4UL
Benzo(a)Anthracene	mg/kg	72	11	13	S4UL
Benzo(b)fluoranthene	mg/kg	2.6	3.3	3.7	S4UL
Benzo(k)fluoranthene	mg/kg	77	93	100.0	S4UL
Benzo(g,h,i)perylene	mg/kg	320	340	350	S4UL
Benzo(a)Pyrene	mg/kg	2.20	2.7	3	S4UL
Chrysene	mg/kg	15	22	27.0	S4UL
Di-benzo(a,h)anthracene	mg/kg	0.24	0.28	0.30	S4UL
Fluoranthene	mg/kg	280	560	890	S4UL
Fluorene	mg/kg	170	400	860	S4UL
Indeno(1,2,3-cd)pyrene	mg/kg	27.0	36	41.0	S4UL
Naphthalene	mg/kg	2.3	5.6	13.0	S4UL
Phenanthrene	mg/kg	95	220	440	S4UL
Pyrene	mg/kg	620	1200	2000	S4UL
Total PAHs	mg/kg	No Sum	No Sum	No Sum	
Chlorinated Solvents/VOCs					
1,2-Dichloroethane (DCE)	mg/kg	0.0071	0.011	0.019	S4UL
1,1,1-Trichloroethane (111 TCA)	mg/kg	8.8	18	39	S4UL
1,1,1,2-Tetrachloroethane (1112 PCA)	mg/kg	1.2	2.8	6.40	S4UL
1,1,2,2-Tetrachloroethane (1122 PCA)	mg/kg	1.60	3.4	7.5	S4UL
Tetrachloroethene (PCE)	mg/kg	0.18	0.39	0.9	S4UL
Tetrachloromethane (Carbon Tetrachloride)	mg/kg	0.026	0.056	0.13	S4UL
Trichloroethene (TCE)	mg/kg	0.016	0.034	0.075	S4UL
Trichloromethane (Chloroform)	mg/kg	0.91	1.7	3.4	S4UL
Vinyl Chloride	mg/kg	0.00064	0.00087	0.0014	S4UL
Chlorobenzene	mg/kg	0.46	1	2.4	S4UL
1,2-Dichlorobenzene	mg/kg	23	55	130	S4UL
1,3-Dichlorobenzene	mg/kg	0.4	1	2.3	S4UL
1,4-Dichlorobenzene	mg/kg	61	150	350	S4UL
1,2,3-Trichlorobenzene	mg/kg	1.5	3.6	8.6	S4UL
1,2,4-Trichlorobenzene	mg/kg	2.6	6.4	15	S4UL
1,3,5-Trichlorobenzene	mg/kg	0.33	0.81	1.9	S4UL
1,2,3,4-Tetrachlorobenzene	mg/kg	15	36	78	S4UL
1,2,3,5-Tetrachlorobenzene	mg/kg	0.66	1.6	3.7	S4UL
1,2,4,5-Tetrachlorobenzene	mg/kg	0.33	0.77	1.6	S4UL
Pentachlorobenzene	mg/kg	5.8	12	22	S4UL
Hexachlorobenzene	mg/kg	1.8	3.3	4.9	S4UL
Carbon Disulphide	mg/kg	0.14	0.29	0.62	S4UL

Hexachlorobutadiene	mg/kg	0.29	0.7	1.6	S4UL
Phenolics					
Phenol	mg/kg	280	550	1100	S4UL
Chlorophenols	mg/kg	0.87	2.00	4.50	S4UL
Pentachlorophenol	mg/kg	0.22	0.52	1.20	S4UL
Explosives					
2,4,6 Trinitrotoluene (TNT)	mg/kg	1.6	3.7	8.1	S4UL
RDX	mg/kg	120.0	250.0	540.0	S4UL
HMX	mg/kg	5.7	13.0	26.0	S4UL
Insecticides/Herbicides					
Aldrin	mg/kg	5.70	6.60	7.10	S4UL
Dieldrin	mg/kg	0.97	2.00	3.50	S4UL
Atrazine	mg/kg	3.30	7.60	17.40	S4UL
Dichlorvos	mg/kg	0.032	0.066	0.140	S4UL
Alpha-Endosulfan	mg/kg	7.4	18.0	41.0	S4UL
Beta-Endosulfan	mg/kg	7.0	17.0	39.0	S4UL
Alpha-Hexachlorocyclohexane	mg/kg	0.23	0.55	1.20	S4UL
Beta-Hexachlorocyclohexane	mg/kg	0.085	0.200	0.460	S4UL
Gamma-Hexachlorocyclohexanes (Lindane)	mg/kg	0.06	0.14	0.33	S4UL
TPH					
TPH Aliphatic >C5-6	mg/kg	42	78	160	S4UL
TPH Aliphatic >C6-8	mg/kg	100	230	530	S4UL
TPH Aliphatic >C8-10	mg/kg	27	65	150	S4UL
TPH Aliphatic >C10-12	mg/kg	130	330	760	S4UL
TPH Aliphatic >C12-16	mg/kg	1100	2,400	4,300	S4UL
TPH Aliphatic >C16-35	mg/kg	65,000	92,000	110,000	S4UL
TPH Aliphatic >C35-44	mg/kg	65,000	92,000	110,000	S4UL
TPH Aromatic >EC5-7 (Benzene)	mg/kg	70	140.00	300	S4UL
TPH Aromatic >EC7-8	mg/kg	130	290	660	S4UL
TPH Aromatic >EC8-10	mg/kg	34	83	190	S4UL
TPH Aromatic >EC10-12	mg/kg	74	180	380	S4UL
TPH Aromatic >EC12-16	mg/kg	140	330	660	S4UL
TPH Aromatic >EC16-21	mg/kg	260	540	930	S4UL
TPH Aromatic >EC21-35	mg/kg	1100	1,500	1,700	S4UL
TPH Aromatic >EC35-44	mg/kg	1100	1,500	1,700	S4UL
TPH Aliphatic & Aromatic >EC44-70	mg/kg	1,600	1,800	1,900	S4UL
Total TPH	mg/kg	No Sum	No Sum	No Sum	
BTEX					
Benzene	mg/kg	0.087	0.17	0.37	S4UL
Toluene	mg/kg	130	290	660	S4UL
Ethylbenzene	mg/kg	47	110	260	S4UL
m-Xylene	mg/kg	60	140	330	S4UL
o-Xylene	mg/kg	59	140	320	S4UL
p-Xylene	mg/kg	56	130	310	S4UL

NOTES

- 1) Compare individual samples values against Soil Screening Values (SSV). If exceedences are noted consider further in relation to averaging areas and statistical analysis.
- 2) These values are for initial screening for potential **risk to human health only**. They are **not remediation thresholds**. **Screening for other receptors to be done separately as appropriate for the site, e.g. for water, ecology, building materials.**
- 3) Screening criteria denoted with an asterisk (*) were capped at the lower vapour/aqueous saturation limits for Tier 1 human health risk assessment purposes and considered conservative. Where concentrations are recorded at levels greater than the SSV, free phase (NAPL) contamination may be present and should be considered qualitatively. Further information to support the interpretation of assessment criteria that exceed theoretical soil saturation limits is provided in Section 4.12 of the CLEA Software Handbook (SR4).
- 4) Screening criteria denoted with hash (#) were capped at 1000000mg/kg. It is noted that aesthetic (e.g. odour) and other site specific factors may also be relevant when providing advice relating to these compounds.
- 5) LQM/CIEH S4ULs November 2014 - Copyright Land Quality Management Limited reproduced with permission; Publication Number S4UL3439. All rights reserved.
- 6) SSVs derived for certain constituents may be low in relation to standard laboratory Limits of Detection (LoD). It is the responsibility of the project engineer to check with the laboratory that appropriate detection limits can be achieved. As a target, an LoD would be no larger than 10% of the SSV, but this is not practicable for some constituents. Clearly an LoD greater than the SSV would prevent use of this SSV screening and/or be interpreted as if all samples exceeded the SSV.
- 7) Human Health Soil Screening Values (SSV) were calculated using a Soil Organic Matter (SOM) value of 1.0%, 2.5% and 6%. This is equivalent to an Fraction Organic Carbon (FOC) values of approx. 0.6%, 1.45% and 3.5% respectively (For reference FOC = 0.58*SOM). Note that some soils have different SOM/FOC, which may give require more stringent SSVs for organic compounds. It is the responsibility of the project engineer to check the SOM with the site specific conditions.

- 8) In general, SSVs above 100mg/kg are rounded down to 3 significant figures. Similarly, SSVs below 100mg/kg are rounded down to 2 significant figures

APPENDIX 4: SOIL SCREENING SUMMARY

Sample ID	Units	GAC	WS101	WS101	WS102	WS102	WS103	HP102	HP101	WS104	WS104	WS105
Depth to Top			0.3	1.1	0.1	1.5	0.0	0.20	0.40	0.4	1.8	0.3
Depth to Bottom			0.5	1.3	0.3	1.6	0.05	0.30	0.50	0.5	1.9	0.4
Date Sampled			29-Nov-22	29-Nov-22	29-Nov-22	29-Nov-22	29-Nov-22	29-Nov-22	29-Nov-22	29-Nov-22	29-Nov-22	29-Nov-22
pH	pH	5-9	7.98	6.8	7.68	6.67	6.31	6.09	7.23	7.77	8.31	8.02
Cyanide (free)	mg/kg	36	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Phenols - Total by HPLC	mg/kg	280	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Organic Matter	% w/w		1	4.7	0.4	1.2	2.7	4	1.1	0.9	1.2	0.9
Total Organic Carbon	% w/w		0.6	2.7	0.22	0.7	1.57	2.31	0.62	0.55	0.7	0.5
Antimony	mg/kg		<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Arsenic	mg/kg	37	5	5	3	5	4	1	6	16	3	6
Cadmium	mg/kg	11	<0.5	<0.5	<0.5	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Copper	mg/kg	2400	10	13	8	6	12	18	9	8	9	11
Chromium	mg/kg		20	12	31	28	8	11	21	18	20	23
Chromium (hexavalent)	mg/kg	6	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Lead	mg/kg	200	22	96	12	9	41	54	18	16	13	22
Mercury	mg/kg	40	0.51	<0.17	<0.17	<0.17	<0.17	0.35	<0.17	0.51	0.39	<0.17
Nickel	mg/kg	130	11	4	20	13	2	3	8	4	11	10
Selenium	mg/kg	250	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Zinc	mg/kg	3700	38	50	25	17	18	31	26	23	32	37
Asbestos in soil		NAD	NAD	NAD	NAD	NAD	NAD	NAD	NAD	NAD	NAD	NAD
PAH-16MS (MSD order)												
Naphthalene	mg/kg	2.3	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Acenaphthylene	mg/kg	170	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Acenaphthene	mg/kg	210	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Fluorene	mg/kg	170	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Phenanthrene	mg/kg	95	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Anthracene	mg/kg	2400	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Fluoranthene	mg/kg	280	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08
Pyrene	mg/kg	620	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07
Benzo(a)anthracene	mg/kg	72	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
Chrysene	mg/kg	15	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06
Benzo(b)fluoranthene	mg/kg	2.6	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Benzo(k)fluoranthene	mg/kg	77	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07
Benzo(a)pyrene	mg/kg	2.2	<0.04	<0.04	<0.							

APPENDIX 5: CHEMICAL LABORATORY TEST CERTIFICATES

FINAL ANALYTICAL TEST REPORT

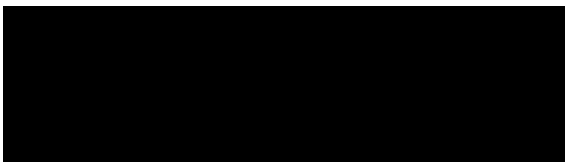
Envirolab Job Number: 22/11814
Issue Number: 1

Date: 09 December, 2022

Client: Ground Condition Consultants Ltd
10 Waldegrave Close
Southampton
SO19 9RY

Project Manager: David Pethica
Project Name: Home Farm
Project Ref: J22-077
Order No: J22-077
Date Samples Received: 01/12/22
Date Instructions Received: 01/12/22
Date Analysis Completed: 09/12/22

Approved by:



Deputy Client Services Supervisor

Envirolab Job Number: 22/11814

Client Project Name: Home Farm

Client Project Ref: J22-077

Lab Sample ID	22/11814/1	22/11814/2	22/11814/3	22/11814/4	22/11814/5	22/11814/6	22/11814/7	Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	WS101	WS101	WS102	WS102	WS103	HP102	HP101			
Depth to Top	0.3	1.1	0.1	1.5	0.0	0.20	0.40			
Depth To Bottom	0.5	1.3	0.3	1.6	0.05	0.30	0.50			
Date Sampled	29-Nov-22	29-Nov-22	29-Nov-22	29-Nov-22	29-Nov-22	29-Nov-22	29-Nov-22			
Sample Type	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES			
Sample Matrix Code	5AE	4A	6AE	6A	6AE	4AE	6A			
% Stones >10mm _A	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	% w/w	0.1	A-T-044
pH _D ^{M#}	7.98	6.80	7.68	6.67	6.31	6.09	7.23	pH	0.01	A-T-031s
Cyanide (free) _A ^{M#}	<1	<1	<1	<1	<1	<1	<1	mg/kg	1	A-T-042sFCN
Phenols - Total by HPLC _A	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	mg/kg	0.2	A-T-050s
Organic Matter _D ^{M#}	1.0	4.7	0.4	1.2	2.7	4.0	1.1	% w/w	0.1	A-T-032 OM
Total Organic Carbon _D ^{M#}	0.60	2.70	0.22	0.70	1.57	2.31	0.62	% w/w	0.03	A-T-032s
Antimony _D	<5	<5	<5	<5	<5	<5	<5	mg/kg	5	A-T-024s
Arsenic _D ^{M#}	5	5	3	5	4	1	6	mg/kg	1	A-T-024s
Cadmium _D ^{M#}	<0.5	<0.5	<0.5	0.5	<0.5	<0.5	<0.5	mg/kg	0.5	A-T-024s
Copper _D ^{M#}	10	13	8	6	12	18	9	mg/kg	1	A-T-024s
Chromium _D ^{M#}	20	12	31	28	8	11	21	mg/kg	1	A-T-024s
Chromium (hexavalent) _D	<1	<1	<1	<1	<1	<1	<1	mg/kg	1	A-T-040s
Lead _D ^{M#}	22	96	12	9	41	54	18	mg/kg	1	A-T-024s
Mercury _D	0.51	<0.17	<0.17	<0.17	<0.17	0.35	<0.17	mg/kg	0.17	A-T-024s
Nickel _D ^{M#}	11	4	20	13	2	3	8	mg/kg	1	A-T-024s
Selenium _D ^{M#}	<1	<1	<1	<1	<1	<1	<1	mg/kg	1	A-T-024s
Zinc _D ^{M#}	38	50	25	17	18	31	26	mg/kg	5	A-T-024s

Envirolab Job Number: 22/11814

Client Project Name: Home Farm

Client Project Ref: J22-077

Lab Sample ID	22/11814/1	22/11814/2	22/11814/3	22/11814/4	22/11814/5	22/11814/6	22/11814/7	Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	WS101	WS101	WS102	WS102	WS103	HP102	HP101			
Depth to Top	0.3	1.1	0.1	1.5	0.0	0.20	0.40			
Depth To Bottom	0.5	1.3	0.3	1.6	0.05	0.30	0.50			
Date Sampled	29-Nov-22	29-Nov-22	29-Nov-22	29-Nov-22	29-Nov-22	29-Nov-22	29-Nov-22			
Sample Type	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES			
Sample Matrix Code	5AE	4A	6AE	6A	6AE	4AE	6A			
Asbestos in Soil (inc. matrix)^ @										
Asbestos in soil _D [#]	NAD	NAD	NAD	NAD	NAD	NAD	NAD			A-T-045
Asbestos Matrix (visual) _D	-	-	-	-	-	-	-			A-T-045
Asbestos Matrix (microscope) _D	-	-	-	-	-	-	-			A-T-045
Asbestos ACM - Suitable for Water Absorption Test? _D	N/A	N/A	N/A	N/A	N/A	N/A	N/A			A-T-045

Envirolab Job Number: 22/11814

Client Project Name: Home Farm

Client Project Ref: J22-077

Lab Sample ID	22/11814/1	22/11814/2	22/11814/3	22/11814/4	22/11814/5	22/11814/6	22/11814/7	Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	WS101	WS101	WS102	WS102	WS103	HP102	HP101			
Depth to Top	0.3	1.1	0.1	1.5	0.0	0.20	0.40			
Depth To Bottom	0.5	1.3	0.3	1.6	0.05	0.30	0.50			
Date Sampled	29-Nov-22	29-Nov-22	29-Nov-22	29-Nov-22	29-Nov-22	29-Nov-22	29-Nov-22			
Sample Type	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES			
Sample Matrix Code	5AE	4A	6AE	6A	6AE	4AE	6A			
PAH-16MS (MSD order)										
Naphthalene _A ^{M#}	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	mg/kg	0.03	A-T-019s
Acenaphthylene _A ^{M#}	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	0.01	A-T-019s
Acenaphthene _A ^{M#}	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	0.01	A-T-019s
Fluorene _A ^{M#}	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	0.01	A-T-019s
Phenanthrene _A ^{M#}	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	mg/kg	0.03	A-T-019s
Anthracene _A ^{M#}	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	mg/kg	0.02	A-T-019s
Fluoranthene _A ^{M#}	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	mg/kg	0.08	A-T-019s
Pyrene _A ^{M#}	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	mg/kg	0.07	A-T-019s
Benzo(a)anthracene _A ^{M#}	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	mg/kg	0.04	A-T-019s
Chrysene _A ^{M#}	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	mg/kg	0.06	A-T-019s
Benzo(b)fluoranthene _A ^{M#}	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	mg/kg	0.05	A-T-019s
Benzo(k)fluoranthene _A ^{M#}	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	mg/kg	0.07	A-T-019s
Benzo(a)pyrene _A ^{M#}	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	mg/kg	0.04	A-T-019s
Indeno(123-cd)pyrene _A ^{M#}	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	mg/kg	0.03	A-T-019s
Dibenzo(ah)anthracene _A ^{M#}	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	mg/kg	0.04	A-T-019s
Benzo(ghi)perylene _A ^{M#}	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	mg/kg	0.05	A-T-019s
Total PAH-16MS (MSD order) _A ^{M#}	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	mg/kg	0.03	A-T-019s

Envirolab Job Number: 22/11814

Client Project Name: Home Farm

Client Project Ref: J22-077

Lab Sample ID	22/11814/1	22/11814/2	22/11814/3	22/11814/4	22/11814/5	22/11814/6	22/11814/7	Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	WS101	WS101	WS102	WS102	WS103	HP102	HP101			
Depth to Top	0.3	1.1	0.1	1.5	0.0	0.20	0.40			
Depth To Bottom	0.5	1.3	0.3	1.6	0.05	0.30	0.50			
Date Sampled	29-Nov-22	29-Nov-22	29-Nov-22	29-Nov-22	29-Nov-22	29-Nov-22	29-Nov-22			
Sample Type	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES			
Sample Matrix Code	5AE	4A	6AE	6A	6AE	4AE	6A			
TPH CWG with Clean Up										
Ali >C5-C6 _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	0.01	A-T-022s
Ali >C6-C8 _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	0.01	A-T-022s
Ali >C8-C10 _A	<1	<1	<1	<1	<1	<1	<1	mg/kg	1	A-T-055s
Ali >C10-C12 _A ^{M#}	<1	<1	<1	<1	<1	<1	<1	mg/kg	1	A-T-055s
Ali >C12-C16 _A ^{M#}	<1	<1	<1	<1	<1	<1	<1	mg/kg	1	A-T-055s
Ali >C16-C21 _A ^{M#}	1	<1	<1	<1	<1	<1	<1	mg/kg	1	A-T-055s
Ali >C21-C35 _A ^{M#}	2	1	<1	<1	4	6	1	mg/kg	1	A-T-055s
Total Aliphatics _A	4	1	<1	<1	4	6	1	mg/kg	1	Calc-As Recd
Aro >C5-C7 _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	0.01	A-T-022s
Aro >C7-C8 _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	0.01	A-T-022s
Aro >C8-C10 _A	<2	<2	<2	<2	<2	<2	<2	mg/kg	1	A-T-055s
Aro >C10-C12 _A	<1	<1	<1	<1	<1	<1	<1	mg/kg	1	A-T-055s
Aro >C12-C16 _A	<1	<1	<1	<1	<1	<1	<1	mg/kg	1	A-T-055s
Aro >C16-C21 _A ^{M#}	<1	<1	<1	<1	<1	1	<1	mg/kg	1	A-T-055s
Aro >C21-C35 _A ^{M#}	1	<1	<1	<1	1	4	<1	mg/kg	1	A-T-055s
Total Aromatics _A	<2	<2	<2	<2	<2	5	<2	mg/kg	1	Calc-As Recd
TPH (Ali & Aro >C5-C35) _A	5	<2	<2	<2	5	11	<2	mg/kg	1	Calc-As Recd
BTEX - Benzene _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	0.01	A-T-022s
BTEX - Toluene _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	0.01	A-T-022s
BTEX - Ethyl Benzene _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	0.01	A-T-022s
BTEX - m & p Xylene _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	0.01	A-T-022s
BTEX - o Xylene _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	0.01	A-T-022s
MTBE _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	0.01	A-T-022s

Envirolab Job Number: 22/11814

Client Project Name: Home Farm

Client Project Ref: J22-077

Lab Sample ID	22/11814/8	22/11814/9	22/11814/10					Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	WS104	WS104	WS105							
Depth to Top	0.4	1.8	0.3							
Depth To Bottom	0.5	1.9	0.4							
Date Sampled	29-Nov-22	29-Nov-22	29-Nov-22							
Sample Type	Soil - ES	Soil - ES	Soil - ES							
Sample Matrix Code	5AE	5AE	5A							
% Stones >10mm _A	<0.1	<0.1	<0.1					% w/w	0.1	A-T-044
pH _D ^{M#}	7.77	8.31	8.02					pH	0.01	A-T-031s
Cyanide (free) _A ^{M#}	<1	<1	<1					mg/kg	1	A-T-042sFCN
Phenols - Total by HPLC _A	<0.2	<0.2	<0.2					mg/kg	0.2	A-T-050s
Organic Matter _D ^{M#}	0.9	1.2	0.9					% w/w	0.1	A-T-032 OM
Total Organic Carbon _D ^{M#}	0.55	0.70	0.50					% w/w	0.03	A-T-032s
Antimony _D	<5	<5	<5					mg/kg	5	A-T-024s
Arsenic _D ^{M#}	16	3	6					mg/kg	1	A-T-024s
Cadmium _D ^{M#}	<0.5	<0.5	<0.5					mg/kg	0.5	A-T-024s
Copper _D ^{M#}	8	9	11					mg/kg	1	A-T-024s
Chromium _D ^{M#}	18	20	23					mg/kg	1	A-T-024s
Chromium (hexavalent) _D	<1	<1	<1					mg/kg	1	A-T-040s
Lead _D ^{M#}	16	13	22					mg/kg	1	A-T-024s
Mercury _D	0.51	0.39	<0.17					mg/kg	0.17	A-T-024s
Nickel _D ^{M#}	4	11	10					mg/kg	1	A-T-024s
Selenium _D ^{M#}	<1	<1	<1					mg/kg	1	A-T-024s
Zinc _D ^{M#}	23	32	37					mg/kg	5	A-T-024s

