soils LIMITED

Main Investigation Report

at
St Mary's Parish Centre, Alverstoke, Gosport, Hampshire PO12 2ET

for
Plum Architects

Reference: 19001/MIR_R27
May 2021

Control Document

Project
St Mary's Parish Centre, Alverstoke, Gosport, Hampshire PO12 2ET

Document Type
Main Investigation Report

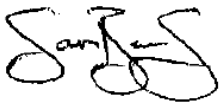
Document Reference
19001_R27

Document Status
Final

Date
May 2021

Prepared by
J Hills BSc (Hons) MIEnvSc MISoilSci

First check by
S J Bevins BSc (Hons), MSc, CEng, CEnv, MIMMM, FGS, RoGEP
(sb@soilslimited.co.uk)



Second check by
Eur Ing R B Higginson BSc, PGDip, CEng, MICE, FGS.

This is not a valid document for use in the design of the project unless it is titled Final in the document status box.

Current regulations and good practice were used in the preparation of this report. The recommendations given in this report must be reviewed by an appropriately qualified person at the time of preparation of the scheme design to ensure that any recommendations given remain valid in light of changes in regulation and practice, or additional information obtained regarding the site.

Commission

Soils Limited was commissioned by Plum Architects to undertake an intrusive ground investigation and prepare a Main Investigation Report on land at St Mary's Parish Centre, Alverstoke, Gosport, Hampshire PO12 2ET. The scope of the investigation was outlined in the Soils Limited quotation reference Q23645 dated 4th November 2020.

This document comprises the Main Investigation Report and incorporates the results, discussion and conclusions to this intrusive works.

This Main Investigation Report must be read in conjunction with the Preliminary Investigation Report undertaken on the above site by Soils Limited, Report ref: 19001/PIR, dated March 2021.

Standards

The site works, soil descriptions and geotechnical testing was undertaken in accordance with the following standards:

- BS 5930:2015 and BS EN ISO 22476-2 2005+A1:2011
- BS EN 1997-1:2004+A1:2013 Eurocode 7.
- BS EN ISO 14688-1:2018
- BS EN ISO 14688-2:2018
- BS 1377:1990 Parts 1 to 8
- BRE SD1: 2005: Concrete in Aggressive Ground
- BSI Code of Practice for Foundations, BS 8004:2015
- BS 1377: 1990: Parts 1 to 8
- NHBC Standards 2021
- BRE Digest 240
- BS 10175:2011+A1:2013 - Investigation of potentially contaminated sites
- SP1010: Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination December 2014

The geotechnical laboratory testing was performed by GEO Site & Testing Services Ltd (GSTL) in accordance with the methods given in BS 1377:1990 Parts 1 to 8 and their UKAS accredited test methods.

For the preparation of this report, the relevant BS code of practice was adopted for the geotechnical laboratory testing technical specifications, in the absence of the relevant Eurocode specifications (ref: ISO TS 17892).

The chemical analyses were undertaken by Derwentside Environmental Testing Services (DETS) in accordance with their UKAS and MCERTS accredited test methods or their documented in-house testing procedures. This investigation did not comprise an environmental audit of the site or its environs.

Trial hole is a generic term used to describe a method of direct investigation. The term trial pit, borehole or window sample borehole implies the specific technique used to produce a trial hole.

Contents

List of Figures

List of Tables

List of Appendices

Section 1 Introduction

1.1 Objective of Investigation

Soils Limited was commissioned by Plum Architects to undertake an intrusive ground investigation and to prepare a Main Investigation Report to supply the client and their designers with information regarding ground conditions, to assist in preparing a foundation scheme for development that was appropriate to the settings present on the site.

The investigation was to be undertaken to provide comment on appropriate foundation options for the proposed development. The investigation was to be made by means of in-situ testing and geotechnical laboratory testing undertaken on soil samples taken from the trial holes.

Soil samples were taken for chemical laboratory testing to enable recommendations for the safe redevelopment of the site and the protection of site workers, end-users and the public from any contamination identified as dictated by the Conceptual Site Model (CSM) in the Preliminary Investigation Report undertaken for the site by Soils Limited (Report ref: 19001/PIR, dated March 2021) and/or the Revised Conceptual Site Model presented in Appendix C.1.

1.2 Location

The site was located at St Mary's Parish Centre, Alverstoke, Gosport, Hampshire PO12 2ET and had an approximate O.S Land Ranger Grid Reference of SZ 60082 98884.

The site location plan is given in Figure 1.

1.3 Site Description

The site is currently occupied by the St Mary's Parish Centre, a single storey, flat roofed community hall. Two sheds are recorded onsite, one adjacent to the main building to the west and a further one located on the north west corner.

The site covering comprises soft landscaping across much of the site outside of the building footprint. Small gravel car park is in the southeast corner. Juvenile trees and mature bushes and shrubs are located on all boundaries. Two further small trees are in the north gardens. The site topography is noted to be flat with no noticeable changes.

An aerial photograph of the site and its environs has been included in Figure 2.

1.4 Proposed Development

The proposal comprised the demolition of the existing parish centre and the construction of a new, larger facility. The proposed comprised a two storey building housing two full height function halls, facilities, offices and storerooms.

Areas of soft landscaping were situated surrounding the main building with footpaths located to the north and east. Areas of vehicle parking were located to the west. No private gardens or areas identified for the growing of produce were shown on the drawings.

In compiling this report reliance was placed on drawings PA17-138-12 Site Layout GA v2020, dated September 2018 and was prepared by Plum Architects. The recommendations provided within this report are made exclusively in relation to the scheme outlined above and must not be applied to any other scheme without further consultation with Soils Limited. Soils Limited must be notified about any change or deviation from the scheme outlined.

Development plans provided by the client are presented in Appendix D.

1.5 Anticipated Geology

The 1:50,000 BGS Geology map showed the site to be situated on the bedrock of the Selsey Sand Formation, with overlying superficial deposits of River Terrace Deposits .

1.5.1 River Terrace Deposits

The rivers Test and Itchen have deposited extensive spreads of River Terrace Deposits in the Southampton area, representative of ancient floodplains. In total, eleven terraces have been recorded. The River Terrace Deposits consist predominantly of gravels made up of subangular to subrounded flints with a significant sand component locally with lenses of silt, clay or peat.

The five highest terraces have appreciable clay content. Poorly sorted, clayey and sandy silts and silty clays overlie the 1st, 3rd, 5th and 6th terraces and locally at above terrace gravels.

1.5.2 Selsey Sand Formation

The Selsey Sand Formation comprises laminated clay, typically wavy to lenticular bedded sand interbedded with clay in equal proportions, and fine to medium grained sparsely glauconitic sand with laminae and intercalations of clay.

1.6 Limitations and Disclaimers

This Main Investigation Report relates to the site located at St Mary's Parish Centre, Alverstoke, Gosport, Hampshire PO12 2ET and was prepared for the sole benefit of

Plum Architects (The "Client"). The report was prepared solely for the brief described in Section 1.1 of this report.

The contents, recommendations and advice given in the report are subject to the Terms and Conditions given in Quotation Q23645 Dated 4th November 2020 accepted by the client.

Soils Limited disclaims any responsibility to the Client and others in respect of any matters outside the scope of the above.

This report has been prepared by Soils Limited, with all reasonable skill, care and diligence within the terms of the Contract with the Client, incorporation of our General Conditions of Contract of Business and taking into account the resources devoted to us by agreement with the Client.

The report is personal and confidential to the Client and Soils Limited accept no responsibility of whatever nature to third parties to whom this report, or any part thereof, is made known. Any such party relies on the report wholly at its own risk.

The Client may not assign the benefit of the report or any part to any third party without the written consent of Soils Limited.

The ground is a product of continuing natural and artificial processes. As a result, the ground will exhibit a variety of characteristics that vary from place to place across a site, and also with time. Whilst a ground investigation will mitigate to a greater or lesser degree against the resulting risk from variation, the risks cannot be eliminated.

The investigation, interpretations, and recommendations given in this report were prepared for the sole benefit of the client in accordance with their brief. As such these do not necessarily address all aspects of ground behaviour at the site.