Envirolab Job Number: 22/11814

Client Project Name: Home Farm

Client Project Ref: J22-077

Lab Sample ID	22/11814/8	22/11814/9	22/11814/10					Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	WS104	WS104	WS105							
Depth to Top	0.4	1.8	0.3							
Depth To Bottom	0.5	1.9	0.4							
Date Sampled	29-Nov-22	29-Nov-22	29-Nov-22							
Sample Type	Soil - ES	Soil - ES	Soil - ES							
Sample Matrix Code	5AE	5AE	5A							
Asbestos in Soil (inc. matrix)^ @										
Asbestos in soil _D #	NAD	NAD	NAD							A-T-045
Asbestos Matrix (visual) _D	-	-	-							A-T-045
Asbestos Matrix (microscope) _D	-	-	-							A-T-045
Asbestos ACM - Suitable for Water Absorption Test? _D	N/A	N/A	N/A							A-T-045

Envirolab Job Number: 22/11814

Client Project Name: Home Farm

Client Project Ref: J22-077

Lab Sample ID	22/11814/8	22/11814/9	22/11814/10					Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	WS104	WS104	WS105							
Depth to Top	0.4	1.8	0.3							
Depth To Bottom	0.5	1.9	0.4							
Date Sampled	29-Nov-22	29-Nov-22	29-Nov-22							
Sample Type	Soil - ES	Soil - ES	Soil - ES							
Sample Matrix Code	5AE	5AE	5A							
PAH-16MS (MSD order)										
Naphthalene _A ^{M#}	<0.03	<0.03	<0.03					mg/kg	0.03	A-T-019s
Acenaphthylene _A ^{M#}	<0.01	<0.01	<0.01					mg/kg	0.01	A-T-019s
Acenaphthene _A ^{M#}	<0.01	<0.01	<0.01					mg/kg	0.01	A-T-019s
Fluorene _A ^{M#}	<0.01	<0.01	<0.01					mg/kg	0.01	A-T-019s
Phenanthrene _A ^{M#}	<0.03	<0.03	<0.03					mg/kg	0.03	A-T-019s
Anthracene _A ^{M#}	<0.02	<0.02	<0.02					mg/kg	0.02	A-T-019s
Fluoranthene _A ^{M#}	<0.08	<0.08	<0.08					mg/kg	0.08	A-T-019s
Pyrene _A ^{M#}	<0.07	<0.07	<0.07					mg/kg	0.07	A-T-019s
Benzo(a)anthracene _A ^{M#}	<0.04	<0.04	<0.04					mg/kg	0.04	A-T-019s
Chrysene _A ^{M#}	<0.06	<0.06	<0.06					mg/kg	0.06	A-T-019s
Benzo(b)fluoranthene _A ^{M#}	<0.05	<0.05	<0.05					mg/kg	0.05	A-T-019s
Benzo(k)fluoranthene _A ^{M#}	<0.07	<0.07	<0.07					mg/kg	0.07	A-T-019s
Benzo(a)pyrene _A ^{M#}	<0.04	<0.04	<0.04					mg/kg	0.04	A-T-019s
Indeno(123-cd)pyrene _A ^{M#}	<0.03	<0.03	<0.03					mg/kg	0.03	A-T-019s
Dibenzo(ah)anthracene _A ^{M#}	<0.04	<0.04	<0.04					mg/kg	0.04	A-T-019s
Benzo(ghi)perylene _A ^{M#}	<0.05	<0.05	<0.05					mg/kg	0.05	A-T-019s
Total PAH-16MS (MSD order) _A ^{M#}	<0.08	<0.08	<0.08					mg/kg	0.03	A-T-019s

Envirolab Job Number: 22/11814

Client Project Name: Home Farm

Client Project Ref: J22-077

Lab Sample ID	22/11814/8	22/11814/9	22/11814/10					Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	WS104	WS104	WS105							
Depth to Top	0.4	1.8	0.3							
Depth To Bottom	0.5	1.9	0.4							
Date Sampled	29-Nov-22	29-Nov-22	29-Nov-22							
Sample Type	Soil - ES	Soil - ES	Soil - ES							
Sample Matrix Code	5AE	5AE	5A							
TPH CWG with Clean Up										
Ali >C5-C6 _A [#]	<0.01	<0.01	<0.01					mg/kg	0.01	A-T-022s
Ali >C6-C8 _A [#]	<0.01	<0.01	<0.01					mg/kg	0.01	A-T-022s
Ali >C8-C10 _A	<1	<1	<1					mg/kg	1	A-T-055s
Ali >C10-C12 _A ^{M#}	<1	<1	<1					mg/kg	1	A-T-055s
Ali >C12-C16 _A ^{M#}	<1	<1	<1					mg/kg	1	A-T-055s
Ali >C16-C21 _A ^{M#}	<1	<1	<1					mg/kg	1	A-T-055s
Ali >C21-C35 _A ^{M#}	2	<1	4					mg/kg	1	A-T-055s
Total Aliphatics _A	2	<1	4					mg/kg	1	Calc-As Recd
Aro >C5-C7 _A [#]	<0.01	<0.01	<0.01					mg/kg	0.01	A-T-022s
Aro >C7-C8 _A [#]	<0.01	<0.01	<0.01					mg/kg	0.01	A-T-022s
Aro >C8-C10 _A	<2	<2	<2					mg/kg	1	A-T-055s
Aro >C10-C12 _A	<1	<1	<1					mg/kg	1	A-T-055s
Aro >C12-C16 _A	<1	<1	<1					mg/kg	1	A-T-055s
Aro >C16-C21 _A ^{M#}	<1	<1	<1					mg/kg	1	A-T-055s
Aro >C21-C35 _A ^{M#}	1	<1	2					mg/kg	1	A-T-055s
Total Aromatics _A	<2	<2	2					mg/kg	1	Calc-As Recd
TPH (Ali & Aro >C5-C35) _A	4	<2	6					mg/kg	1	Calc-As Recd
BTEX - Benzene _A [#]	<0.01	<0.01	<0.01					mg/kg	0.01	A-T-022s
BTEX - Toluene _A [#]	<0.01	<0.01	<0.01					mg/kg	0.01	A-T-022s
BTEX - Ethyl Benzene _A [#]	<0.01	<0.01	<0.01					mg/kg	0.01	A-T-022s
BTEX - m & p Xylene _A [#]	<0.01	<0.01	<0.01					mg/kg	0.01	A-T-022s
BTEX - o Xylene _A [#]	<0.01	<0.01	<0.01					mg/kg	0.01	A-T-022s
MTBE _A [#]	<0.01	<0.01	<0.01					mg/kg	0.01	A-T-022s

REPORT NOTES

General

This report shall not be reproduced, except in full, without written approval from Envirolab.

The results reported herein relate only to the material supplied to the laboratory.

The residue of any samples contained within this report, and any received with the same delivery, will be disposed of six weeks after initial scheduling. For samples tested for Asbestos we will retain a portion of the dried sample for a minimum of six months after the initial Asbestos testing is completed.

Analytical results reflect the quality of the sample at the time of analysis only.

Opinions and interpretations expressed are outside the scope of our accreditation.

If results are in italic font they are associated with an AQC failure, these are not accredited and are unreliable.

A deviating samples report is appended and will indicate if samples or tests have been found to be deviating. Any test results affected may not be an accurate record of the concentration at the time of sampling and, as a result, may be invalid.

The Client Sample No, Client Sample ID, Depth to Top, Depth to Bottom and Date Sampled were all provided by the client.

Soil chemical analysis:

All results are reported as dry weight (<40°C).

For samples with Matrix Codes 1 - 6 natural stones, brick and concrete fragments >10mm and any extraneous material (visible glass, metal or twigs) are removed and excluded from the sample prior to analysis and reported results corrected to a whole sample basis. This is reported as '% stones >10mm'.

For samples with Matrix Code 7 the whole sample is dried and crushed prior to analysis and this supersedes any "A" subscripts

All analysis is performed on the sample as received for soil samples which are positive for asbestos or the client has informed asbestos may be present and/or if they are from outside the European Union and this supersedes any "D" subscripts.

TPH analysis of water by method A-T-007:

Free and visible oils are excluded from the sample used for analysis so that the reported result represents the dissolved phase only.

Electrical Conductivity of water by Method A-T-037:

Results greater than 12900µS/cm @ 25°C / 11550µS/cm @ 20°C fall outside the calibration range and as such are unaccredited.

Asbestos:

Asbestos in soil analysis is performed on a dried aliquot of the submitted sample and cannot guarantee to identify asbestos if only present in small numbers as discrete fibres/fragments in the original sample.

Stones etc. are not removed from the sample prior to analysis.

Quantification of asbestos is a 3 stage process including visual identification, hand picking and weighing and fibre counting by sedimentation/phase contrast optical microscopy if required. If asbestos is identified as being present but is not in a form that is suitable for analysis by hand picking and weighing (normally if the asbestos is present as free fibres) quantification by sedimentation is performed. Where ACMs are found a percentage asbestos is assigned to each with reference to 'HSG264, Asbestos: The survey guide' and the calculated asbestos content is expressed as a percentage of the dried soil sample aliquot used.

Predominant Matrix Codes:

1 = SAND, 2 = LOAM, 3 = CLAY, 4 = LOAM/SAND, 5 = SAND/CLAY, 6 = CLAY/LOAM, 7 = OTHER, 8 = Asbestos bulk ID sample, 9 = INCINERATOR ASH.

Samples with Matrix Code 7 & 8 are not predominantly a SAND/LOAM/CLAY mix and are not covered by our BSEN 17025 or MCERTS accreditations, with the exception of bulk asbestos which are BSEN 17025 accredited.

Secondary Matrix Codes:

A = contains stones, B = contains construction rubble, C = contains visible hydrocarbons, D = contains glass/metal,

E = contains roots/twigs.

Key:

IS indicates Insufficient Sample for analysis.

US indicates Unsuitable Sample for analysis.

NDP indicates No Determination Possible.

NAD indicates No Asbestos Detected.

N/A indicates Not Applicable.

Superscript # indicates method accredited to ISO 17025.

Superscript "M" indicates method accredited to MCERTS.

Subscript "A" indicates analysis performed on the sample as received.

Subscript "D" indicates analysis performed on the dried sample, crushed to pass a 2mm sieve

Subscript "A" indicates analysis has dependant options against results. Testing dependant on results appear in the comments area of your sample receipt.

EPH CWG results have humics mathematically subtracted through instrument calculation

TPH results "with Cleanup" indicates results cleaned up with Silica during extraction

EPH CWG GCxGC ID from TPH CWG

Where we have identified humic substances in any ID's from TPH CWG with Clean Up please note that the concentration of these

humic substances is not included in the quantified results and are included in the ID for information.

Please contact us if you need any further information.

Envirolab Deviating Samples Report

Units 7&8 Sandpits Business Park, Mottram Road, Hyde, SK14 3AR
Tel. 0161 368 4921 email. ask@envlab.co.uk

Client:	Ground Condition Consultants Ltd, 10 Waldegrave Close, Southampton, SO19 9RY	Project No:	22/11814
Project:	Home Farm	Date Received:	01/12/2022 (am)
Clients Project No:	J22-077	Cool Box Temperatures (°C):	8.1

NO DEVIATIONS IDENTIFIED

If, at any point before reaching the laboratory, the temperature of the samples has breached those set in published standards, e.g. BS-EN 5667-3, ISO 18400-102:2017, then the concentration of any affected analytes may differ from that at the time of sampling.

Envirolab Analysis Dates

Lab Sample ID	22/11814/1	22/11814/2	22/11814/3	22/11814/4	22/11814/5	22/11814/6	22/11814/7	22/11814/8	22/11814/9	22/11814/10
Client Sample No										
Client Sample ID/Depth	WS101 0.3-0.5m	WS101 1.1-1.3m	WS102 0.1-0.3m	WS102 1.5-1.6m	WS103 0.0-0.05m	HP102 0.20-0.30m	HP101 0.40-0.50m	WS104 0.4-0.5m	WS104 1.8-1.9m	WS105 0.3-0.4m
Date Sampled	29/11/22	29/11/22	29/11/22	29/11/22	29/11/22	29/11/22	29/11/22	29/11/22	29/11/22	29/11/22
A-T-019s	05/12/2022	05/12/2022	05/12/2022	05/12/2022	05/12/2022	05/12/2022	05/12/2022	05/12/2022	05/12/2022	05/12/2022
A-T-022s	06/12/2022	06/12/2022	06/12/2022	06/12/2022	06/12/2022	06/12/2022	06/12/2022	06/12/2022	06/12/2022	06/12/2022
A-T-024s	08/12/2022	08/12/2022	08/12/2022	08/12/2022	08/12/2022	08/12/2022	08/12/2022	08/12/2022	08/12/2022	08/12/2022
A-T-031s	09/12/2022	09/12/2022	09/12/2022	09/12/2022	09/12/2022	09/12/2022	09/12/2022	09/12/2022	09/12/2022	09/12/2022
A-T-032 OM	08/12/2022	08/12/2022	08/12/2022	08/12/2022	08/12/2022	08/12/2022	08/12/2022	08/12/2022	08/12/2022	08/12/2022
A-T-032s	08/12/2022	08/12/2022	08/12/2022	08/12/2022	08/12/2022	08/12/2022	08/12/2022	08/12/2022	08/12/2022	08/12/2022
A-T-040s	08/12/2022	08/12/2022	08/12/2022	08/12/2022	08/12/2022	08/12/2022	08/12/2022	08/12/2022	08/12/2022	08/12/2022
A-T-042sFCN	05/12/2022	05/12/2022	05/12/2022	05/12/2022	05/12/2022	05/12/2022	05/12/2022	05/12/2022	05/12/2022	05/12/2022
A-T-044	08/12/2022	08/12/2022	08/12/2022	08/12/2022	08/12/2022	08/12/2022	08/12/2022	08/12/2022	08/12/2022	08/12/2022
A-T-045	06/12/2022	06/12/2022	06/12/2022	06/12/2022	06/12/2022	06/12/2022	06/12/2022	06/12/2022	06/12/2022	06/12/2022
A-T-050s	07/12/2022	07/12/2022	07/12/2022	07/12/2022	07/12/2022	07/12/2022	07/12/2022	07/12/2022	07/12/2022	07/12/2022
A-T-055s	06/12/2022	06/12/2022	06/12/2022	06/12/2022	06/12/2022	06/12/2022	06/12/2022	06/12/2022	06/12/2022	06/12/2022
Calc-As Recd	06/12/2022	06/12/2022	06/12/2022	06/12/2022	06/12/2022	06/12/2022	06/12/2022	06/12/2022	06/12/2022	06/12/2022

The above dates are the analysis completion dates, please note that these are not necessarily the date that the analysis was weighed/extracted.

End of Report

APPENDIX 6: GEOTECHNICAL TEST CERTIFICATES

4041

Client: Ground Condition Consultants
Client Address: 10 Waldegrave Close, Southampton,
S019 9RY

Contact: Antony Platt
Site Address: Home Farm

Client Reference: J22 077
Job Number: 22-11751
Date Sampled: Not Given
Date Received: 30/11/2022
Date Tested: 14/12/2022
Sampled By: Not Given

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

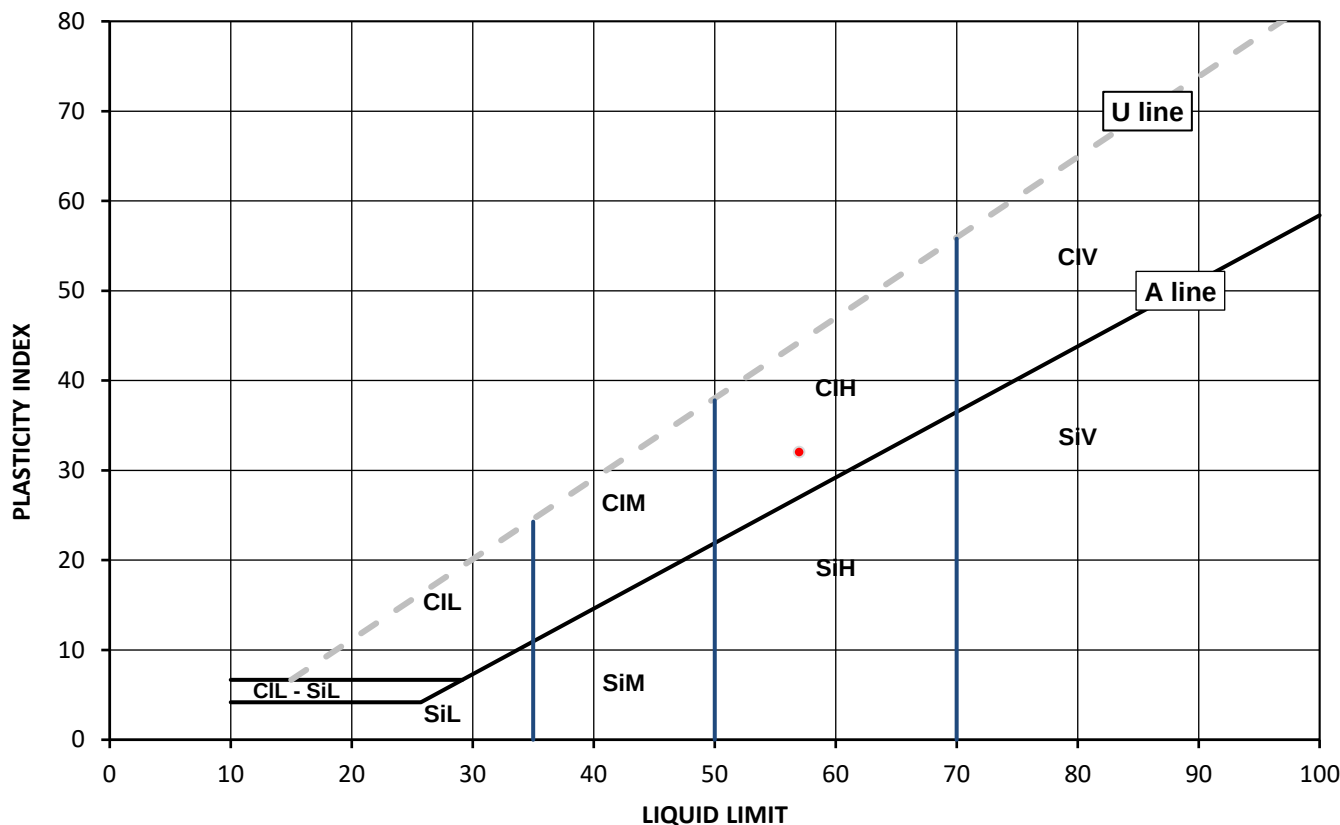
Test Results:

Laboratory Reference: 2523933
Hole No.: WS104
Sample Reference: Not Given
Sample Description: Yellowish brown slightly gravelly slightly sandy CLAY

Depth Top [m]: 2.50
Depth Base [m]: 3.00
Sample Type: U

Sample Preparation: Tested after >425um removed by hand

As Received Water Content [W] %	Liquid Limit [WL] %	Plastic Limit [Wp] %	Plasticity Index [Ip] %	% Passing 425µm BS Test Sieve
30	57	25	32	99



Legend, based on BS EN ISO 14688 2:2018 Geotechnical investigation and testing – Identification and classification of soil

	Plasticity	Liquid Limit
Cl Clay	L Low	below 35
Si Silt	M Medium	35 to 50
	H High	50 to 70
	V Very high	exceeding 70
	O Organic	append to classification for organic material (eg CIHO)

Note: Water Content by BS 1377-2: 1990: Clause 3.2

Remarks:

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Anna Dudzinska
PL Deputy Head of Reporting Team
for and on behalf of i2 Analytical Ltd

Date Reported: 21/12/2022

GF 232.12



4041

Client: Ground Condition Consultants

Client Address: 10 Waldegrave Close, Southampton,
S019 9RY

Contact: Antony Platt

Site Address: Home Farm

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

SUMMARY REPORT

DETERMINATION OF WATER CONTENT

Tested in Accordance with: BS 1377-2: 1990: Clause 3.2

i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB



Environmental Science

Client Reference: J22 077

Job Number: 22-11751

Date Sampled: Not Given

Date Received: 30/11/2022

Date Tested: 13/12 - 14/12/2022

Sampled By: Not Given

Test results

Laboratory Reference	Hole No.	Sample				Description	Remarks	WC	Sample preparation / Oven temperature at the time of testing			
		Reference	Depth Top m	Depth Base m	Type							
2523929	WS101	Not Given	2.00	Not Given	D	Brown CLAY		27	Sample was quartered, oven dried at 106.2 °C			
2523933	WS104	Not Given	2.50	3.00	U	Yellowish brown slightly gravelly slightly sandy CLAY		30	Sample was quartered, oven dried at 106.2 °C			

Comments:

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Pa

Anna Dudzinska
PL Deputy Head of Reporting Team
for and on behalf of i2 Analytical Ltd

Date Reported: 21/12/2022

GF 099.16

TEST CERTIFICATE

DETERMINATION OF PARTICLE SIZE DISTRIBUTION

Tested in Accordance with: BS 1377-2: 1990

i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB

Client: Ground Condition Consultants
Client Address: 10 Waldegrave Close, Southampton,
SO19 9RY

Contact: Antony Platt
Site Address: Home Farm

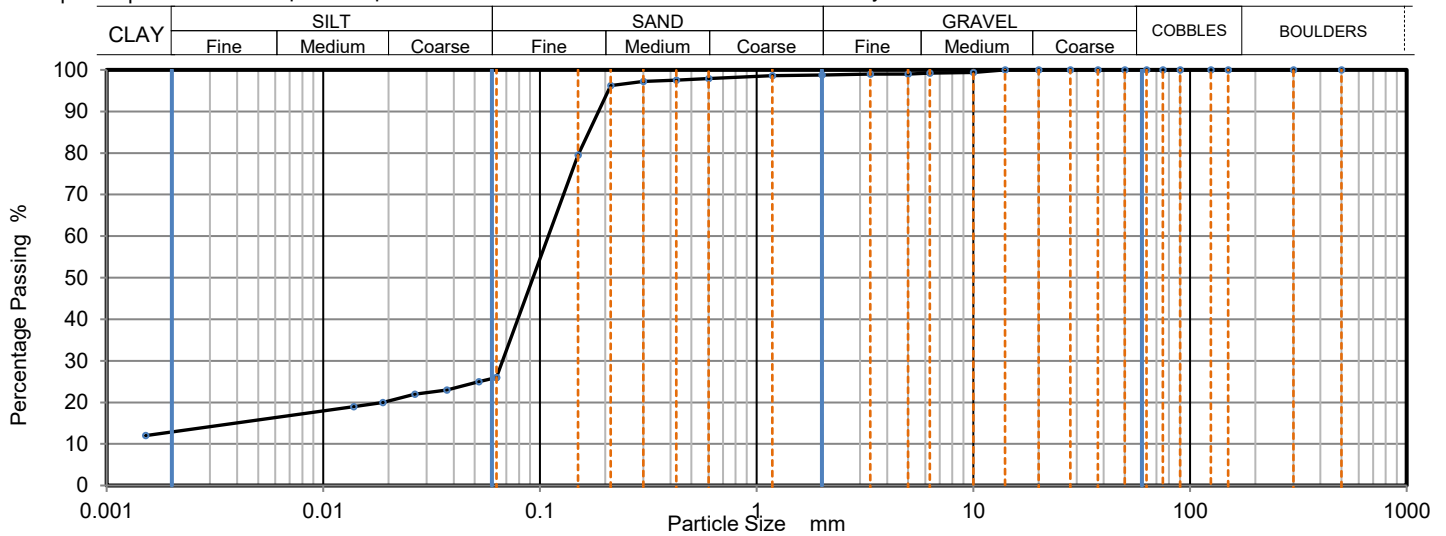
Client Reference: J22 077
Job Number: 22-11751
Date Sampled: Not Given
Date Received: 30/11/2022
Date Tested: 14/12/2022
Sampled By: Not Given

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

Test Results:

Laboratory Reference: 2523930
Hole No.: WS101
Sample Reference: Not Given
Sample Description: Yellowish brown clayey SAND
Sample Preparation: Sample was quartered, oven dried at 109.0 °C and broken down by hand.

Depth Top [m]: 3.00
Depth Base [m]: 3.50
Sample Type: B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
500	100	0.0630	26
300	100	0.0522	25
150	100	0.0371	23
125	100	0.0264	22
90	100	0.0188	20
75	100	0.0138	19
63	100	0.0105	18
50	100	0.0075	17
37.5	100	0.0060	16
28	100	0.0045	15
20	100	0.0030	14
14	100	0.0020	13
10	99	0.0015	12
6.3	99		
5	99		
3.35	99		
2	99		
1.18	99		
0.6	98		
0.425	98		
0.3	97		
0.212	96		
0.15	80		
0.063	26		

Sample Proportions	% dry mass
Very coarse	0
Gravel	1
Sand	72
Silt	14
Clay	13

Grading Analysis	
D100	mm
D60	mm
D30	mm
D10	mm
Uniformity Coefficient	> 72
Curvature Coefficient	

Uniformity Coefficient calculated in accordance with BS EN ISO 14688-2:2018

Note: Tested in Accordance with BS1377:Part 2:1990, clauses 9.2 and 9.5

Remarks:

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Anna Dudzinska
PL Deputy Head of Reporting Team
for and on behalf of i2 Analytical Ltd

Date Reported: 21/12/2022

GF 100.21

TEST CERTIFICATE

DETERMINATION OF PARTICLE SIZE DISTRIBUTION

Tested in Accordance with: BS 1377-2: 1990

i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB

Client: Ground Condition Consultants
Client Address: 10 Waldegrave Close, Southampton,
S019 9RY

Contact: Antony Platt
Site Address: Home Farm

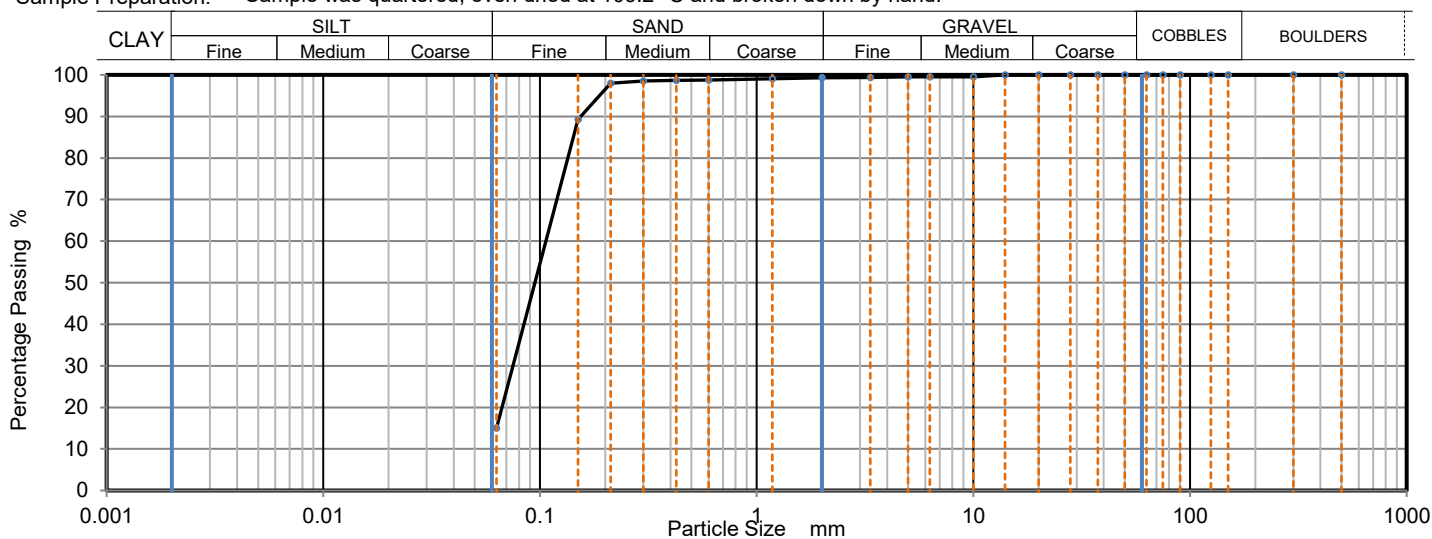
Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

Client Reference: J22 077
Job Number: 22-11751
Date Sampled: Not Given
Date Received: 30/11/2022
Date Tested: 14/12/2022
Sampled By: Not Given

Test Results:

Laboratory Reference: 2523931
Hole No.: WS102
Sample Reference: Not Given
Sample Description: Yellowish brown clayey SAND
Sample Preparation: Sample was quartered, oven dried at 106.2 °C and broken down by hand.

Depth Top [m]: 2.00
Depth Base [m]: 2.60
Sample Type: B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
500	100		
300	100		
150	100		
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	99		
2	99		
1.18	99		
0.6	99		
0.425	99		
0.3	99		
0.212	98		
0.15	89		
0.063	16		

Sample Proportions	% dry mass
Very coarse	0
Gravel	1
Sand	84
Fines <0.063mm	16

Grading Analysis	
D100	mm
D60	mm
D30	mm
D10	mm
Uniformity Coefficient	> 1.7
Curvature Coefficient	

Uniformity Coefficient calculated in accordance with BS EN ISO 14688-2:2018

Note: Tested in Accordance with BS1377:Part 2:1990, clause 9.2

Remarks:

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Anna Dudzinska
PL Deputy Head of Reporting Team
for and on behalf of i2 Analytical Ltd

Date Reported: 21/12/2022

GF 100.21

TEST CERTIFICATE

DETERMINATION OF PARTICLE SIZE DISTRIBUTION

Tested in Accordance with: BS 1377-2: 1990

i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB

Client: Ground Condition Consultants
Client Address: 10 Waldegrave Close, Southampton,
SO19 9RY

Contact: Antony Platt
Site Address: Home Farm

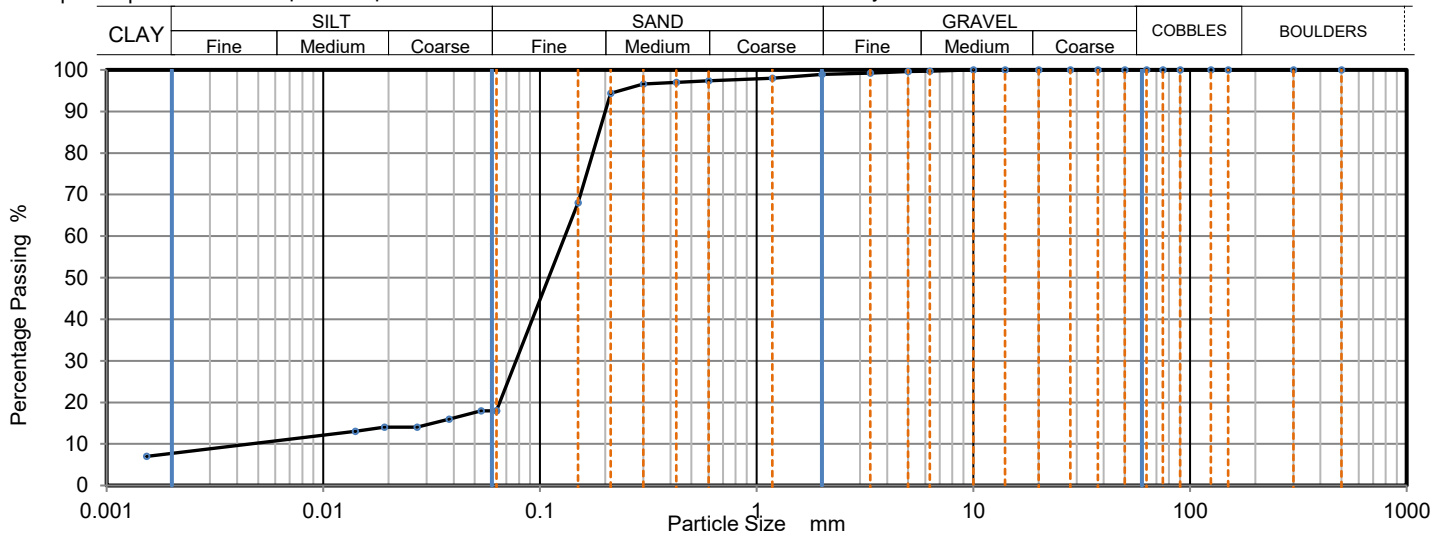
Client Reference: J22 077
Job Number: 22-11751
Date Sampled: Not Given
Date Received: 30/11/2022
Date Tested: 14/12/2022
Sampled By: Not Given

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

Test Results:

Laboratory Reference: 2523932
Hole No.: WS103
Sample Reference: Not Given
Sample Description: Yellowish brown clayey SAND
Sample Preparation: Sample was quartered, oven dried at 106.1 °C and broken down by hand.

Depth Top [m]: 2.70
Depth Base [m]: 4.00
Sample Type: B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
500	100	0.0630	18
300	100	0.0535	18
150	100	0.0380	16
125	100	0.0270	14
90	100	0.0191	14
75	100	0.0140	13
63	100	0.0015	7
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	99	Particle density (assumed) 2.65 Mg/m3	
2	99		
1.18	98		
0.6	97		
0.425	97		
0.3	97		
0.212	94		
0.15	68		
0.063	18		

Sample Proportions	% dry mass
Very coarse	0
Gravel	1
Sand	81
Silt	10
Clay	8

Grading Analysis	
D100	mm
D60	mm
D30	mm
D10	mm
Uniformity Coefficient	26
Curvature Coefficient	9.4

Uniformity Coefficient calculated in accordance with BS EN ISO 14688-2:2018

Note: Tested in Accordance with BS1377:Part 2:1990, clauses 9.2 and 9.5

Remarks:

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Anna Dudzinska
PL Deputy Head of Reporting Team
for and on behalf of i2 Analytical Ltd

Date Reported: 21/12/2022

GF 100.21

TEST CERTIFICATE

DETERMINATION OF PARTICLE SIZE DISTRIBUTION

Tested in Accordance with: BS 1377-2: 1990

i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB

Client: Ground Condition Consultants
Client Address: 10 Waldegrave Close, Southampton,
S019 9RY

Contact: Antony Platt
Site Address: Home Farm

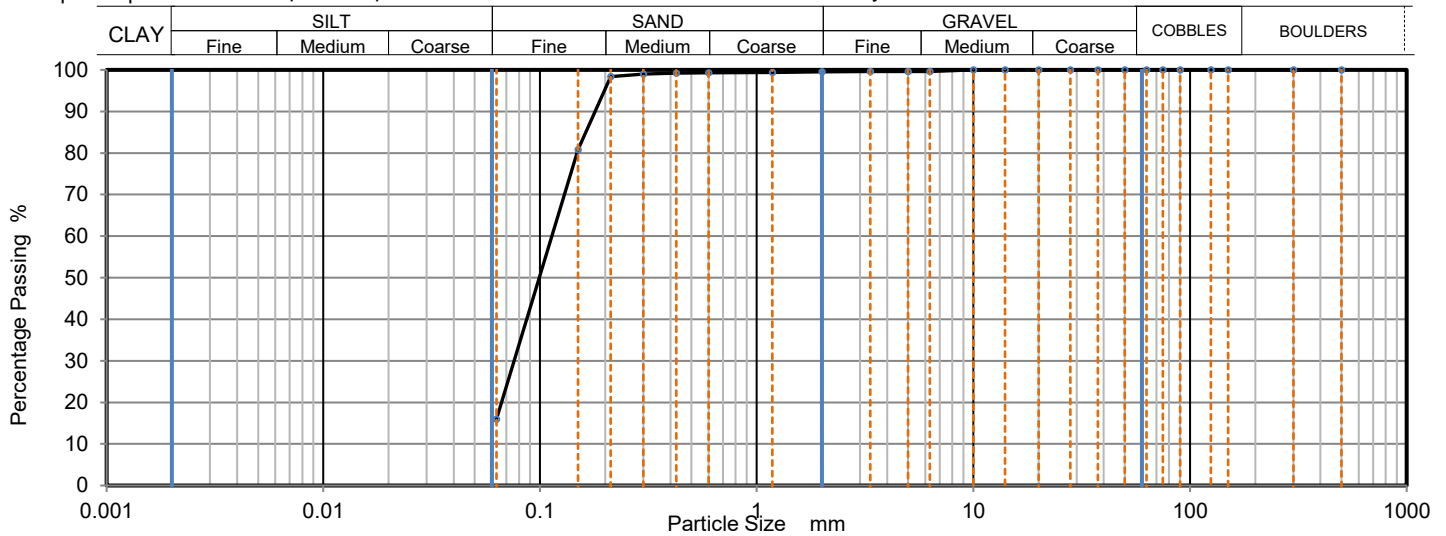
Client Reference: J22 077
Job Number: 22-11751
Date Sampled: Not Given
Date Received: 30/11/2022
Date Tested: 14/12/2022
Sampled By: Not Given

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

Test Results:

Laboratory Reference: 2523934
Hole No.: WS104
Sample Reference: Not Given
Sample Description: Yellowish brown clayey SAND
Sample Preparation: Sample was quartered, oven dried at 109.0 °C and broken down by hand.

Depth Top [m]: 3.00
Depth Base [m]: 4.00
Sample Type: B



TEST CERTIFICATE

DETERMINATION OF PARTICLE SIZE DISTRIBUTION

Tested in Accordance with: BS 1377-2: 1990

i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB

Client: Ground Condition Consultants
Client Address: 10 Waldegrave Close, Southampton,
SO19 9RY

Contact: Antony Platt
Site Address: Home Farm

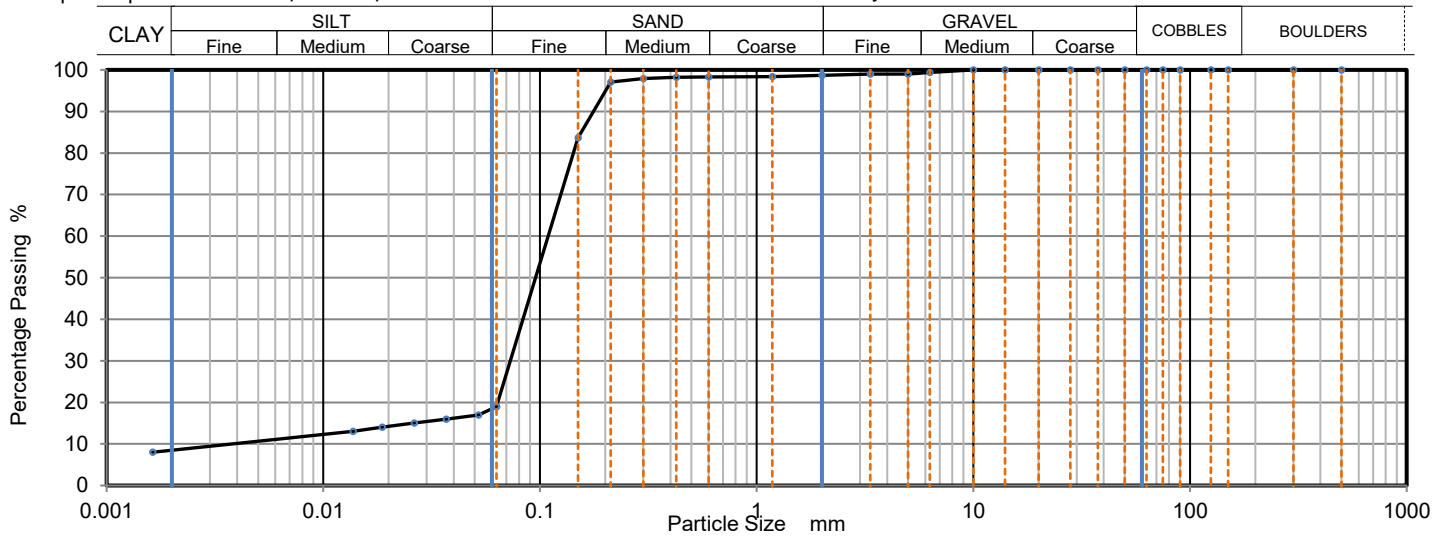
Client Reference: J22 077
Job Number: 22-11751
Date Sampled: Not Given
Date Received: 30/11/2022
Date Tested: 13/12/2022
Sampled By: Not Given

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

Test Results:

Laboratory Reference: 2523935
Hole No.: WS105
Sample Reference: Not Given
Sample Description: Light brown clayey SAND
Sample Preparation: Sample was quartered, oven dried at 108.7 °C and broken down by hand.

Depth Top [m]: 2.00
Depth Base [m]: Not Given
Sample Type: D



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
500	100	0.0630	19
300	100	0.0519	17
150	100	0.0369	16
125	100	0.0263	15
90	100	0.0187	14
75	100	0.0137	13
63	100	0.0106	12
50	100	0.0075	11
37.5	100	0.0060	10
28	100	0.00475	9
20	100	0.00375	8
14	100	0.0025	7
10	100	0.0016	6
6.3	99		
5	99		
3.35	99		
2	99		
1.18	98		
0.6	98		
0.425	98		
0.3	98		
0.212	97		
0.15	84		
0.063	19		

Sample Proportions	% dry mass
Very coarse	0
Gravel	1
Sand	80
Silt	10
Clay	9

Grading Analysis	
D100	mm
D60	mm
D30	mm
D10	mm
Uniformity Coefficient	
Curvature Coefficient	

Uniformity Coefficient calculated in accordance with BS EN ISO 14688-2:2018

Note: Tested in Accordance with BS1377:Part 2:1990, clauses 9.2 and 9.5

Remarks:

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Anna Dudzinska
PL Deputy Head of Reporting Team
for and on behalf of i2 Analytical Ltd

Date Reported: 21/12/2022

GF 100.21

TEST CERTIFICATE

DETERMINATION OF THE UNDRAINED SHEAR STRENGTH IN TRIAXIAL COMPRESSION WITHOUT MEASUREMENT OF PORE PRESSURE

i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB

Tested in Accordance with: BS 1377-7: 1990: Clause 8

Client: Ground Condition Consultants
Client Address: 10 Waldegrave Close, Southampton,
S019 9RY

Contact: Antony Platt
Site Address: Home Farm

Client Reference: J22 077
Job Number: 22-11751
Date Sampled: Not Given
Date Received: 30/11/2022
Date Tested: 14/12/2022
Sampled By: Not Given

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

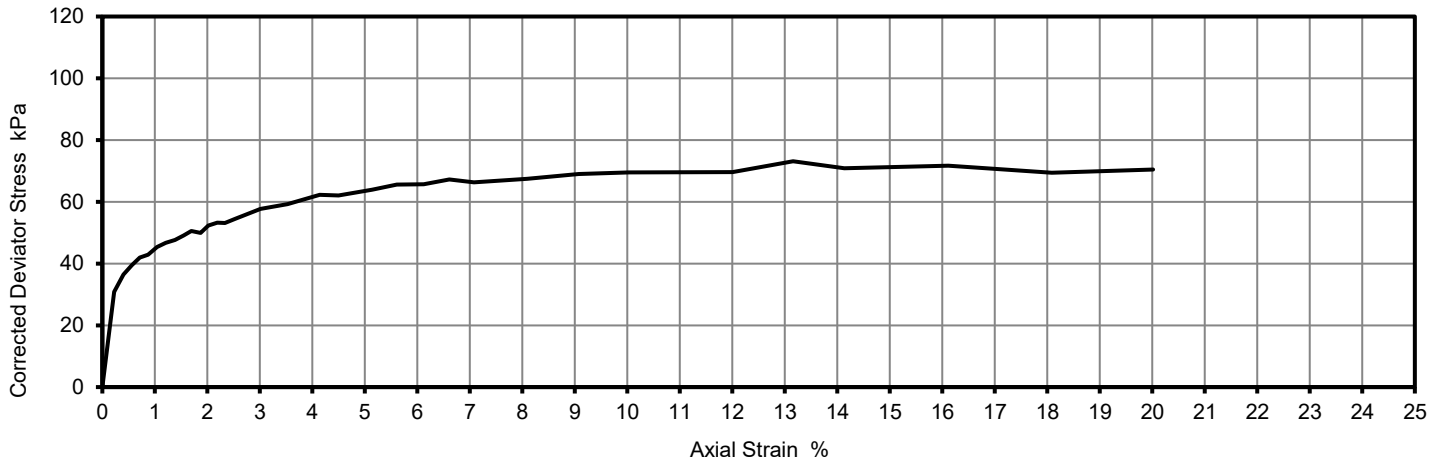
Test Results:

Laboratory Reference: 2523933
Hole No.: WS104
Sample Reference: Not Given
Sample Description: Yellowish brown slightly gravelly slightly sandy CLAY
Sample Preparation: Sample prepared in accordance with BS 1377-1:2016 Clause 9.1.1.