Current regulations and good practice were used in the preparation of this report. An appropriately qualified person must review the recommendations given in this report at the time of preparation of the scheme design to ensure that any recommendations given remain valid in light of changes in regulation and practice, or additional information obtained regarding the site.

The depth to roots and/or of desiccation may vary from that found during the investigation. The client is responsible for establishing the depth to roots and/or of desiccation on a plot by plot basis prior to the construction of foundations. Supplied site surveys may not include substantial shrubs or bushes and is also unlikely to have data or any trees, bushes or shrubs removed prior to or following the site survey.

Where trees are mentioned in the text this means existing trees, substantial bushes or shrubs, recently removed trees (approximately 20 years to full recovery on cohesive soils) and those planned as part of the site landscaping).

It should be noted that a detailed survey of the possible presence or absence of invasive species, such as Japanese Knotweed, is outside of the scope of investigation.

Ownership of land brings with it onerous legal liabilities in respect of harm to the environment. "Contaminated Land" is defined in Section 57 of the Environment Act 1995 as:

"Land which is in such a condition by reason of substances in, on or under the land that significant harm is being caused or that there is a significant possibility of such harm being caused or that pollution of controlled waters is being, or is likely to be caused".

The investigation, analysis or recommendations in respect of contamination are made solely in respect of the prevention of harm to vulnerable receptors, using where possible best practice at the date of preparation of the report. The investigation and report do not address, define or make recommendations in respect of environmental liabilities. A separate environmental audit and liaison with statutory authorities is required to address these issues.

Section 2 Site Works

2.1 Proposed Project Works

The proposed intrusive investigation was designed to provide information on the ground conditions and to aid the design of foundations for the proposed development. The intended investigation, as outlined within the Soils Limited quotation (Q23645, dated 4th November 2020), was to comprise the following items:

- 4No. up to 4m deep windowless sampler boreholes
- 4No. up to 6m deep dynamic probes
- Geotechnical laboratory testing
- Chemical laboratory testing*
- Interpretive reporting

2.1.1 Actual Project Works

The actual project site works were undertaken on 13th February 2021, with subsequent testing and report writing thereafter, and comprised:

- 4No. Windowless sampler boreholes (WS01 to WS04)
- 4No. Dynamic probes (DP01 to DP04)
- Geotechnical laboratory testing
- Chemical laboratory testing*
- Interpretive reporting

Note: * This was originally included as a Rate Only, but was commissioned following the findings of the investigation.

Following completion of site works, soil cores were logged and sub-sampled so that samples could be sent to the laboratory for both contamination and geotechnical testing.

All trial hole locations have been presented in Figure 3.

2.2 Ground Conditions

On 13th February 2021 four windowless sampler boreholes (WS01 to WS04) were drilled, using a Premier Compact 110 Series windowless sampler and dynamic probing rig, to depths ranging between 2.00m and 2.90m below ground level (bgl).

Four super heavy dynamic probes, (DP01 to DP04) were driven prior and adjacent to their corresponding windowless sampler borehole to depths ranging between 2.60m and 6.00m bgl.

Depths achieved in the windowless sampler boreholes and dynamic probes were limited by the dense gravels encountered underlying the site.

All windowless sampler boreholes were backfilled with bentonite.

The maximum depths of trial holes have been included in Table 2.1.

All trial holes were scanned with a Cable Avoidance Tool (C.A.T.) and GENNY prior to excavation to ensure the health and safety of the operatives.

Table 2.1 Final Depth of Trial Holes

Trial Hole	Depth (m bgl)	Trial Hole	Depth (m bgl)
WS01	2.30	DP01	6.00
WS02	2.00	DP02	6.00
WS03	2.00	DP03	2.60
WS04	2.90	DP04	6.00

The approximate trial hole locations are shown on Figure 3.

The soil conditions encountered were recorded and soil sampling commensurate with the purposes of the investigation was carried out. The depths given on the trial hole logs and quoted in this report were measured from ground level.

The soils encountered from immediately below ground surface have been described in the following manner. Where the soil incorporated an organic content such as either decomposing leaf litter or roots, or has been identified as part of the in-situ weathering profile, it has been described as Topsoil both on the logs and within this report. Where man has clearly either placed the soil, or the composition altered, with say greater than an estimated 5% of a non-natural constituent, it has been referred to as Made Ground both on the log and within this report.