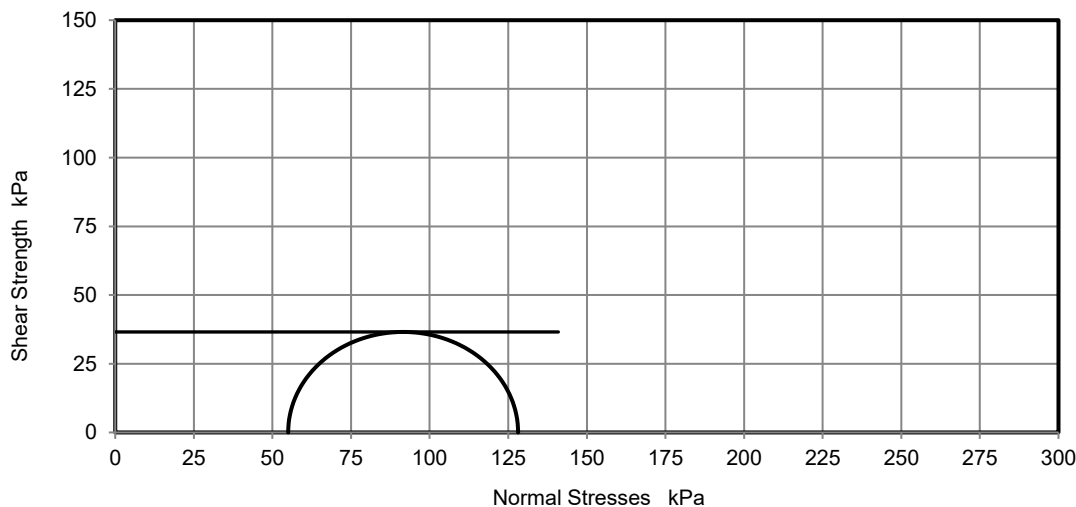
Depth Top [m]: 2.50
Depth Base [m]: 3.00
Sample Type: U

Test Number	1	Rate of Strain	2.00	%/min
Length	101.98	Cell Pressure	55	kPa
Diameter	49.67	Axial Strain at failure	13.2	%
Bulk Density	1.88	Deviator Stress, ($\sigma_1 - \sigma_3$) _f	73	kPa
Moisture Content	30	Undrained Shear Strength, c_u	37	kPa $\frac{1}{2}(\sigma_1 - \sigma_3)_f$
Dry Density	1.44	Mode of Failure	Compound	
Membrane Correction	1.27	Membrane thickness	0.23	mm

Deviator Stress v Axial Strain



Mohr Circles



Position within sample



Note: Deviator stress corrected for area change and membrane effects. Mohr circles and their interpretation is not covered by BS1377.
This is provided for information only.

Remarks:

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Anna Dudzinska
PL Deputy Head of Reporting Team
for and on behalf of i2 Analytical Ltd

Date Reported: 21/12/2022

GF 184.12

Antony Platt
Ground Condition Consultants
10 Waldegrave Close
Southampton
SO19 9RY

e: aplatt@groundcc.com

i2 Analytical Ltd.
7 Woodshots Meadow,
Croxley Green
Business Park,
Watford,
Herts,
WD18 8YS

t: 01923 225404
f: 01923 237404
e: reception@i2analytical.com

Analytical Report Number : 22-11752

Project / Site name:	Home Farm	Samples received on:	30/11/2022
Your job number:	J22 077	Samples instructed on/ Analysis started on:	06/12/2022
Your order number:		Analysis completed by:	16/12/2022
Report Issue Number:	1	Report issued on:	19/12/2022
Samples Analysed:	5 soil samples		

Signed:

Anna Goc
Junior Reporting Specialist
For & on behalf of i2 Analytical Ltd.

Standard Geotechnical, Asbestos and Chemical Testing Laboratory located at: ul. Pionierów 39, 41 -711 Ruda Śląska, Poland.

Accredited tests are defined within the report, opinions and interpretations expressed herein are outside the scope of accreditation.

Standard sample disposal times, unless otherwise agreed with the laboratory, are :

soils	- 4 weeks from reporting
leachates	- 2 weeks from reporting
waters	- 2 weeks from reporting
asbestos	- 6 months from reporting

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Any assessments of compliance with specifications are based on actual analytical results with no contribution from uncertainty of measurement. Application of uncertainty of measurement would provide a range within which the true result lies. An estimate of measurement uncertainty can be provided on request.

Analytical Report Number: 22-11752
Project / Site name: Home Farm

Lab Sample Number				2523936	2523937	2523938	2523939	2523940
Sample Reference				WS101	WS101	WS102	WS103	WS104
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.50-1.00	2.00	1.00	2.70-4.00	1.00
Date Sampled				Deviating	Deviating	Deviating	Deviating	Deviating
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
Stone Content	%	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Moisture Content	%	0.01	NONE	19	18	20	11	19
Total mass of sample received	kg	0.001	NONE	0.4	0.2	0.4	0.4	0.4

General Inorganics

pH - Automated	pH Units	N/A	MCERTS	7.2	5.2	5.3	6.1	7.9
Total Sulphate as SO ₄	%	0.005	MCERTS	-	0.025	0.034	-	-
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.14	0.012	0.015	0.0075	0.053
Water Soluble Chloride (2:1) (leachate equivalent)	mg/l	0.5	MCERTS	-	2.9	4.2	-	-
Total Sulphur	%	0.005	MCERTS	-	0.013	0.017	-	-
Water Soluble Nitrate (2:1) as N (leachate equivalent)	mg/l	2	NONE	-	< 2.0	< 2.0	-	-

Heavy Metals / Metalloids

Magnesium (water soluble)	mg/kg	5	NONE	-	40	16	-	-
Magnesium (leachate equivalent)	mg/l	2.5	NONE	-	20	7.8	-	-

U/S = Unsuitable Sample I/S = Insufficient Sample ND = Not detected

Analytical Report Number : 22-11752

Project / Site name: Home Farm

* These descriptions are only intended to act as a cross check if sample identities are questioned. The major constituent of the sample is intended to act with respect to MCERTS validation. The laboratory is accredited for sand, clay and loam (MCERTS) soil types. Data for unaccredited types of solid should be interpreted with care.

Stone content of a sample is calculated as the % weight of the stones not passing a 10 mm sieve. Results are not corrected for stone content.

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
2523936	WS101	None Supplied	0.50-1.00	Brown clay and sand with gravel and vegetation.
2523937	WS101	None Supplied	2	Brown clay and sand.
2523938	WS102	None Supplied	1	Brown clay and sand with vegetation.
2523939	WS103	None Supplied	2.70-4.00	Brown sand.
2523940	WS104	None Supplied	1	Brown clay and sand with gravel.

Analytical Report Number : 22-11752

Project / Site name: Home Farm

Water matrix abbreviations:

Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters (PrW) Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Sulphate, water soluble, in soil (16hr extraction)	Determination of water soluble sulphate by ICP-OES. Results reported directly (leachate equivalent) and corrected for extraction ratio (soil equivalent).	In house method.	L038-PL	D	MCERTS
Magnesium, water soluble, in soil	Determination of water soluble magnesium by extraction with water followed by ICP-OES.	In-house method based on TRL 447	L038-PL	D	NONE
Moisture Content	Moisture content, determined gravimetrically. (30 oC)	In house method.	L019-UK/PL	W	NONE
pH in soil (automated)	Determination of pH in soil by addition of water followed by automated electrometric measurement.	In house method.	L099-PL	D	MCERTS
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight.	In-house method based on British Standard Methods and MCERTS requirements.	L019-UK/PL	D	NONE
Total Sulphate in soil as %	Determination of total sulphate in soil by extraction with 10% HCl followed by ICP-OES.	In house method.	L038-PL	D	MCERTS
Total Sulphur in soil as %	Determination of total sulphur in soil by extraction with aqua-regia, potassium bromide/bromate followed by ICP-OES.	In house method.	L038-PL	D	MCERTS
Water Soluble Nitrate (2:1) as N in soil	Determination of nitrate by reaction with sodium salicylate and colorimetry.	In-house method based on Examination of Water and Wastewater & Polish Standard Method PN-82/C-04579.08, 2:1 extraction.	L078-PL	W	NONE
Chloride, water soluble, in soil	Determination of Chloride colorimetrically by discrete analyser.	In house method.	L082-PL	D	MCERTS

For method numbers ending in 'UK or A' analysis have been carried out in our laboratory in the United Kingdom (WATFORD).

For method numbers ending in 'F' analysis have been carried out in our laboratory in the United Kingdom (East Kilbride).

For method numbers ending in 'PL or B' analysis have been carried out in our laboratory in Poland.

Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.

Unless otherwise indicated, site information, order number, project number, sampling date, time, sample reference and depth are provided by the client. The instructed on date indicates the date on which this information was provided to the laboratory.

Analytical Report Number : 22-11752

Project / Site name: Home Farm

This deviation report indicates the sample and test deviations that apply to the samples submitted for analysis. Please note that the associated result(s) may be unreliable and should be interpreted with care.

Key: a - No sampling date b - Incorrect container c - Holding time d - Headspace e - Temperature

Sample ID	Other ID	Sample Type	Lab Sample Number	Sample Deviation	Test Name	Test Ref	Test Deviation
WS101	None Supplied	S	2523936	a	None Supplied	None Supplied	None Supplied
WS101	None Supplied	S	2523937	a	None Supplied	None Supplied	None Supplied
WS102	None Supplied	S	2523938	a	None Supplied	None Supplied	None Supplied
WS103	None Supplied	S	2523939	a	None Supplied	None Supplied	None Supplied
WS104	None Supplied	S	2523940	a	None Supplied	None Supplied	None Supplied

APPENDIX 7: GEOTECHNICAL CALCULATIONS

Project Title:		Home Farm		
Shallow Foundation		Trench Fill		
Determination of Bearing Resistance		Calcs by	DF	
Coarse-Grained Wittering Formation				
Design Approach 1		Characteristic Geotechnical Parameters		
Combination 1 A1 + M1 + R1		Unit Weight	18	
		Shearing Resistance	36	
		Cohesion	0	
<u>Material Properties and Resistance</u>		Foundation Size		
Partial factors set M1: $\gamma_\phi = 1$ and $\gamma_c = 1$		depth	1	
		breadth	0.6	
		length	10	
Design shearing resistance is $\phi_d = \tan^{-1}\left(\frac{\tan \phi_K}{\gamma_\phi}\right) = 36$				
Design cohesion is $c'_d = \frac{c_k}{\gamma_c} = 0$				
<u>Bearing Capacity Factors</u>				
For overburden $N_q = \left[e^{(\pi \times \tan(\phi_d))} \times \left(\tan\left(45 + \frac{\phi_d}{2}\right) \right)^2 \right] = 37.7$				
For cohesion $N_c = [(N_q - 1) \times \cot(\phi_d)] = 50.5$				
For self-weight $N_\gamma = [2(N_q - 1) \times \tan(\phi_d)] = 53.3$				
<u>Shape Factors</u>				
For overburden $s_q = \left[1 + \left(\frac{B}{L} \right) \times \sin(\phi_d) \right] = 1.04$				
For cohesion $s_c = \frac{(s_q \times N_q - 1)}{(N_q - 1)} = 1.04$				
For self weight $s_\gamma = 1 - 0.3 \times \left(\frac{B}{L} \right) = 0.982$				
<u>Bearing Resistance</u>				
Total overburden at foundation base is $\sigma_{vk,b} = \gamma_k \times d = 18$				
Partial factors set R1: $\gamma_{Rv} = 1$				
From overburden $q_{ult_1} = N_q \times s_q \times \sigma_{vk,b} = 703$				
From cohesion $q_{ult_2} = N_c \times s_c \times c_d = 0$				

Project Title:		Home Farm		
Shallow Foundation		Trench Fill		
Determination of Bearing Resistance		Calcs by	DF	
From self-weight	$q_{ult_3} = \left(N_\gamma \times s_\gamma \times \gamma_k \times \frac{B}{2} \right) =$		283	
Total resistance is	$q_{ult} = \sum_{i=1}^3 q_{ult} =$		986	
Design resistance is	$q_{Rd} = \frac{q_{ult}}{\gamma_{Rv}} =$		986	
<u>Design Approach 1</u>				
Combination 2 A2 + M2 + R1				
<u>Material Properties and Resistance</u>				
Partial factors set M2: $\gamma_\phi = 1.25$ and $\gamma_c = 1.25$				
Design shearing resistance is	$\phi_d = \tan^{-1} \left(\frac{\tan \phi_K}{\gamma_\phi} \right) =$		30.2	
Design cohesion is	$c'_d = \frac{c_k}{\gamma_c} =$		0	
<u>Bearing Capacity Factors</u>				
For overburden	$N_q = \left[e^{(\pi \times \tan(\phi_d))} \times \left(\tan \left(45 + \frac{\phi_d}{2} \right) \right)^2 \right] =$		18.7	
For cohesion	$N_c = [(N_q - 1) \times \cot(\phi_d)] =$		30.5	
For self-weight	$N_\gamma = [2(N_q - 1) \times \tan(\phi_d)] =$		20.6	
<u>Shape Factors</u>				
For overburden	$s_q = \left[1 + \left(\frac{B}{L} \right) \times \sin(\phi_d) \right] =$		1.03	
For cohesion	$s_c = \frac{(s_q \times N_q - 1)}{(N_q - 1)} =$		1.03	
For self weight	$s_\gamma = 1 - 0.3 \times \left(\frac{B}{L} \right) =$		0.982	

Project Title:		Home Farm		
Shallow Foundation		Trench Fill		
Determination of Bearing Resistance		Calcs by	DF	
<u>Bearing Resistance</u>				
Total overburden at foundation base is $\sigma_{vk,b} = \gamma_k \times d = 18$				
Partial factors set R1: $\gamma_{Rv} = 1$				
From overburden $q_{ult_1} = N_q \times s_q \times \sigma_{vk,b} = 347$				
From cohesion $q_{ult_2} = N_c \times s_c \times c_d = 0$				
From self-weight $q_{ult_3} = \left(N_\gamma \times s_\gamma \times \gamma_k \times \frac{B}{2} \right) = 109$				
Total resistance is $q_{ult} = \sum_{i=1}^3 q_{ult_i} = 457$				
Design resistance is $q_{Rd} = \frac{q_{ult}}{\gamma_{Rv}} = 457$				

APPENDIX 8: GROUNDWATER AND GROUND GAS MONITORING RESULTS

GROUND GAS AND GROUNDWATER MONITORING RESULTS



SITE/REF: Home Farm						General Site comments	
DATE: 29/11/2022		1... of1...					
OPERATOR(S): DP							
Ambient Conditions:		Barometric Pressure (mb)	CH ₄ (%v/v)	CO ₂ (%v/v)	O ₂ (%v/v)		PID (ppm)
Before Monitoring							EQUIPMENT
After Monitoring							
Atmospheric Pressure Trend:							
Ground Conditions:		Dip metre					
Weather Conditions:							

Ground Gas Note: "0" readings to be recorded as instrument detection limit

Borehole ID	Time	Flow (l/hr)	Relative Pressure (mb)	Steady CH ₄ (%v/v)	CO ₂ (%v/v)	O ₂ (%v/v)	Peak CH ₄ (%v/v)	% of Lower Explosive Limit	CO (ppm)	H ₂ S (ppm)	Balance (%)	PID (ppm)	Response Zone		Response Strata	Gas screening value CH ₄	Gas screening value CO ₂
													From (mbgl)	To (mbgl)			

Groundwater

Borehole ID	Standing Water Level (mbgl)	Installation Base Dip (mbgl)	Free Phase LNAPL Thickness (m)	Free Phase DNAPL Thickness (m)	Water Quality Indicators					Well Volume (l)	Purge Volume (l)	Comments (samples)
					Eh	EC	pH	DO	Temp			
WS101	Dry	5.18										
WS102	Dry	3.18										
WS103	Dry	5.29										
WS104	4.16	4.19										
WS105	Dry	3.53										

Well volume (l) = (3.14 x (hole diameter (m)/2)² x (base dip (m) - standing water level (m)))x1000 (2l/m in 50mm well) Gas screening value = gas concentration (%) x gas flow rate (l/hr)

%v/v - Percentage volume by total volume; mbgl - metres below ground level; ppm - parts per million; mb - milibars; l/hr - litres per hour; wv - water vial; gb - 1l glass bottle; pb - 1l plastic bottle

GROUND GAS AND GROUNDWATER MONITORING RESULTS



SITE/REF: Home Farm						General Site comments	
DATE: 06/12/2022		1... of1...					
OPERATOR(S): RP							
Ambient Conditions:		Barometric Pressure (mb)	CH ₄ (%v/v)	CO ₂ (%v/v)	O ₂ (%v/v)		PID (ppm)
Before Monitoring							EQUIPMENT
After Monitoring							
Atmospheric Pressure Trend:							
Ground Conditions:		Dip metre					
Weather Conditions:							

Ground Gas Note: "0" readings to be recorded as instrument detection limit

Borehole ID	Time	Flow (l/hr)	Relative Pressure (mb)	Steady CH ₄ (%v/v)	CO ₂ (%v/v)	O ₂ (%v/v)	Peak CH ₄ (%v/v)	% of Lower Explosive Limit	CO (ppm)	H ₂ S (ppm)	Balance (%)	PID (ppm)	Response Zone		Response Strata	Gas screening value CH ₄	Gas screening value CO ₂
													From (mbgl)	To (mbgl)			

Groundwater

Borehole ID	Standing Water Level (mbgl)	Installation Base Dip (mbgl)	Free Phase LNAPL Thickness (m)	Free Phase DNAPL Thickness (m)	Water Quality Indicators					Well Volume (l)	Purge Volume (l)	Comments (samples)
					Eh	EC	pH	DO	Temp			
WS101	Dry	5.18										
WS102	Dry	3.18										
WS103	Dry	5.29										
WS104	4.16	4.19										
WS105	Dry	3.53										

Well volume (l) = (3.14 x (hole diameter (m)/2)² x (base dip (m) - standing water level (m)))x1000 (2l/m in 50mm well) Gas screening value = gas concentration (%) x gas flow rate (l/hr)

%v/v - Percentage volume by total volume; mbgl - metres below ground level; ppm - parts per million; mb - milibars; l/hr - litres per hour; wv - water vial; gb - 1l glass bottle; pb - 1l plastic bottle

GROUND GAS AND GROUNDWATER MONITORING RESULTS



SITE/REF: Home Farm						General Site comments MG - Made Ground WF - Wittering Formation			
DATE: 14/12/2022		1... of1...							
OPERATOR(S): DP									
Ambient Conditions:		Barometric Pressure (mb)	CH ₄ (%v/v)	CO ₂ (%v/v)	O ₂ (%v/v)				PID (ppm)
Before Monitoring		1000	0.0	0.0	20.1				
After Monitoring									
Atmospheric Pressure Trend:							EQUIPMENT		
Ground Conditions:		Firm, frozen, locally slightly soft					Instrument / Model Type		
Weather Conditions:		very cold but clear					Serial Number		
							Comments		
							Dip metre		

Ground Gas Note: "0" readings to be recorded as instrument detection limit

Borehole ID	Time	Flow (l/hr)	Relative Pressure (mb)	Steady CH ₄ (%v/v)	CO ₂ (%v/v)	O ₂ (%v/v)	Peak CH ₄ (%v/v)	% of Lower Explosive Limit	CO (ppm)	H ₂ S (ppm)	Balance (%)	PID (ppm)	Response Zone		Response Strata	Gas screening value CH ₄	Gas screening value CO ₂
													From (mbgl)	To (mbgl)			
WS101		0.0		0.0	0.3	19.8	0.0			0	79.9		1.00	5.20	MG,WF	0.0001	0.0003
WS102		0.0		0.0	2.4	19.0	0.0			0	78.6		1.00	3.20	MG,WF	0.0001	0.0024
WS103		0.0		0.0	0.7	19.8	0.0			0	79.5		1.00	5.30	MG,WF	0.0001	0.0007
WS104		0.0		0.0	2.2	18.1	0.0			0	79.7		1.00	4.20	MG,WF	0.0001	0.0022
WS105		0.1		0.0	3.6	17.5	0.0			0	79.0		1.00	3.60	MG,WF	0.0001	0.0036

Groundwater

Borehole ID	Standing Water Level (mbgl)	Installation Base Dip (mbgl)	Free Phase LNAPL Thickness (m)	Free Phase DNAPL Thickness (m)	Water Quality Indicators					Well Volume (l)	Purge Volume (l)	Comments (samples)
					Eh	EC	pH	DO	Temp			
WS101	Dry	5.18										
WS102	Dry	3.18										
WS103	Dry	5.29										
WS104	4.15	4.19										
WS105	Dry	3.53										

Well volume (l) = (3.14 x (hole diameter (m)/2)² x (base dip (m) - standing water level (m)))x1000 (2l/m in 50mm well)

Gas screening value = gas concentration (%) x gas flow rate (l/hr)

%v/v - Percentage volume by total volume; mbgl - metres below ground level; ppm - parts per million; mb - milibars; l/hr - litres per hour; wv - water vial; gb - 1l glass bottle; pb - 1l plastic bottle

GROUND GAS AND GROUNDWATER MONITORING RESULTS



SITE/REF: Home Farm						General Site comments MG - Made Ground WF - Wittering Formation			
DATE: 06/01/2023		1... of1...							
OPERATOR(S): RP									
Ambient Conditions:		Barometric Pressure (mb)	CH ₄ (%v/v)	CO ₂ (%v/v)	O ₂ (%v/v)	PID (ppm)			
Before Monitoring							EQUIPMENT		
After Monitoring									
Atmospheric Pressure Trend:									
Ground Conditions:		Firm, locally slightly soft					Dip metre		
Weather Conditions:									

Ground Gas Note: "0" readings to be recorded as instrument detection limit

Borehole ID	Time	Flow (l/hr)	Relative Pressure (mb)	Steady CH ₄ (%v/v)	CO ₂ (%v/v)	O ₂ (%v/v)	Peak CH ₄ (%v/v)	% of Lower Explosive Limit	CO (ppm)	H ₂ S (ppm)	Balance (%)	PID (ppm)	Response Zone		Response Strata	Gas screening value CH ₄	Gas screening value CO ₂
													From (mbgl)	To (mbgl)			

Groundwater

Borehole ID	Standing Water Level (mbgl)	Installation Base Dip (mbgl)	Free Phase LNAPL Thickness (m)	Free Phase DNAPL Thickness (m)	Water Quality Indicators					Well Volume (l)	Purge Volume (l)	Comments (samples)
					Eh	EC	pH	DO	Temp			
WS101	5.11	5.18										
WS102	1.6	3.18										
WS103	5.1	5.25										
WS104	2.01	4.16										
WS105	GL	3.53										

Well volume (l) = (3.14 x (hole diameter (m)/2)² x (base dip (m) - standing water level (m)))x1000 (2l/m in 50mm well) Gas screening value = gas concentration (%) x gas flow rate (l/hr)

%v/v - Percentage volume by total volume; mbgl - metres below ground level; ppm - parts per million; mb - milibars; l/hr - litres per hour; wv - water vial; gb - 1l glass bottle; pb - 1l plastic bottle

APPENDIX 9: TRRL PROBE WORKSHEETS

Estimated California Bearing Ratio - Derived using TRL (60° cone) in accordance with TRRL Road note 8

Site: Home Farm
Client: Wykeham Homes

GCC
 10 Waldegrave Close
 Southampton
 SO19 9RY

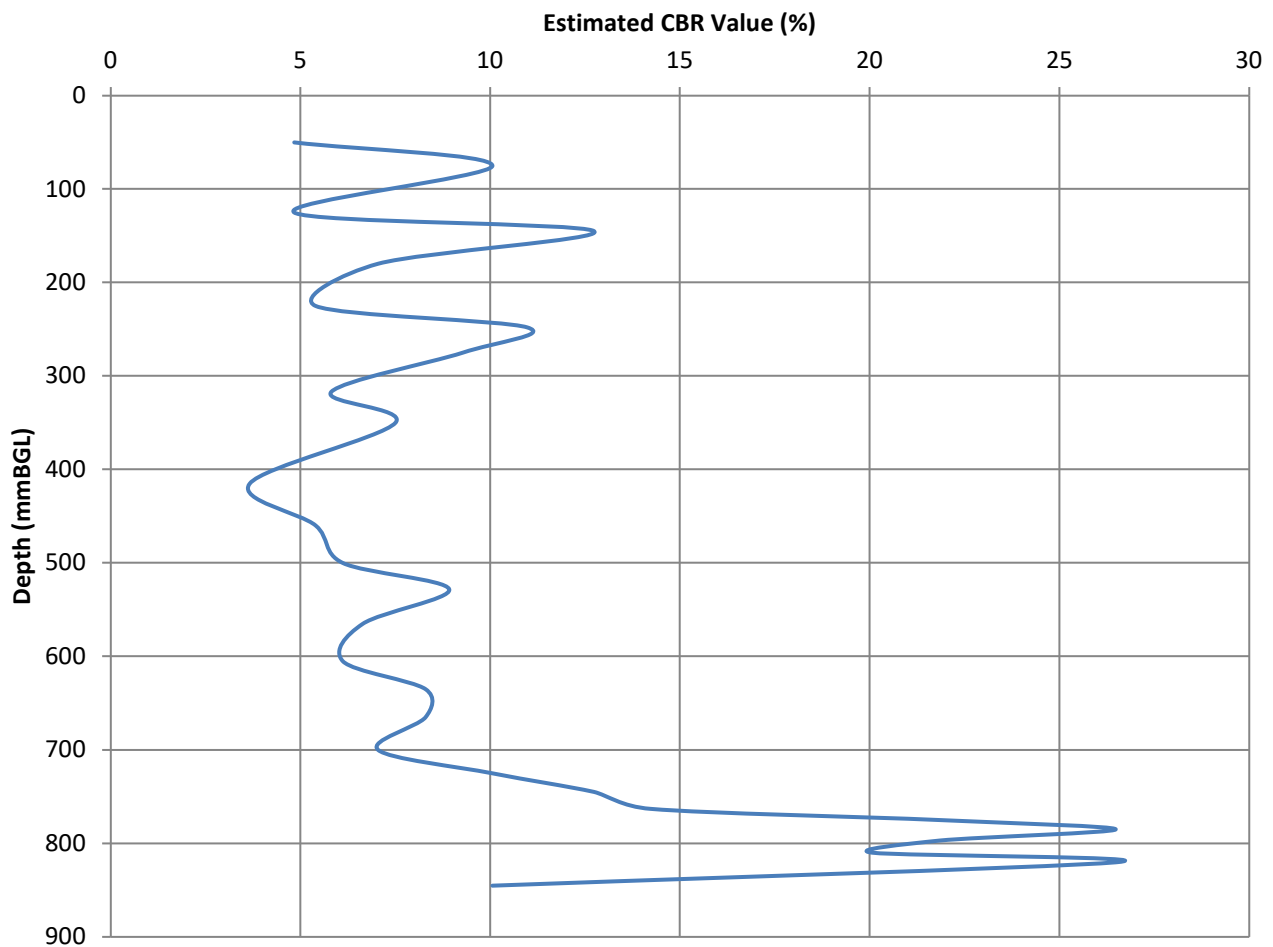


Project Number: J22-07
Location ID: CBR1

Date: 06/12/2022 **Engineer:** RP
Easting: **Northing:**

Initial Depth (mmBGL): 0
Final Depth (mmBGL): 845

Estimated California Bearing Ratio (%) against Depth (mmBGL)



Summary Table

Start Depth	Finish Depth (mmBGL)	No of Blows	Blows per Layer	mm/Blows	Average Estimated CBR (%)
0	400	10	10	40.00	6.12
400	600	15	5	40.00	6.12
600	845	28	13	18.85	13.55

Comments:

Checked By:
AP

Date:
06/12/2022

Approved By:
RP

Date:
06/12/2022

Estimated California Bearing Ratio - Derived using TRL (60° cone) in accordance with TRRL Road note 8

Site: Home Farm
Client: Wykeham Homes

GCC
 10 Waldegrave Close
 Southampton
 SO19 9RY

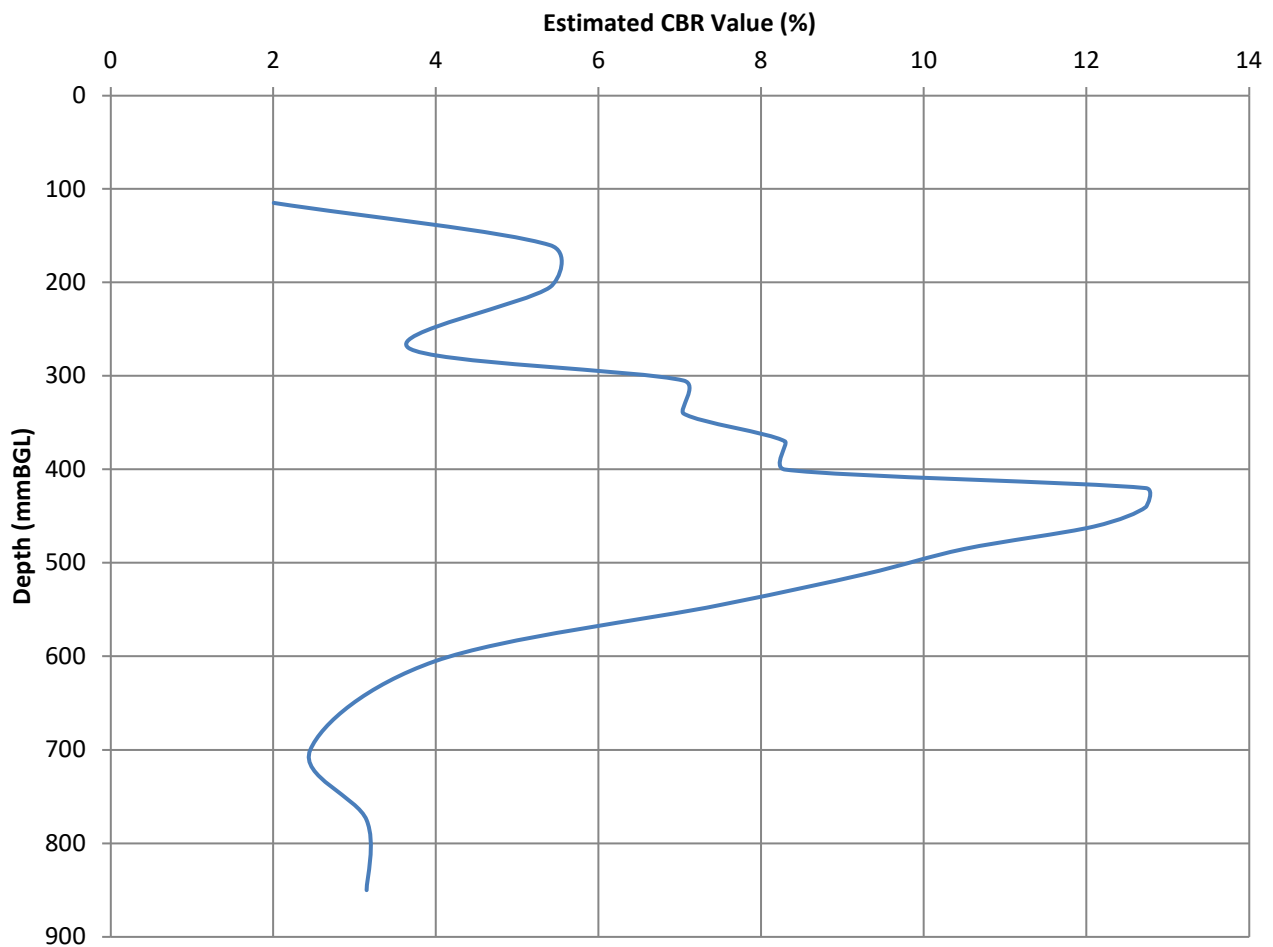


Project Number: J22-07
Location ID: CBR2

Date: 06/12/2022 **Engineer:** RP
Easting: **Northing:**

Initial Depth (mmBGL): 0
Final Depth (mmBGL): 850

Estimated California Bearing Ratio (%) against Depth (mmBGL)



Summary Table

Start Depth	Finish Depth (mmBGL)	No of Blows	Blows per Layer	mm/Blows	Average Estimated CBR (%)
0	400	8	8	50.00	4.83
400	600	14	6	33.33	7.42
600	850	18	4	62.50	3.82

Comments:

Checked By:
AP

Date:
06/12/2022

Approved By:
RP

Date:
06/12/2022

Estimated California Bearing Ratio - Derived using TRL (60° cone) in accordance with TRRL Road note 8

Site: Home Farm
Client: Wykeham Homes

GCC
 10 Waldegrave Close
 Southampton
 SO19 9RY

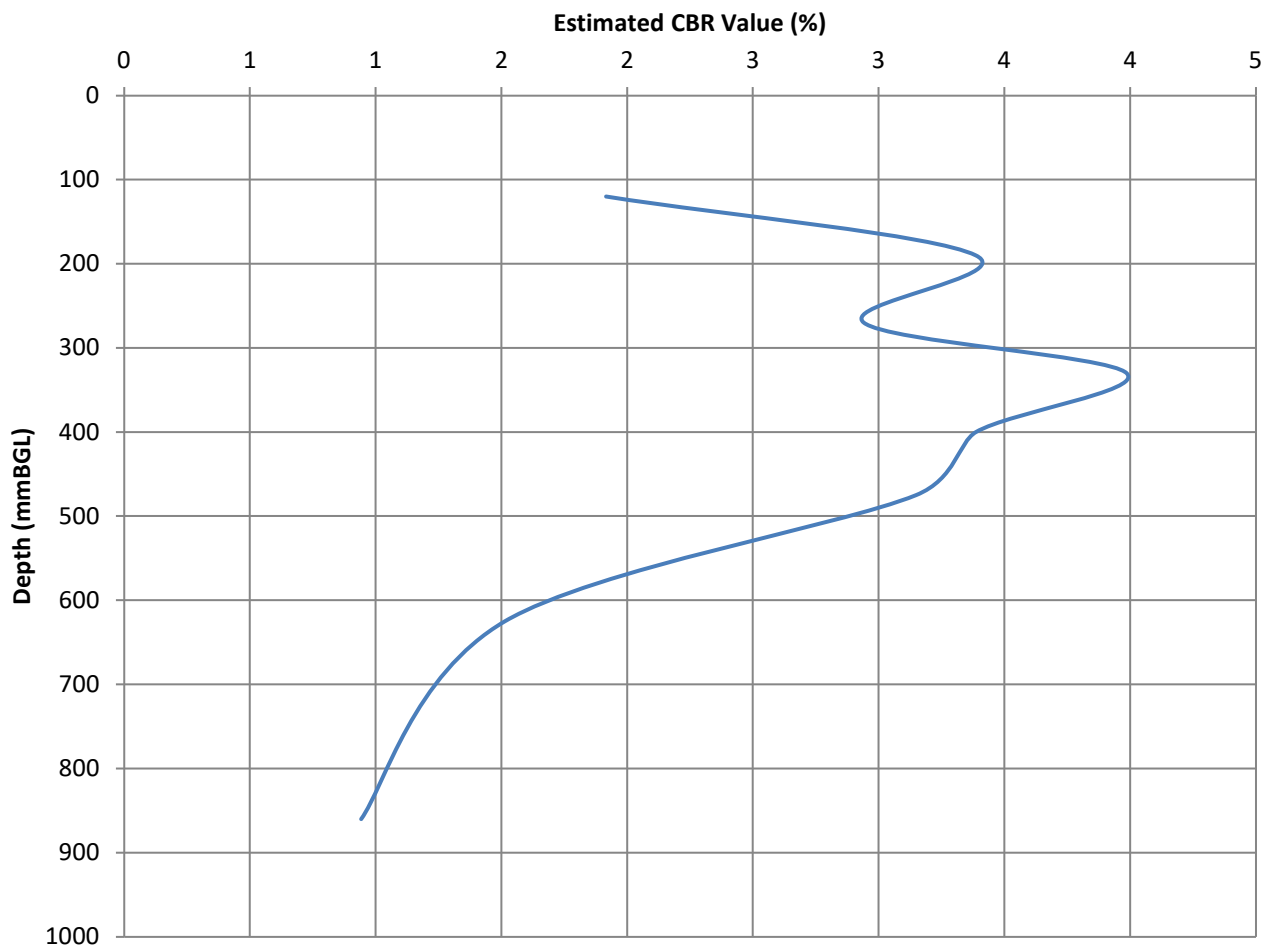


Project Number: J22-07
Location ID: CBR3

Date: 06/12/2022 **Engineer:** RP
Easting: **Northing:**

Initial Depth (mmBGL): 0
Final Depth (mmBGL): 860

Estimated California Bearing Ratio (%) against Depth (mmBGL)



Summary Table

Start Depth	Finish Depth (mmBGL)	No of Blows	Blows per Layer	mm/Blows	Average Estimated CBR (%)
0	860	5	5	172.00	1.31

Comments:

Checked By:
AP

Date:
06/12/2022

Approved By:
RP

Date:
06/12/2022

APPENDIX 10: DISCOVERY STRATEGY

Attn: Ground Works Contractors

Home Farm, Hedge End – Discovery Strategy

Background

This document presents a brief summary of the actions to be taken if suspected contamination of the soil or groundwater is encountered during the development of the site and follows on from the GCC Ground Condition Assessment dated December 2022.

Evidence of contamination

Evidence of contamination may be in the following forms, although other indicators may be observed.

- Dark staining of the soil
- Ash in soil
- Oily sheen on soil or water
- Tanks and pipework
- Smell of oil/diesel/petrol
- Asbestos containing material fragments
- Large deposits of made ground (e.g. waste deposits)

Actions following identification of evidence of contamination

Contractors encountering evidence of contamination are to report the discovery to the site office/site manager.

- Further development of the potentially contaminated area should cease and Site Manager should contact GCC (ask@groundcc.com) to attend site and assess the implications of the discovered impact.
- GCC will in turn inform the Local Authority and/or the Environment Agency as appropriate.
- Potentially contaminated material is to be left in situ where possible, or stockpiled in bunded areas where it is not possible to leave in situ, until an assessment is complete and appropriate action is agreed with the relevant regulator.
- Potentially contaminated material to be disposed of off site may require further chemical testing.

Ground Gas Note: "0" readings to be recorded as instrument detection limit

Groundwater

Well volume (l) = $(3.14 \times (\text{hole diameter (m)}/2)^2 \times (\text{base dip (m)} - \text{standing water level (m)})) \times 1000$ (2l/m in 50mm well)

$$\text{Gas screening value} = \text{gas concentration (\%)} \times \text{gas flow rate (l/hr)}$$

%v/v - Percentage volume by total volume; mbgl - metres below ground level; ppm - parts per million; mb - millibars; l/hr - litres per hour; vv - water vial; gb - 1l glass bottle; pb - 1l plastic bottle

GROUND GAS AND GROUNDWATER MONITORING RESULTS



SITE/REF: Home Farm		General Site comments				
DATE:	06/12/2022					1... Of1...
OPERATOR(S):	RP					
Ambient Conditions:						
	Barometric Pressure (mb)	CH ₄ (%v/v)	CO ₂ (%v/v)	O ₂ (%v/v)	PID (ppm)	
Before Monitoring						
After Monitoring						
EQUIPMENT						
Instrument / Model Type		Serial Number		Comments		
Atmospheric Pressure Trend:						
Ground Conditions:		Dip metre				
Weather Conditions:						

Ground Gas Note: "0" readings to be recorded as instrument detection limit

Borehole ID	Time	Flow (l/hr)	Relative Pressure (mb)	Steady CH ₄ (%v/v)	CO ₂ (%v/v)	O ₂ (%v/v)	Peak CH ₄ (%v/v)	% of Lower Explosive Limit	CO (ppm)	H ₂ S (ppm)	Balance (%)	PID (ppm)	Response Zone		Response Strata	Gas screening value CH ₄	Gas screening value CO ₂
													From (mbgl)	To (mbgl)			

Groundwater

Borehole ID	Standing Water Level (mbgl)	Installation Base Dip (mbgl)	Free Phase LNAPL Thickness (m)	Free Phase DNAPL Thickness (m)	Water Quality Indicators					Well Volume (l)	Purge Volume (l)	Comments (samples)
					Eh	EC	pH	DO	Temp			
WS101	Dry	5.18										
WS102	Dry	3.18										
WS103	Dry	5.29										
WS104	4.16	4.19										
WS105	Dry	3.53										

Well volume (l) = $(3.14 \times (\text{hole diameter (m)}/2)^2 \times (\text{base dip (m)} - \text{standing water level (m)})) \times 1000$ (2l/m in 50mm well)

Gas screening value = gas concentration (%) x gas flow rate (l/hr)

%v/v - Percentage volume by total volume; mbgl - metres below ground level; ppm - parts per million; mb - milibars; l/hr - litres per hour; ww - water vial; gb - 1l glass bottle; pb - 1l plastic bottle

GROUND GAS AND GROUNDWATER MONITORING RESULTS



SITE/REF: Home Farm						General Site comments MG - Made Ground WF - Wittering Formation			
DATE: 14/12/2022		1... of1...							
OPERATOR(S): DP									
Ambient Conditions:		Barometric Pressure (mb)	CH ₄ (%v/v)	CO ₂ (%v/v)	O ₂ (%v/v)				PID (ppm)
Before Monitoring		1000	0.0	0.0	20.1		EQUIPMENT		
After Monitoring									
Atmospheric Pressure Trend:							Instrument / Model Type Serial Number Comments		
Ground Conditions:		Firm, frozen, locally slightly soft							
Weather Conditions:		very cold but clear							
		Dip metre							

Ground Gas Note: "0" readings to be recorded as instrument detection limit

Borehole ID	Time	Flow (l/hr)	Relative Pressure (mb)	Steady CH ₄ (%v/v)	CO ₂ (%v/v)	O ₂ (%v/v)	Peak CH ₄ (%v/v)	% of Lower Explosive Limit	CO (ppm)	H ₂ S (ppm)	Balance (%)	PID (ppm)	Response Zone		Response Strata	Gas screening value CH ₄	Gas screening value CO ₂
													From (mbgl)	To (mbgl)			
WS101		0.0		0.0	0.3	19.8	0.0			0	79.9		1.00	5.20	MG,WF	0.0001	0.0003
WS102		0.0		0.0	2.4	19.0	0.0			0	78.6		1.00	3.20	MG,WF	0.0001	0.0024
WS103		0.0		0.0	0.7	19.8	0.0			0	79.5		1.00	5.30	MG,WF	0.0001	0.0007
WS104		0.0		0.0	2.2	18.1	0.0			0	79.7		1.00	4.20	MG,WF	0.0001	0.0022
WS105		0.1		0.0	3.6	17.5	0.0			0	79.0		1.00	3.60	MG,WF	0.0001	0.0036

Groundwater

Borehole ID	Standing Water Level (mbgl)	Installation Base Dip (mbgl)	Free Phase LNAPL Thickness (m)	Free Phase DNAPL Thickness (m)	Water Quality Indicators					Well Volume (l)	Purge Volume (l)	Comments (samples)
					Eh	EC	pH	DO	Temp			
WS101	Dry	5.18										
WS102	Dry	3.18										
WS103	Dry	5.29										
WS104	4.15	4.19										
WS105	Dry	3.53										

Well volume (l) = $(3.14 \times (\text{hole diameter (m)} / 2)^2 \times (\text{base dip (m)} - \text{standing water level (m)})) \times 1000$ (2l/m in 50mm well)

Gas screening value = gas concentration (%) x gas flow rate (l/hr)

%v/v - Percentage volume by total volume; mbgl - metres below ground level; ppm - parts per million; mb - milibars; l/hr - litres per hour; wv - water vial; gb - 1l glass bottle; pb - 1l plastic bottle

GROUND GAS AND GROUNDWATER MONITORING RESULTS



SITE/REF: Home Farm						General Site comments MG - Made Ground WF - Wittering Formation			
DATE: 06/01/2023		1... of1...							
OPERATOR(S): RP									
Ambient Conditions:		Barometric Pressure (mb)	CH ₄ (%v/v)	CO ₂ (%v/v)	O ₂ (%v/v)	PID (ppm)			
Before Monitoring							EQUIPMENT		
After Monitoring									
Atmospheric Pressure Trend:									
Ground Conditions:		Firm, locally slightly soft					Dip metre		
Weather Conditions:									

Ground Gas Note: "0" readings to be recorded as instrument detection limit

Borehole ID	Time	Flow (l/hr)	Relative Pressure (mb)	Steady CH ₄ (%v/v)	CO ₂ (%v/v)	O ₂ (%v/v)	Peak CH ₄ (%v/v)	% of Lower Explosive Limit	CO (ppm)	H ₂ S (ppm)	Balance (%)	PID (ppm)	Response Zone		Response Strata	Gas screening value CH ₄	Gas screening value CO ₂
													From (mbgl)	To (mbgl)			

Groundwater

Borehole ID	Standing Water Level (mbgl)	Installation Base Dip (mbgl)	Free Phase LNAPL Thickness (m)	Free Phase DNAPL Thickness (m)	Water Quality Indicators					Well Volume (l)	Purge Volume (l)	Comments (samples)
					Eh	EC	pH	DO	Temp			
WS101	5.11	5.18										
WS102	1.6	3.18										
WS103	5.1	5.25										
WS104	2.01	4.16										
WS105	GL	3.53										

Well volume (l) = (3.14 x (hole diameter (m)/2)² x (base dip (m) - standing water level (m)))x1000 (2l/m in 50mm well) Gas screening value = gas concentration (%) x gas flow rate (l/hr)
 %v/v - Percentage volume by total volume; mbgl - metres below ground level; ppm - parts per million; mb - milibars; l/hr - litres per hour; vv - water vial; gb - 1l glass bottle; pb - 1l plastic bottle

GROUND GAS AND GROUNDWATER MONITORING RESULTS



SITE/REF: Home Farm						General Site comments MG - Made Ground WF - Wittering Formation			
DATE: 09/02/2023		1... of1...							
OPERATOR(S): RP									
Ambient Conditions:		Barometric Pressure (mb)	CH ₄ (%v/v)	CO ₂ (%v/v)	O ₂ (%v/v)	PID (ppm)	EQUIPMENT		
Before Monitoring									
After Monitoring									
Atmospheric Pressure Trend:									
Ground Conditions:		Firm, locally slightly soft					Instrument / Model Type		
Weather Conditions:		Cloudy					Serial Number		
							Comments		
							Dip metre		

Ground Gas Note: "0" readings to be recorded as instrument detection limit

Borehole ID	Time	Flow (l/hr)	Relative Pressure (mb)	Steady CH ₄ (%v/v)	CO ₂ (%v/v)	O ₂ (%v/v)	Peak CH ₄ (%v/v)	% of Lower Explosive Limit	CO (ppm)	H ₂ S (ppm)	Balance (%)	PID (ppm)	Response Zone		Response Strata	Gas screening value CH ₄	Gas screening value CO ₂
													From (mbgl)	To (mbgl)			

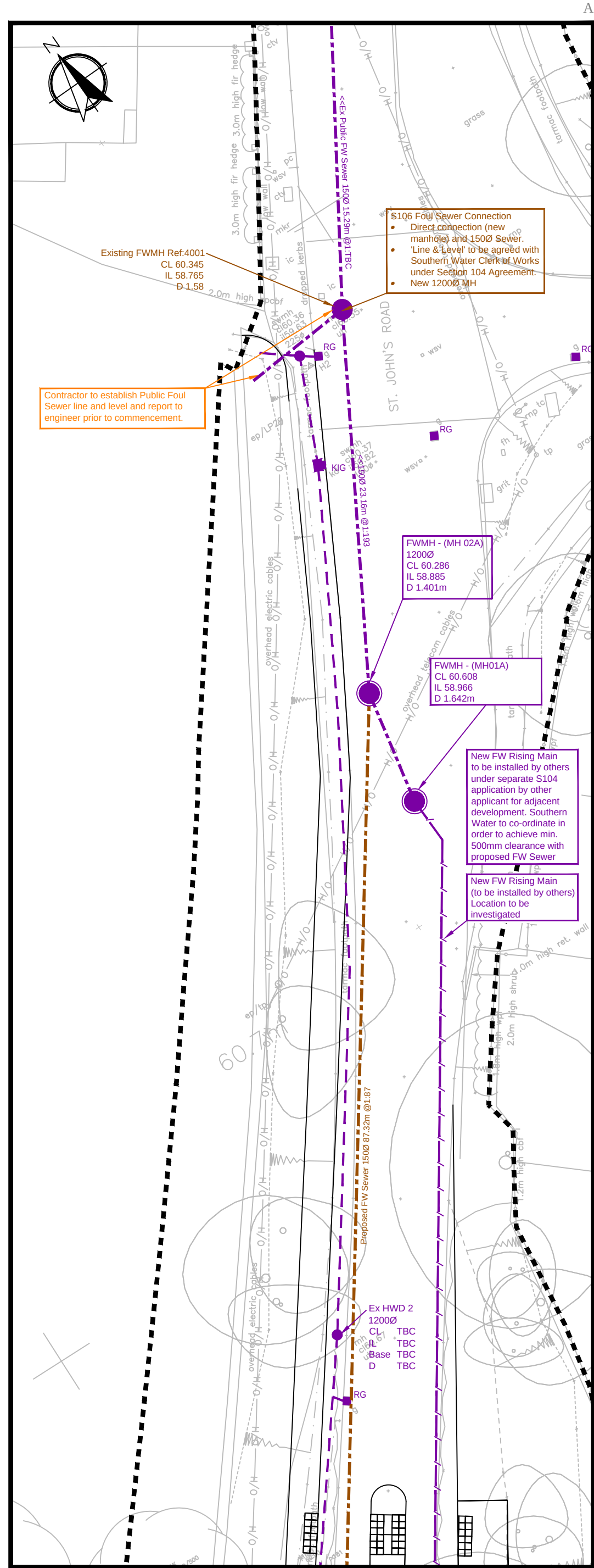
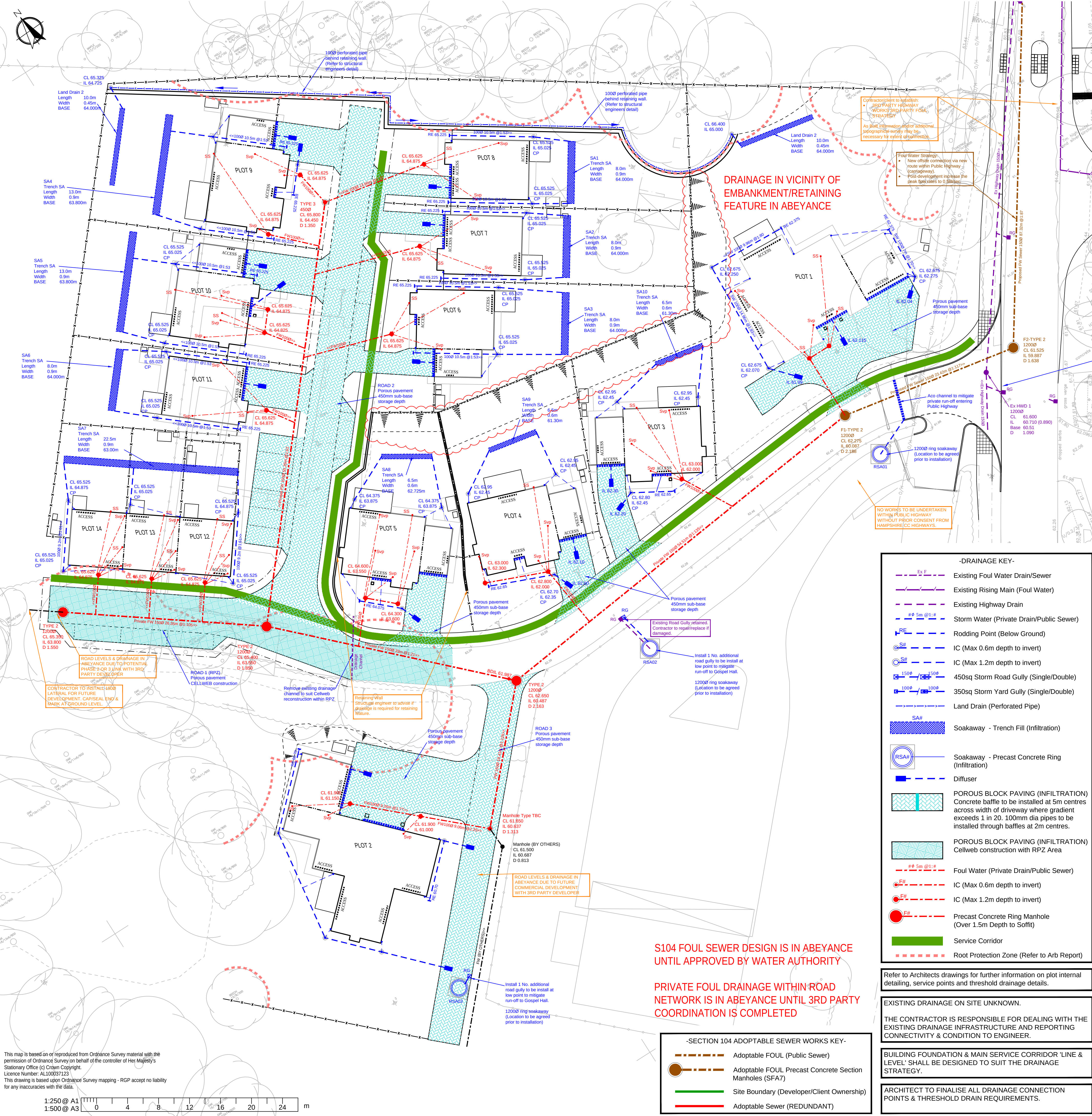
Groundwater

Borehole ID	Standing Water Level (mbgl)	Installation Base Dip (mbgl)	Free Phase LNAPL Thickness (m)	Free Phase DNAPL Thickness (m)	Water Quality Indicators					Well Volume (l)	Purge Volume (l)	Comments (samples)
					Eh	EC	pH	DO	Temp			
WS101	Dry	5.17										
WS102	Dry	3.16										
WS103	Dry	5.22										
WS104	Dry	4.14										
WS105	2.51	3.51										

Well volume (l) = (3.14 x (hole diameter (m)/2)² x (base dip (m) - standing water level (m)))x1000 (2l/m in 50mm well)

Gas screening value = gas concentration (%) x gas flow rate (l/hr)

%v/v - Percentage volume by total volume; mbgl - metres below ground level; ppm - parts per million; mb - milibars; l/hr - litres per hour; wv - water vial; gb - 1l glass bottle; pb - 1l plastic bottle



FOR APPROVAL

- DRAINAGE NOTES:**
- ALL DRAINAGE WORKS TO BE CONSTRUCTED IN STRICT ACCORDANCE WITH SPECIFICATION OF THE LOCAL AUTHORITY, BUILDING REGULATIONS, SEWERS FOR ADOPTION, BS8301 & BSEN.752-1.
 - FOR LOCATION AND SETTING OUT OF BUILDING DRAINAGE POINTS REFER TO ARCHITECT'S DRAWINGS.
 - ALL PIPE RUNS NEAR BUILDINGS TO COMPLY WITH THE BUILDING REGULATIONS 2002 PART H1. WHERE A PIPE IS WITHIN 1m OF A FOUNDATION THE TRENCH SHALL BE FILLED WITH CLASS GEN3 CONCRETE UP TO THE LOWEST LEVEL OF THE FOUNDATION. WHERE THE TRENCH IS FURTHER THAN 1m FROM THE FOUNDATION, THE TRENCH SHALL BE FILLED WITH CLASS GEN3 CONCRETE TO A LEVEL BELOW THE LOWEST LEVEL FOR THE FOUNDATION EQUAL TO THE DISTANCE FROM THE FOUNDATION LESS 150mm. IN BOTH CASES THE PIPE SHALL BE BEDDED AND SURROUNDED IN 150mm THICK CLASS GEN3 CONCRETE.
 - WHERE PIPES, EXTERNAL TO THE STRUCTURES, HAVE A DEPTH TO SOFFIT FROM GROUND LEVEL OF LESS THAN 450mm THEY SHALL HAVE A CLASS GEN3 CONCRETE ENCASEMENT (150mm THICK).
 - WHERE A PIPE, UNDER A CARRIAGEWAY, HAS A DEPTH OF COVER OF LESS THAN 1.2m THE PIPE SHALL BE LAID IN A CONCRETE BED AND SURROUND.
 - IN ANY CIRCUMSTANCES WHERE PIPES ARE BEDDED AND SURROUNDED IN CONCRETE FLEXIBLE JOINTS SHOULD BE PROVIDED. COMPRESSIBLE BOARDS (FIBREBOARD OR POLYSTYRENE) SHALL BE PROVIDED AT A MAXIMUM OF 8m CENTRES (CONCORDING WITH PIPE JOINTS). THE BOARDS SHALL BE PRE-CUT TO PIPE DIAMETER AND TO A HEIGHT AND WIDTH EQUAL TO THE CONCRETE CROSS SECTION. A BOARD THICKNESS OF 18mm FOR PIPES UP TO 450mm NOMINAL DIAMETER AND 36mm FOR PIPES OVER 450mm NOMINAL DIAMETER.
 - ALL PRIVATE BUILDING DRAINAGE SHALL BE CONSTRUCTED IN STRICT ACCORDANCE WITH BSEN.752-1. UNLESS OTHERWISE SPECIFIED BUILDING DRAINAGE SHALL BE 100mm DIAMETER AND SHALL BE LAID AT A MINIMUM GRADIENT OF (<1.5 = 1 IN 40) PLUS = 1 IN 80) FOR FOUL DRAINS AND 1 IN 80 FOR SURFACE WATER DRAINS. ALL BUILDING DRAINS SHALL BE LAID IN CONJUNCTION WITH 'NON ADOPTIVE BEDDING DETAILS' (CLASS D, N OR B) UNLESS OTHERWISE SPECIFIED.
 - ALL PIPES, BENDS AND JUNCTION FOR PRIVATE BUILDING DRAINAGE SHALL BE UPVC CONFORMING TO BS4660 AND BS5481 AS APPROPRIATE AND SHALL BE LAID IN ACCORDANCE WITH THE MANUFACTURER'S SPECIFICATION. ALL PIPES, BENDS AND JUNCTION MATERIALS FOR ADOPTABLE DRAINAGE SHALL BE VITRIFIED CLAY, EXTRA STRENGTH OR SUPER STRENGTH TO BS2925, WITH FLEXIBLE JOINTS AND KITEMARK CERTIFIED.
 - ALL BACK INLET GULLIES TO BE RODDABLE OR CONNECTED TO INSPECTION CHAMBERS.
 - ALL ROAD GULLY CONNECTIONS OTHER THAN AT MANHOLES TO BE 'Y' JUNCTIONS.
 - ALL ROAD GULLY CONNECTIONS TO BE 150mm DIAMETER.
 - ALL STUB STACKS TO BE FITTED WITH AIR ADMITTANCE VALVES WHERE BRANCH DRAIN EXCEEDS 12m EXCEPT AT THE HEAD OF THE RUN. SOIL VENT PIPES LOCATED AT THE HEAD OF A RUN TO TERMINATE TO FRESH AIR.
 - ALL CONNECTIONS TO BE SOFFIT TO SOFFIT UNLESS OTHERWISE NOTED.
 - ALL CONCRETE AND CONCRETE PRODUCTS TO BE IN ACCORDANCE WITH BRE 383 FOR SULPHATES.
 - THE LOCATIONS OF ALL SVPS AND RWPS SHALL BE CROSS REFERENCED AGAINST THE ARCHITECT'S DRAWINGS DURING SETTING OUT.
 - BEFORE CONNECTIONS ARE MADE TO EXISTING PUBLIC SEWERS AN APPLICATION UNDER 108 MUST BE MADE TO SOUTHERN WATER.
 - THE PRECISE DEPTH AND LOCATION AND SIZE OF EXISTING PIPES OR MANHOLES WHERE CONNECTIONS OR DIVERSION ARE PROPOSED MUST BE CONFIRMED AND REPORTED TO THE ENGINEER AT THE EARLIEST OPPORTUNITY.
 - WHERE INSPECTION COVERS ARE LOCATED IN AREAS OF BLOCK PAVING OR PAVING SLABS THEY SHALL BE FITTED WITH RECESSED COVERS AND INFILLED WITH THE ADJACENT MATERIAL.
 - PROPOSED SOAKAWAYS ARE TO BE LOCATED A MINIMUM OF 6m FROM BUILDINGS.
 - THE CONTRACTOR MUST INFORM THE ENGINEER WHEN GROUNDWATER IS ENCOUNTERED.

Rev.	Date	Amendments	Drawn	Appr.
E	06/09/2018	Co-ordination with third party scheme	SPB	MJA
D	11/06/2018	Positioning of New FW rising main refined	SPB	MJA
C	24/05/2018	Issue for approval	MJA	MJA
B	16/05/2018	General update to suit Architects GA	MJA	MJA
A	26/04/2018	General update to suit existing FW invert	MJA	MJA
-	26/02/2018	Original issue	MJA	MJA

rgp Design

Transport Planning and Infrastructure Design Consultants
Metro House, Northgate, Chichester, West Sussex, PO19 1BE
Tel: 01243 210418 Fax: 01483 861682 www.rgp.co.uk

Client	Knightsgate Ltd
Project	Land at Home Fm, St John's Road, Hedge End
Drawing Title	Drainage GA
Scale	1:250
Drawn By	MJA
Checked By	LDF
Approved By	MJA
Date	February 2018
Drawing No.	2018-D1424-102
Rev.	E

- NOTES**
- This drawing is to be read in conjunction with all other RGP drawings, and with all relevant Architect's and Engineer's drawings and specification. Any discrepancies found are to be reported immediately to the Engineer.
 - RGP accepts no responsibility for inaccuracies in data provided by third parties such as topographic surveys or Ordnance Survey mapping.
 - Do not scale, work to figured dimensions only. All dimensions are in millimetres unless noted otherwise and all levels are in metres from the topographic survey datum.
 - Any information given regarding existing underground services is given in good faith after consultation with the relevant authority, however accuracy is not certain. The main contractor is responsible for checking all information on site prior to work commencing and taking due care whilst undertaking the works.
 - All dimensions to be checked on site. All details and dimensions relating to sub-contractors work must be checked and agreed between the sub-contractor or supplier and the general contractor.
 - The electronic information from this drawing can not be guaranteed as dimensionally drawn exact. Figured dimensions must be used for setting out and detailing. RGP logos and company information must be removed from copies if information is re-used.
 - The main contractor is responsible for the design of all temporary works, and is also responsible for the safe maintenance and stability of existing buildings at all times.
 - The main contractor is responsible for dealing with all occurrences of ground water during the construction period.
 - The contractor must comply with all current legislation relating to health & safety.
 - All products specified shall be installed in strict accordance with the manufacturers recommendations and instructions. If there are discrepancies between that information and the details on any RGP drawings, the manufacturers instructions must be used.

RESIDUAL HAZARDS

In addition to the hazards/risks normally associated with the type of work detailed on this drawing, note the following:

- Buried services. Contractor to refer to record drawings and use CAT to locate existing services.
- Working in live traffic. Contractor to ensure traffic management is designed, erected and maintained to protect the workforce and the public.

It is assumed that all works will be carried out by a competent contractor working, where appropriate, to an approved risk assessment and method statement.

13 January 2023

✉ 52 Common Lane
Titchfield, Hants,
PO14 4BU

☎ 07717 759149
🌐 www.aquacallidus.co.uk

Wykeham Homes
12a Vicarage Farm Business Park
Winchester Road
Fair Oak
Hants
SO50 7HD

FAO Michael O'Brien

Ref: 22066

Land at Home Farm, St Johns Road, Hedge End, Hants Drainage Strategy and Flood Risk screening and Concept

Dear Sirs

Further to your instructions we have reviewed the form and location of residential development you propose on the basis this being something similar to the preliminary layout shown on Pope Priestley Architects drawing PP1433-SK02-B, annotated copy attached.

We have also reviewed:

- Encompass surveys topographic survey ENC-290922-2458-S1 sheets 1 and 2
- GCC soils investigation J22-077 and groundwater monitoring results to date (6/1/23)
- RGP drainage layout 2018-D1424-102- E of the drainage arrangements on the new Knightsgate development forming the approach road to the site and the housing development immediately east of the site
- Southern Water local sewer plan
- EA Flood Zone, surface water and reservoir flood risk mapping

Fig 1 Historic mapping with modern aerial photograph underlay confirms what the current topographic site survey and soils survey show

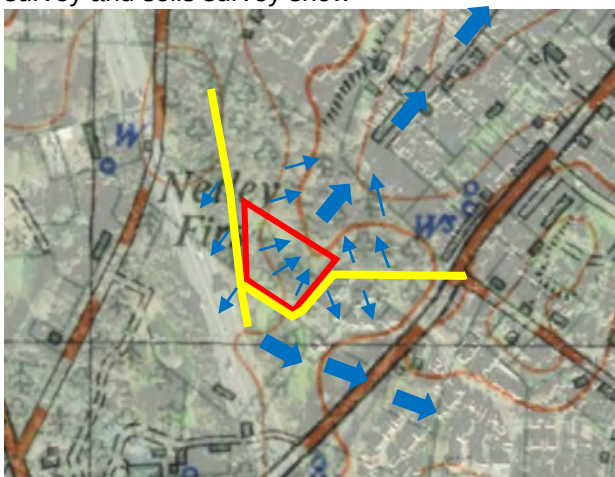


Fig 1 Site terrain/catchment context

Catchment watersheds in yellow above.

- 1) The site is the head of a natural valley line in the Clay geology falling northeast and Granada Road was laid up the axis of that valley bottom
- 2) There is a local ridgeline/watershed in the terrain along the south western and south eastern boundaries and that land falls south eastwards in separate catchment to beyond Hellyar Rise and is crossed by the realigned St Johns road embankment constructed some 40 or so years ago as part of the M27 installation.
- 3) To the west of the site the M27 is in a deep cutting and now forms its own catchment falling westwards away from the site to the toe of the cutting then south west along the M27 corridor.
- 4) In terms of catchment hydraulics there is no catchment upslope of the site, and the site is the very head of a natural catchment falling northeast from the site through the adjacent woodland and towards Granada Road.
- 5) At some point some soil fill has been placed in the very base of the valley 'bowl' in the site to flatten the base of the bowl to make the field more useful. There is a short embankment of 1.5-2.0m maximum height where the plane of the soil fill ends within the site and chamfers down to the site boundary. The soil investigation hole logs at the locations shown on Fig 2 confirm up to 1.5-2m of gravelly silt/clay fill over relict top soil.



Fig 2 soil investigation hole locations

- 6) Site soil permeability testing in the natural Silt/Clay Wittering Formation soil on site determined a permeability of $1-1.4 \times 10^{-6}$ m/sec which is a low permeability value. Given enough time water would eventually soak into this, however for heavy or prolonged rainfall, given the steep slope around the housing area, then after a little initial uptake by topsoil, if not already saturated, then subsequent rainfall would runoff to the northeast along the natural terrain flow path. For development purposes it is usual to seek to attain an arrangement which can half drain in 24 hours. It is not however uncommon on Wittering Formation geology that half drain times for more rare rainfall events to exceed 24 hours if looking to infiltration only. This does not mean that infiltration should be abandoned but rather you should utilise what natural soakage there is as for most events this will be sufficient and then seek to attenuate the runoff of the balance of the volume at as near to natural runoff rates as is practically possible.
- 7) The winter groundwater monitoring results to date indicate the gravelly silt/clay soil fill has a spatially variable permeability. Holes WS102 and WS104 show previously dry holes through to the underlying Wittering Formation presently have groundwater levels at the base of the soil fill/top of the Wittering Formation. Hole WS105 previously dry currently has water up to ground level. It appears that towards the open side of the fill area water is draining to the base of the fill and standing on the underlying natural Wittering Formation, and towards the opposite site the fill has not fully drained. These readings are commensurate with our own observations on site last week that whilst in places at the foot of the natural slope onto the fill area the soil is wet at the surface,

on the open side the soil fill is not saturated and water issues as diffuse 'groundwater' emergence from the toe of the embankment and continues on its natural flow path to the north east.

- 8) It is our opinion that the presence of a shallow depth of clay based soil fill at the base of the 'bowl' in the terrain has not fundamentally altered the natural runoff from the site to the north east.
- 9) It is inadvisable to seek to orphan the site from its natural catchment and discharge it to a different catchment for two main reasons; firstly this would require pumping and pumping is only permitted if unavoidable and; secondly redirecting to another catchment, in this case the one running to the south east would increase the load, no matter how little, on that catchment. The M27 St Johns Road bridge approach embankment was built across that catchment about 40 years ago and the area south east of the embankment more recently developed for housing. It is unclear if the flow path was culverted under the embankment and subsequently maintained there and downstream. It is therefore not advisable to alter the status quo of that catchment.
- 10) Whilst we note that the adjacent Knightsgate development immediately east of the site is 100% reliant on infiltration it is evident from the size of the infiltration infrastructure shown on the plans that the soil permeability in that area was significantly better than that on the site now in consideration.
- 11) Measuring off the concept layout the pavement area including the parking to the car port between units 1 and 8 is some 600m² (of which some 450m² is in the courtyard area at the foot of the access road) and the roof area (save for the car port over pavement between plots 1 and 8) is some 600m² also. Assuming pavement storage on an infiltration over 80% of the pavement area of the courtyard this amounts to an effective footprint of about 350m²
- 12) The actual housing development part of the site appears to be just under 0.5 Ha. The greenfield Q_{BAR} discharge rate from this is 2.8 l/sec and the 100 year Q_{100} greenfield rate is 9 l/sec. 1 in 100 year + 45% climate change +10% urban creep rainfall onto a 1,200m² catchment is some 160m³. The attenuation storage requirement for the same event for 1,200m² catchment discharging at 2.8 l/sec is some 74m³ which equates to 0.6m thick of CGA stone matrix to 80% of the courtyard area at 35% void content. 350m² of infiltration footprint below pavement in the courtyard can infiltrate some 20m³ day. So for the design storm of 160m³ or a lesser storm the first 20m³ a day will infiltrate the ground and the remaining 140m³ or less would be attenuated to a natural Q_{bar} discharge rate of 2.8 l/sec ie total infiltration would take about 8 days if there was no runoff but this is not the natural case anyway. However runoff at the natural Q_{bar} rate of no more than 2.8 l/sec and would discharge than part in about 14 hours. In practice by changing the level at which the attenuation starts to drain from the storage the balance between infiltration and attenuated discharge volumes can be manipulated. The discharge should however be located within the bottom half of the storage so as to ensure the storage half drains within 24 hours. The retained infiltration storage component will drain at 20m³ per day so if the outfall is set around 25% of storage the retained storage will drain in just under a day and at 50% just under 2 days. The upper half of the storage, if mobilised by the size of the rainfall event, would drain away within 24 hours thus ensuring at least half capacity is available 24 hours after peak storage. Illustrative calculations for attenuation and for infiltration is attached.
- 13) To provide a diffuse/dispersed release from the site as currently occurs the outlet pipe from the flow control chamber would pass the discharge to perforated pipe in a gravel filled trench along the line of the base of the current fill embankment. This would then release a natural flow rate in the same location in a diffuse manner as currently occurs from the base of the fill, or occurred off the underlying clay 'bowl' before the soil fill was placed. The concept is illustrated in Fig 3 attached.
- 14) In addition to flow control water quality treatment train needs to be considered. Eastleigh BC policy for sites under 0.5Ha such as this allows for porous pavement only provision as these sites are of very limited size. The porous pavement proposed would therefore meet EBC policy requirements for this.
- 15) Exceedance events are those greater than the hydraulic design requirement which have to be designed for. There is very little land in the catchment above the housing area. A cut off ditch should be provided to the rear boundaries of plots 5-8 to prevent the small amount of natural runoff west of these plots from running towards the back of those plots. The housing area is located in a natural open sided bowl in the terrain. Whilst the runoff within this bowl in excess of the design event would be very limited the plots should be slightly elevated above the central courtyard and the courtyard should be subtly graded in towards the central spine and then down the central spine towards the car port between plots 1 and 8. The car port should be open sided so the exceedance flow can

freely pass from the back of the car port down the embankment slope and along the natural flow path to the north east. The green space north of plots 1, 8 and the car port should also be subtly graded to maintain an overall pathway continuation onto the central axis and down the embankment. The Architects concept plan has been annotated to illustrate the key points.

Foul Water Drainage

- 16) The adjacent Knightsgate development to the immediate east is served by public sewer connection. The site will need to make connection to that network via the access road into the site. As the site is of lower elevation than the adjacent part of the Knightsgate development a small private package pump station will be required around the courtyard area.
- 17) For 8 dwellings a 100mm minimum sized connection will be required and is present in the Knightsgate development.

Flood risk

- 18) The site is at an elevation well above tidal levels and is remote from the sea.
- 19) The site is at the extreme head of catchment (highest point in the catchment) and water runs away from the site not towards it. There are no rivers or watercourses presenting fluvial flood risk at the site.
- 20) EA mapping generally indicates the site to be at very low risk of surface water flooding. A low risk surface water flood path is shown on a north east alignment from the base of the embankment at the edge of the site and towards Granada Road, consistent with the natural pathway alignment in the terrain as discussed in paragraph (1) see also Fig 1.
- 21) EA mapping does not indicate a reservoir flood risk at the site.
- 22) The site soils investigation confirms the site to be of low permeability silty Clay geology. The site is also the highest ground in the catchment at the head of the catchment. It is evident from this that the groundwater flood risk is low.
- 23) The critical flood source is surface water flooding and run-off within the site. The site surface water system will accord with the principles of CIRIA C753. Paragraphs 1-15 above set out how surface water will be appropriately managed.

Summary

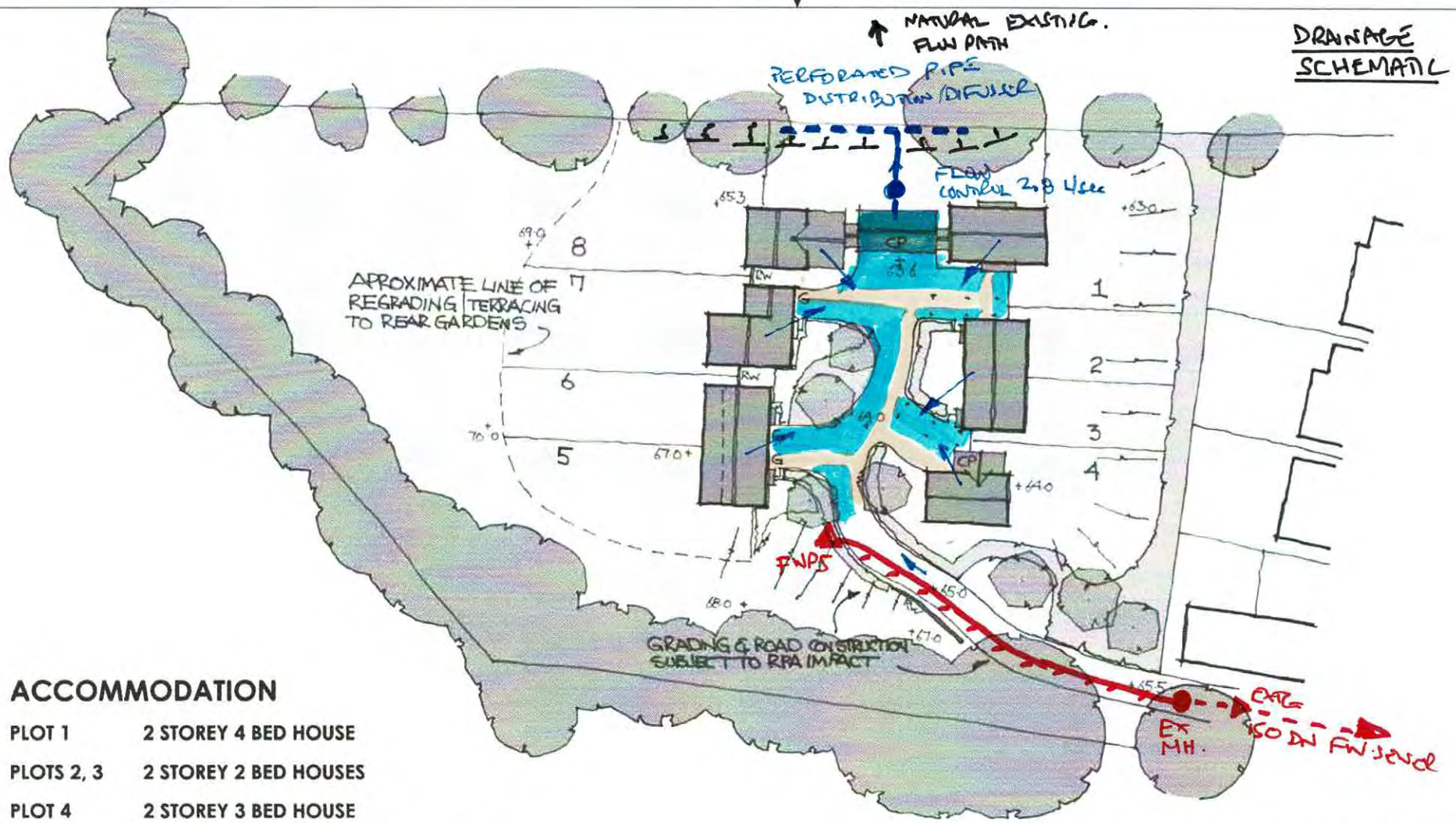
- The site is at low risk of flooding
- Foul water should be discharged to the public sewer network serving the adjacent Knightsbank development immediately to the east. This will require a small private package pump station around the courtyard area.
- Surface water drainage will comprise 0.6m CGA partial infiltration permeable pavement to the courtyard pavements on an 80% effective footprint basis to facilitate services placement. In order to ensure 24 hour half drain of the system is achieved CGA matrix will have an overflow mechanism set at partial depth discharging at natural Q_{BAR} rate to a perforated diffuser pipe in a gravel dispersal trench along the toe of the existing embankment. This arrangement will take advantage of the limited permeability of the site soils and mimic the infiltration/runoff balance that naturally occurs on the site.
- Being at the topographical head of the catchment there can be no exceedance flows into the site from higher ground. Exceedance flow generated within the site will be constrained onto the north easterly axis of the natural valley line out of the site, with the dwellings elevated either side of this axis and the pavement level through the car port at the northern end of the housing area subtly profiled to ensure ponding within the development does not occur.

Yours Sincerely,

Aqua Callidus Consulting Ltd

Andy Traves

Enc.	PP1433-SK02-B	Concept layout annotated with exceedance provision.
	PP1433-SK02-B	Concept layout annotated with SW and FW schematic layouts
	Fig 3	surface water drainage concept
	Greenfield runoff assessment	
	Attenuation assessment	
	Infiltration assessment	



ACCOMMODATION

PLOT 1	2 STOREY 4 BED HOUSE
PLOTS 2, 3	2 STOREY 2 BED HOUSES
PLOT 4	2 STOREY 3 BED HOUSE
PLOTS 5, 6, 7	2/3 STOREY SPLIT LEVEL 3 BED HOUSES
PLOT 8	2 STOREY SPLIT LEVEL 4 BED HOUSE

PARTIALLY INFILTRATING CGA PAVING
(80% OF COURTYARD)
20% SERVICES ALLOWANCE.



POPE PRIESTLEY ARCHITECTS

ARCHITECTURE | TOWN PLANNING | URBAN DESIGN

UNIT 15, VCARAGE FARM BUSINESS PARK, WINCHESTER ROAD, FAIR OAK, HAMPSHIRE SO50 7HD T +44 (0)23 80335228 E info@popepriestley.co.uk

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SCALE BAR: DIMENSIONS GIVEN WHEN PRINTED AT FULL SCALE

HOME FARM
HEDGE END

SITE LAYOUT

SCALE BAR: 0 5 10 15 20m

DRAWING STATUS
PRELIMINARY ISSUE

SCALE: 1:500
DATE: 17.05.2022
AUTHOR: DP
CHECK: DP

DRAWING NO:
PP1433/ SK 02
REVISION:
B



Project/Reference No: 22066

Sheet No: FIG 3.

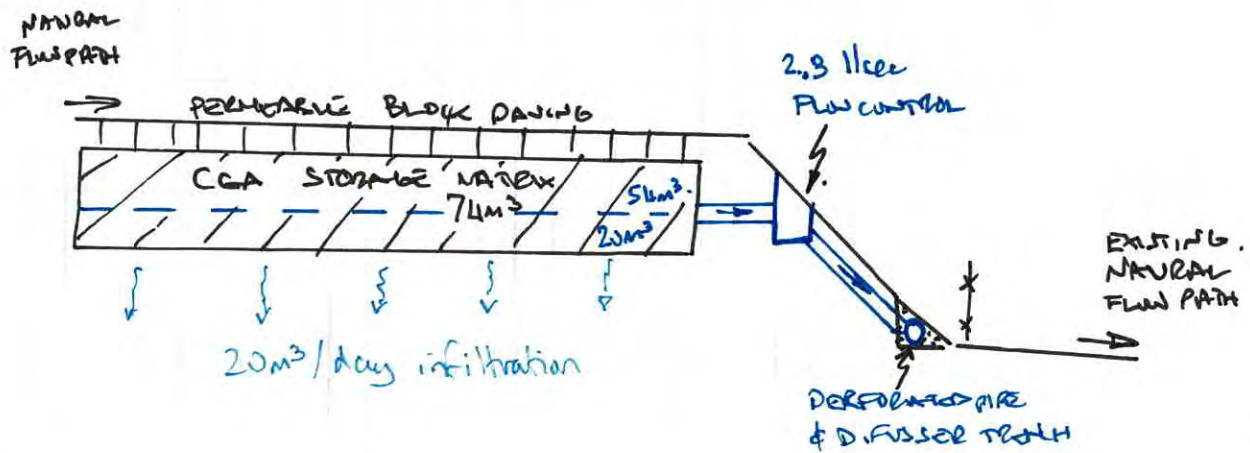
Project and Description: HOME FROM
HEDGE END

Office:

Computed:

Checked:

SW DRAINAGE CONCEPT.



LONG SECTION ON NATURAL FLOW PATH AXIS

[Print](#)[Close Report](#)

Greenfield runoff rate estimation for sites

www.uksubs.com | Greenfield runoff tool

Calculated by:	Andy Traves
Site name:	Home Farm
Site location:	Hedge End

This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance "Rainfall runoff management for developments", SC030219 (2013), the SuDS Manual C753 (Ciria, 2015) and the non-statutory standards for SuDS (Defra, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Site Details

Latitude:	50.90606° N
Longitude:	1.31479° W
Reference:	257540541
Date:	Jan 13 2023 09:43

Runoff estimation approach

Site characteristics

Total site area (ha):

Methodology

Q_{BAR} estimation method: SPR estimation method:

Soil characteristics

Default

Edited

SOIL type: HOST class: SPR/SPRHOST:

Hydrological characteristics

Default

Edited

SAAR (mm): Hydrological region: Growth curve factor 1 year: Growth curve factor 30 years: Growth curve factor 100 years: Growth curve factor 200 years:

Notes

(1) Is Q_{BAR} < 2.0 l/s/ha?

When Q_{BAR} is < 2.0 l/s/ha then limiting discharge rates are set at 2.0 l/s/ha.

(2) Are flow rates < 5.0 l/s?

Where flow rates are less than 5.0 l/s consent for discharge is usually set at 5.0 l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set where the blockage risk is addressed by using appropriate drainage elements.

(3) Is SPR/SPRHOST ≤ 0.3?

Where groundwater levels are low enough the use of soakaways to avoid discharge offsite would normally be preferred for disposal of surface water runoff.

Greenfield runoff rates

Default

Edited

Q _{BAR} (l/s):	2.81	2.81
1 in 1 year (l/s):	2.38	2.38
1 in 30 years (l/s):	6.45	6.45
1 in 100 year (l/s):	8.95	8.95
1 in 200 years (l/s):	10.49	10.49

This report was produced using the greenfield runoff tool developed by HR Wallingford and available at www.uksuds.com. The use of this tool is subject to the UK SuDS terms and conditions and licence agreement , which can both be found at www.uksuds.com/terms-and-conditions.htm. The outputs from this tool are estimates of greenfield runoff rates. The use of these results is the responsibility of the users of this tool. No liability will be accepted by HR Wallingford, the Environment Agency, CEH, Hydrosolutions or any other organisation for the use of this data in the design or operational characteristics of any drainage scheme.

Project No.: 22066

Project Title: Home Farm

Detention Assessment to CIRIA C753

No infiltration

Site Location: Hedge end

$r = 0.36$ (range 0.12 to 0.45)

Drained Area = 1200 m²

Design storm 1 in = 100 year

Runoff volume uplift = 45 % for climate change

10 % for urban creep

Catchment ID: attenuated catchment

$C_v = 1.00$

Technical Assessment

Base axis Length $L_x = 35.00$ m

Base axis Length $L_y = 10.00$ m

Discharge rate = 2.8 l/s

Storage depth = 0.60 m

storage porosity = 35 %

Base area = 350.0 m²

storage volume = 73.5 m³

Design volume = 73.5 m³

M5-60 Rainfall = 20 mm

Storm Duration	5 min	10 min	15 min	30 min	1 hr	2 hr	4 hr	6 hr	10 hr	24 hr
(secs)	300	600	900	1800	3600	7200	14400	21600	36000	86400
$r = 0.36$ Value Z1	0.36	0.51	0.62	0.79	1.00	1.22	1.48	1.67	1.90	2.42
Rainfall M5 (mm)	7.2	10.2	12.4	15.8	20.0	24.4	29.6	33.4	38.0	48.4
M100/M5 gf Value Z2	1.84	1.91	1.95	2.00	2.03	2.01	1.97	1.94	1.91	1.82
Rainfall M100 (mm)	13.3	19.5	24.2	31.5	40.6	49.1	58.4	64.9	72.4	88.2
With climate uplift (mm)	19.2	28.3	35.0	45.7	58.9	71.2	84.7	94.1	105.0	127.9
With urban creep (mm)	21.2	31.1	38.5	50.3	64.8	78.3	93.2	103.5	115.5	140.7
RUNOFF (m³)	25.4	37.4	46.2	60.4	77.7	94.0	111.8	124.2	138.6	168.9
inflow rate (l/s)	84.7	62.3	51.4	33.5	21.6	13.1	7.8	5.7	3.9	2.0
storage rate (l/s)	81.9	59.5	48.6	30.7	18.8	10.3	5.0	2.9	1.1	0.0
Discharge (m³)	0.8	1.7	2.5	5.0	10.1	20.2	40.3	60.5	100.8	168.9
Req'd STORAGE (m³)	24.6	35.7	43.7	55.3	67.6	73.8	71.5	63.7	37.8	0.0
Residual drain time (h)	2.4	3.5	4.3	5.5	6.7	7.3	7.1	6.3	3.8	0.0

Project No.: 22066
Project Title: Home farm

Drainage blanket/CGA pavement or 2D planar infiltration (R156)

Site Location: Hedge end Catchment ID: gross concept
 $r = 0.36$ (range 0.12 to 0.45)
 Drained Area = 1200 m² Infiltration Area = 350 m²
 Design storm 1 in = 100 year
 Runoff volume uplift = 45 % for climate change
 Urban Creep allowance = 10 % uplift to Drained Area

Site Considerations

Where determined, what is the depth to highest seasonal groundwater level (GWL) from surface 5.00 m
 Is the infiltration far enough from drainage mounds/fields or other soakaways etc to avoid impact? Yes
 What Source Protection Zone (SPZ) is the proposed soakaway located in? None
 What is known and proposed about potential contaminated ground on the site? EA/LPA accept infiltration

Technical Assessment

Consequence of failure = 1-No inconvenience
 Measured Soil Filtration Rate = 1.00E-06 m/s
 Design Soil Filtration Rate = 6.67E-07 m/s
 Storage media thickness = 0.600 m
 Effective net porosity = 35 %
 Depth of cover over media = 0.15 m

Storm Duration	5 min	10 min	15 min	30 min	1 hr	2 hr	4 hr	6 hr	10 hr	24 hr
(secs)	300	600	900	1800	3600	7200	14400	21600	36000	86400
$r = 0.36$ Value Z1	0.36	0.51	0.62	0.79	1.00	1.22	1.48	1.67	1.90	2.42
Rainfall M5 (mm)	7.2	10.2	12.4	15.8	20.0	24.4	29.6	33.4	38.0	48.4
M100/M5 gf Value Z2	1.84	1.91	1.95	2.00	2.03	2.01	1.97	1.94	1.91	1.82
Rainfall M100 (mm)	13.3	19.5	24.2	31.5	40.6	49.1	58.4	64.9	72.4	88.2
with CC & UC uplift (mm)	20.6	30.2	37.4	48.9	62.9	76.1	90.5	100.6	112.3	136.7
RUNOFF (m ³)	24.68	36.30	44.94	58.67	75.52	91.33	108.64	120.69	134.72	164.10
Infiltr capacity (m ³)	0.07	0.14	0.21	0.42	0.84	1.68	3.36	5.04	8.40	20.16
INFILTRATED (m ³)	0.07	0.14	0.21	0.42	0.84	1.68	3.36	5.04	8.40	20.16
Req'd STORAGE (m ³)	24.61	36.16	44.73	58.25	74.68	89.65	105.28	115.65	126.32	143.94
	pass	pass	pass	pass	fail	fail	fail	fail	fail	fail

TOTAL STORAGE AVAILABLE 73.50 m³
 Time to drain full to half full = 85.7 hours

Overall Assessment

Media base elevation above seasonal high GWL 4.25 m meets GP3
 Will the soakaway drain from full to half full in 24 hours or less? No fail
 Does the soakaway provide sufficient storage? No fail

Appendix C

Calculated by:	Andy Traves
Site name:	Home Farm
Site location:	Hedge End

This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance "Rainfall runoff management for developments", SC030219 (2013), the SuDS Manual C753 (Ciria, 2015) and the non-statutory standards for SuDS (Defra, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Site Details	
Latitude:	50.90608° N
Longitude:	1.31462° W
Reference:	2965649215
Date:	Apr 04 2023 14:15

Runoff estimation approach IH124

Site characteristics

Total site area (ha): 0.455

Methodology

 Q_{BAR} estimation method: Calculate from SPR and SAAR

SPR estimation method: Calculate from SOIL type

Soil characteristics

SOIL type: 4 4

HOST class: N/A N/A

SPR/SPRHOST: 0.47 0.47

Hydrological characteristics

SAAR (mm): 796 796

Hydrological region: 7 7

Growth curve factor 1 year: 0.85 0.85

Growth curve factor 30 years: 2.3 2.3

Growth curve factor 100 years: 3.19 3.19

Growth curve factor 200 years: 3.74 3.74

Notes

(1) Is $Q_{BAR} < 2.0$ l/s/ha?

When Q_{BAR} is < 2.0 l/s/ha then limiting discharge rates are set at 2.0 l/s/ha.

(2) Are flow rates < 5.0 l/s?

Where flow rates are less than 5.0 l/s consent for discharge is usually set at 5.0 l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set where the blockage risk is addressed by using appropriate drainage elements.

(3) Is $SPR/SPRHOST \leq 0.3$?

Where groundwater levels are low enough the use of soakaways to avoid discharge offsite would normally be preferred for disposal of surface water runoff.

Greenfield runoff rates	Default	Edited
Q_{BAR} (l/s):	2.55	2.55
1 in 1 year (l/s):	2.17	2.17
1 in 30 years (l/s):	5.87	5.87
1 in 100 year (l/s):	8.14	8.14
1 in 200 years (l/s):	9.55	9.55



Rev.	Amendment	Date	Original Sheet Size A1 (841 x 594)		Project		
			0 10 mm 50 		Land at Home Farm		
			 54 Common Lane Titchfield Hants PO14 4BU 07717 759149		St John's Road		
					Hedge End		
					Subject		
					Drainage Strategy		
			Scale	Project No.	Drawing No.	Sheet No.	Revision
			1:200	22066	ACC-22066-01	na	-

Project No.: 22066
Project Title: Home Farm

Detention Assessment to CIRIA C753

No infiltration

Site Location: Hedge End
r = 0.36 (range 0.12 to 0.45)
Drained Area = 1480 m²
Design storm 1 in = 100 year
Runoff volume uplift = 45 % for climate change
10 % for urban creep

Catchment ID: attenuated catchment

C_v = 1.00

Technical Assessment

Base axis Length L_x = 51.50 m

Base axis Length L_y = 10.00 m

Discharge rate = 2.55 l/s

Storage depth = 0.57 m

storage porosity = 35 %

Base area = 515.0 m²

storage volume = 102.7 m³

Design volume = 102.7 m³

M5-60 Rainfall = 20 mm

Storm Duration	5 min	10 min	15 min	30 min	1 hr	2 hr	4 hr	6 hr	10 hr	24 hr
(secs)	300	600	900	1800	3600	7200	14400	21600	36000	86400
r= 0.36 Value Z1	0.36	0.51	0.62	0.79	1.00	1.22	1.48	1.67	1.90	2.42
Rainfall M5 (mm)	7.2	10.2	12.4	15.8	20.0	24.4	29.6	33.4	38.0	48.4
M100/M5 gf Value Z2	1.84	1.91	1.95	2.00	2.03	2.01	1.97	1.94	1.91	1.82
Rainfall M100 (mm)	13.3	19.5	24.2	31.5	40.6	49.1	58.4	64.9	72.4	88.2
With climate uplift (mm)	19.2	28.3	35.0	45.7	58.9	71.2	84.7	94.1	105.0	127.9
With urban creep (mm)	21.2	31.1	38.5	50.3	64.8	78.3	93.2	103.5	115.5	140.7
RUNOFF (m³)	31.3	46.1	57.0	74.5	95.8	115.9	137.9	153.2	171.0	208.3
inflow rate (l/s)	104.4	76.8	63.4	41.4	26.6	16.1	9.6	7.1	4.7	2.4
storage rate (l/s)	101.9	74.2	60.8	38.8	24.1	13.5	7.0	4.5	2.2	0.0
Discharge (m³)	0.8	1.5	2.3	4.6	9.2	18.4	36.7	55.1	91.8	208.3
Req'd STORAGE (m³)	30.6	44.5	54.7	69.9	86.7	97.6	101.2	98.1	79.2	0.0
Residual drain time (h)	3.3	4.9	6.0	7.6	9.4	10.6	11.0	10.7	8.6	0.0

Project No.: 22066
Project Title: Home Farm

Drainage blanket/CGA pavement or 2D planar infiltration (R156)

Site Location: Hedge End Catchment ID: Entrance catchment

$r = 0.36$ (range 0.12 to 0.45)

Drained Area = 95 m² Infiltration Area = 95 m²

Design storm 1 in = 100 year

Runoff volume uplift = 45 % for climate change

Urban Creep allowance = 10 % uplift to Drained Area

Site Considerations

Where determined, what is the depth to highest seasonal groundwater level (GWL) from surface 5.00 m

Is the infiltration far enough from drainage mounds/fields or other soakaways etc to avoid impact? Yes

What Source Protection Zone (SPZ) is the proposed soakaway located in? None

What is known and proposed about potential contaminated ground on the site? EA/LPA accept infiltration

Technical Assessment

Consequence of failure = 1-No inconvenience

Measured Soil Filtration Rate = 2.00E-06 m/s

Design Soil Filtration Rate = 1.33E-06 m/s

Storage media thickness = 0.225 m

Effective net porosity = 35 %

Depth of cover over media = 0.15 m

Storm Duration	5 min	10 min	15 min	30 min	1 hr	2 hr	4 hr	6 hr	10 hr	24 hr
(secs)	300	600	900	1800	3600	7200	14400	21600	36000	86400
$r = 0.36$ Value Z1	0.36	0.51	0.62	0.79	1.00	1.22	1.48	1.67	1.90	2.42
Rainfall M5 (mm)	7.2	10.2	12.4	15.8	20.0	24.4	29.6	33.4	38.0	48.4
M100/M5 gf Value Z2	1.84	1.91	1.95	2.00	2.03	2.01	1.97	1.94	1.91	1.82
Rainfall M100 (mm)	13.3	19.5	24.2	31.5	40.6	49.1	58.4	64.9	72.4	88.2
with CC & UC uplift (mm)	20.6	30.2	37.4	48.9	62.9	76.1	90.5	100.6	112.3	136.7
RUNOFF (m ³)	1.95	2.87	3.56	4.64	5.98	7.23	8.60	9.55	10.67	12.99
Infiltr capacity (m ³)	0.04	0.08	0.11	0.23	0.46	0.91	1.82	2.74	4.56	10.94
INFILTRATED (m ³)	0.04	0.08	0.11	0.23	0.46	0.91	1.82	2.74	4.56	10.94
Req'd STORAGE (m ³)	1.92	2.80	3.44	4.42	5.52	6.32	6.78	6.82	6.11	2.05
	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass

TOTAL STORAGE AVAILABLE 7.48 m³

Time to drain full to half full = 7.5 hours

Overall Assessment

Media base elevation above seasonal high GWL 4.63 m meets GP3

Will the soakaway drain from full to half full in 24 hours or less? Yes pass

Does the soakaway provide sufficient storage? Yes pass

Date: 04/04/2023

Site Ref

Home Farm

SuDS Water Quality Management CIRIA C753 Ch26

Simple Index Approach

Catchment

roofs

Is discharge to: SPZ1? ☐ N Drinking Water Protection Area? ☐ N

Is site in close proximity to an area with sensitive environmental designation?

☐ N

if so how close?

m

Is an additional treatment component required due to sensitivity?

☐ Y

Land Use

roofs-residential

Hazard

very low

TSS index	Metals index	HydroCar index
0.2	0.2	0.05

*2 residential roofs remove gross solids and sediments

Treatments

To surface water discharge ☐ Y

Component

1 Permeable pavement

2 N/A

3 N/A

mitigation index

X1 N/A

Enhanced mitigation index

Residual pollution index

TSS MIndex	Metals MIndex	HydroCa MIndex	factor
0.7	0.6	0.7	1.00
0	0	0	0.50
0	0	0	0.50
0.7	0.6	0.7	
0	0	0	1.00
0.7	0.6	0.7	
0	0	0	

Land Use

roofs-residential

Hazard

very low

TSS index	Metals index	HydroCar index
0	0	0

residual

*2 residential roofs remove gross solids and sediments

Treatments

To groundwater discharge ☐ N

Infiltration surface

1 N/A

2 N/A

Final residual pollution index

TSS MIndex	Metals MIndex	HydroCa MIndex	factor
0	0	0	1.00
0	0	0	0.50
0	0	0	

Is a groundwater risk screening required?

☐ N

Notes:

Date: 04/04/2023

Site Ref

Home Farm

SuDS Water Quality Management CIRIA C753 Ch26

Simple Index Approach

Catchment

Pavement

Is discharge to: SPZ1? ☐ N Drinking Water Protection Area ?

☐ N

Is site in close proximity to an area with sensitive environmental designation?

☐ N

if so how close?

m

Is an additional treatment component required due to sensitivity?

☐ Y

Land Use

roads-low traffic

Hazard

low

TSS index	Metals index	HydroCar index
0.5	0.4	0.4

Treatments

To surface water discharge ☐ Y

Component

1 Permeable pavement

2 N/A

3 N/A

mitigation index

X1 N/A

Enhanced mitigation index

Residual pollution index

TSS MIndex	Metals MIndex	HydroCa MIndex	factor
0.7	0.6	0.7	1.00
0	0	0	0.50
0	0	0	0.50
0.7	0.6	0.7	
0	0	0	1.00
0.7	0.6	0.7	
0	0	0	

Land Use

roads-low traffic

Hazard

low

TSS index	Metals index	HydroCar index	residual
0	0	0	

Treatments

To groundwater discharge ☐ N

Infiltration surface

1 N/A

2 N/A

Final residual pollution index

TSS MIndex	Metals MIndex	HydroCa MIndex	factor
0	0	0	1.00
0	0	0	0.50
0	0	0	

Is a groundwater risk screening required?

☐ N

Notes:

SUDS operation and maintenance - general

There are three categories on maintenance activities:

Regular maintenance consists of basic tasks done on a frequent and predictable schedule, including vegetation management, litter and debris removal, and inspections.

Occasional maintenance comprises tasks that are likely to be required periodically, but on a much less frequent and predictable basis than the routine tasks (sediment removal is an example). The table below summarises the likely maintenance activities required for each SUDS component and specific maintenance activities is given in the following sections.

Remedial maintenance comprises intermittent tasks that may be required to rectify faults associated with the system. Where remedial work is found to be necessary, it is likely to be due to site-specific characteristics or unforeseen events, and as such timings are difficult to predict. Remedial maintenance items can comprise items such as:

- inlet/outlet repairs
- erosion repairs
- reinstatement or realignment of edgings, barriers, rip-rap or other erosion control
- infiltration surface rehabilitation
- replacement of blocked filter fabrics
- construction stage sediment removal (although this activity should have been undertaken before the maintenance contract)
- system rehabilitation immediately following a pollution event.

O&M activity	SUDS component												
	Pond	Wetland	Detention basin	Infiltration basin	Soakaway	Infiltration trench	Filter trench	Modular storage	Pervious pavements	Swale/bioretention/greenroofs	Filter strip	Sand filter	Pre-treatment systems
Regular maintenance													
Inspection	■	■	■	■	■	■	■	■	■	■	■	■	■
Litter/debris removal	■	■	■	■	□	■	■	□	■	■	■	■	■
Grass cutting	■	■	■	■	□	■	■	□	□	■	■	□	□
Wee/invasive plant control	□	□	□	□		□	□		□	□	□	□	□
Shrub management	□	□	□	□					□	□	□		□
Shoreline vegetation management	■	■	□										□
Aquatic vegetation management	■	■	□										□
Occasional maintenance													
Sediment management *	■	■	■	■	■	■	■	■	■	■	■	■	■
Vegetation/plant replacement	□	□	□	□						□	□		□
Vacuum sweeping and brushing									■				
Remedial maintenance													
Structure rehabilitation/repair	□	□	□	□	□	□	□	□	□	□	□	□	□
Infiltration surface reconditioning				□	□	□	□		□	□	□	□	

■ will be required

□ may be required

* sediment to be collected upstream of the main device

GENERAL MAINTENANCE

Litter/debris removal

This is an integral part of SUDS maintenance and reduces the risks of inlet and outlet blockages, retains amenity value and minimises pollution risks. High litter removal frequencies may be required at high profile commercial/retail parks where aesthetics are a major driver.

Grass cutting

It is recommended that grass cutting be minimised around SUDS facilities, apart from swales and filter strips and structural embankments where a height of 100–150 mm is recommended to prevent the plants falling over, or “lodging”, when water flows across the surface. In general, allowing grass to grow tends to enhance water quality performance. Short grass around a wet system such as pond or wetland provides an ideal habitat for nuisance species such as geese; allowing the grass to grow is an effective means of discouraging them. Grass around wet pond or wetland systems should not be cut to the edge of the permanent water. Grass cutting is an activity undertaken primarily to enhance the perceived aesthetics of the facility. The frequency of cutting will tend to depend on surrounding land uses, and public requirements. Therefore, grass cutting should be done as infrequently as possible, recognising the aesthetic concerns of local residents. However, grass around inlet and outlet infrastructure should be trimmed closely to reduce risks to system performance. If a manicured, parkland effect is required, then cutting will need to be undertaken more regularly than for meadow type grass areas, which aim to maximise habitat and biodiversity potential.

Weed/invasive plant control

Weeds are generally defined as vegetation types that are unwanted in a particular area. For SUDS, weeds are often alien or invasive species, which do not enhance the technical performance or aesthetic value of the system, or non-native species and the spread of which is undesirable. In some places, weeding has to be done by hand to prevent the destruction of surrounding vegetation (hand weeding should generally be required only during the first year, ie during plant establishment). However, over grassed surfaces, mowing can be an effective management measure. The use of herbicides and pesticides should be prohibited since they cause water quality deterioration. The use of fertilisers should also be limited or prohibited to minimise nutrient loadings which are damaging to water bodies.

Shrub management

Shrubs tend to be densely planted and are likely to require weeding at the base, especially during the first year to ensure that they get enough water. Shrubs should be selected so they can grow to their maximum natural height without pruning.

Aquatic/shoreline vegetation management

Aquatic plant aftercare in the first 1–3 years may be required to ensure establishment of planted vegetation and control nuisance weeds/invasive plants. Once established, the build-up of dead vegetation from previous seasons should be removed at convenient intervals to reduce organic silt accumulation (eg every three years and at the end of landscape contract periods).

Emergent vegetation may need to be harvested every 5–10 years to maintain flood attenuation volumes, optimise water quality treatment potential and ensure fresh growth, although this is often not required. Care should be taken to avoid nesting birds during the breeding season and to avoid great crested newt and water vole habitats. The typical window for this activity is towards the end of the growing season (September and October). As vegetation matures, plant height may also become a safety issue in residential areas.

Where emergent vegetation is managed, up to 25 per cent can be removed by cutting at 100 mm above soil level using shearing action machinery. Up to 25 per cent of submerged vegetation can be cut and raked out at any one time, using approved rakes, grabs or other techniques, depending on whether clay or waterproof membranes are present. Aquatic vegetation arisings should be stacked close to the water's edge for 48 hours to de-water and allow wildlife to return to the SUDS feature. They should then be removed to wildlife piles, compost heaps or off site before decomposition, rotting or damage to existing vegetation can occur.

Algae removal may be undertaken for aesthetic purposes during the first 3–5 years of a pond/wetland's life. The growth of algae, which is considered by some to be visually intrusive, is encouraged by nutrients introduced into the water body. This situation should settle down once upstream construction activities are complete.

Management of green waste

Appropriate methods should be implemented to dispose of green waste, including

- The development of wildlife piles
- On- or off-site composting
- Disposal to landfill

REMEDIAL MAINTENANCE

Structure rehabilitation/repair

There will come a time with most SUDS techniques when a major overhaul of the system is required to remove clogged filters, geotextiles, gravel etc. This will typically be between 10 and 25 years, depending on the technique and factors such as the type of catchment and sediment load. For example the use of geotextiles close to the surface in pervious surfaces traps the majority of sediment in a relatively easily accessible location. Reconstruction of the surface layer and bedding layer is all that is required, rather than reconstruction of the whole pavement depth.

Major overhaul is most likely to be required on techniques that rely on filtration through soils or aggregates, such as sand filters and infiltration devices. Other SUDS techniques are unlikely to need major overhaul if routine maintenance is undertaken as required (for example ponds and wetlands).

Rehabilitation activities for each SUDS component are described on the following tables.

Infiltration surface rehabilitation

In the event that grassed surface permeability has reduced, there are a number of landscape techniques that can be used to open the surface to encourage infiltration. Such activities are not commonplace and are likely to be required only in circumstances where silt has not been effectively managed upstream.

1. Scarifying to remove “thatch”. Thatch is a tightly intermingled organic layer of dead and living shoots, stems and roots, developing between the zone of green vegetation and the soil surface. Scarifying with tractor-drawn or self-propelled equipment to a depth of at least 50 mm breaks up silt deposits, removes dead grass and other organic matter and relieves compaction of the soil surface.
2. Spiking or tining the soil, using aerating equipment to encourage water percolation. This is particularly effective if followed by top dressing with a medium to fine sand, and is best undertaken when the soil is moist. Spiking or tining with tractor drawn or self-propelled equipment penetrates and perforates soil layers to a depth of at least 100 mm (at 100 mm centres) and allows the entry of air, water, nutrients and top dressing materials.
3. As a last resort, it may be necessary to remove and replace the grass and topsoil by:
 - removing accumulated silt and (subject to a toxicity test) applying to land or dispose of to landfill
 - removing damaged turf which should be composted
 - cultivating remaining topsoil to required levels
 - re turfing (using turf of a quality and appearance to match existing) or reseeded (to BS 7370: Part 3, Clause 12.6 (BSI, 1991) using seed to match existing turf) area to required levels. It may be necessary to supply and fix fully biodegradable coir blanket to protect seeded soil. Turf and seeded areas should be top dressed with fine sieved topsoil to BS 3882 (BSI, 1994) to achieve final design levels. Watering will be required to promote successful germination and/or establishment.

Water butts operation and maintenance

Maintenance schedule	Required action	Frequency
Regular maintenance	Cleaning of tank, inlets, outlets, gutters, withdrawal devices and roof drain filters of silts and other debris..	Annually (or following poor performance).
Occasional maintenance	Replacement of any filters.	As required
Remedial actions	Repair of erosion damage, or damage to tank.	As required
Monitoring	Inspection of the tank for debris and sediment build up.	Annually (or following poor performance).
	Inspection of inlets, outlets and withdrawal devices.	Annually (or following poor performance).
	Inspection of areas receiving overflow, for evidence of erosion.	After extreme storms.
	Inspection of roof drain filters	Annually (or following poor performance).

Trenches operation and maintenance

Maintenance schedule	Required action	Frequency
Regular maintenance	Litter and debris removal from trench surface, access chambers and pre-treatment devices.	Monthly (or as required).
	Removal and washing of exposed stones on the trench surface.	Annual (bi-annual the first year) or when silt is evident on the surface.
	Trimming any roots that may be causing blockages	Annual (semi-annual the first year).
	Remove weeds on the trench surface.	Monthly (at start, then as required)
Occasional maintenance	Removal of sediment from pre-treatment devices.	Six monthly.
	Remove tree roots or trees that grow close to the trench.	As required.
	At locations with high pollution loads, remove surface geotextile and replace, and wash or replace filter media.	Five yearly.
Remedial actions	Clear perforated pipework of blockages.	As required
	Rehabilitate infiltration or filtration surfaces.	As required
	Replace geotextiles and clean and replace filter media, if clogging occurs.	As required
	Excavate trench walls to expose clean soils if infiltration performance reduces to unacceptable levels.	As required
	Inspect inlets, outlets and inspection points for blockages, clogging, standing water and structural damage.	Monthly in the first year and then annually.
Monitoring	Inspect pre-treatment systems, inlets, trench surfaces and perforated pipework for silt accumulation. Establish appropriate silt removal frequencies.	Half yearly.

Sediment testing may be required before sediment excavation to determine its classification and appropriate disposal methods. For industrial site runoff sediment testing will be essential. In the majority of cases, it will be acceptable to distribute the sediment on-site if there is an appropriate safe and acceptable location to do so.

Pervious pavement operation and maintenance

Maintenance schedule	Required action	Frequency
Regular maintenance	Brushing and vacuuming.	Three times/year at end of winter, mid-summer, after autumn leaf fall, or as required based on site-specific observations of clogging or manufacturers' recommendations.
Occasional maintenance	Stabilise and mow contributing and adjacent areas.	As required
	Removal of weed.	As required
Remedial actions	Remediate any landscaping which, through vegetation maintenance or soil slip, has been raised to within 50 mm of the level of the paving.	As required
	Remedial work to any depressions, rutting and cracked or broken blocks considered detrimental to the structural performance or a hazard to users.	As required
	Rehabilitation of surface and upper sub-structure.	As required (if infiltration performance is reduced as a result of significant clogging).
Monitoring	Initial inspection.	Monthly for 3 months after installation.
	Inspect for evidence of poor operation and/or weed growth. If required take remedial action.	3-monthly, 48 h after large storms.
	Inspect silt accumulation rates and establish appropriate brushing frequencies.	Annually
	Monitor inspection chambers.	Annually

Appendix D

CONDITIONS AND LIMITATIONS OF FLOOD RISK ASSESSMENT & DRAINAGE STRATEGIES

October 2020

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