For more complete information about the soils encountered within the general area of the site reference should be made to the detailed records given within Appendix A, but for the purposes of discussion, the succession of conditions encountered in the trial holes in descending order can be summarised as:

Made Ground (MG)
River Terrace Deposits (RTD)
Selsey Sand Formation (SLSY)

The ground conditions encountered in the trial holes are summarised in Table 2.2.

Table 2.2 Ground Conditions

Strata	Epoch	Depth Encountered (m bgl)		Typical Thickness (m)	Typical Description
		Top	Bottom		
MG	Anthropocene	G.L.	0.50–2.50	0.60	Soft dark brown silty slightly sandy, slightly gravelly CLAY, locally with fragments of brick, limestone and ash.
RTD	Holocene	0.50–2.50	2.00[1]–2.90[1] (2.60[1]–4.70)[3]	(3.50), where proven	Cohesive: soft greyish brown silty, sandy, slightly gravelly CLAY. Granular: yellowish brown, slightly clayey, very sandy GRAVEL. Gravel was angular to well rounded, fine to coarse flint.
SLSY	Eocene	(4.0)4.70)[3]	(6.00)[3]	Not proven[2]	Not directly encountered

Note: [1] Final depth of trial hole. [2] Base of strata not encountered. [3] Inferred from DP

2.3 Ground Conditions Encountered in Trial Holes

The ground conditions encountered in trial holes have been described below in descending order. The engineering logs are presented in Appendix A.1.

2.3.1 Made Ground

Soils described as Made Ground were encountered in all four trial holes from ground level to depths ranging between 0.50m and 2.50m bgl.

The Made Ground typically comprised soft dark brown silty slightly sandy, slightly gravelly CLAY. Gravel was angular to sub-rounded fine to coarse flint, with rare brick, limestone and ash.

The depths of Made Ground have been included in Table 2.3.

Table 2.3 Final Depth of Made Ground

Trial Hole	Depth (m bgl)
WS/DP01	0.70
WS/DP02	0.60
WS/DP03	0.50
WS/DP04	2.50

2.3.2 River Terrace Deposits

Soils described as River Terrace Deposits were encountered in each of the borehole from directly beneath the Made Ground to their base at depths ranging between 2.00m and 2.90m bgl. The River Terrace Deposits typically comprised a cohesive horizon directly underlying the Made Ground, underlain by a granular horizon to the base of the unit.

The cohesive soils were typically encountered to depths ranging between 1.60m and 2.00m bgl and comprised soft greyish brown silty, sandy, slightly gravelly

CLAY. Gravel was angular to sub-angular, fine to coarse flint. The cohesive River Terrace Deposits were not identified within WS04 due to depth of Made Ground encountered (2.50m bgl).

The granular soils of the River Terrace Deposits were encountered underlying, and typically comprised yellowish brown, slightly clayey, very sandy GRAVEL. Gravel was angular to well rounded, fine to coarse flint.

The depth of River Terrace Deposits has been included in Table 2.4.

Table 2.4 Final Depth of River Terrace Deposits

Trial Hole	Depth (m bgl)
WS / DP01	2.30[I] / 4.50
WS / DP02	2.00[I] / 4.20
WS / DP03	2.00[I] / 2.60[I]
WS / DP04	2.90[I] / 4.70

Note: [I] Final depth of trial hole.

2.3.3 Selsey Sand Formation

The Selsey Sand Formation was not directly encountered during the investigation but was inferred within three of the dynamic probe holes (DP01, DP2 and DP04).

The Selsey Sand Formation normally comprises sand interbedded with clay.

2.4 Roots

Roots were encountered in all four trial holes at depths ranging between 1.35m and 2.50m bgl. The depths of root penetration have been included in Table 2.5.

Table 2.5 Depth of Root Penetration

Trial Hole	Depth (m bgl)
WS01	1.70
WS02	1.35
WS03	1.50
WS04	2.50

Roots may be found to greater depth at other locations on the site particularly close to trees and/or trees that have been removed both within the site and its close environs. Juvenile trees and mature bushes and shrubs are located on all boundaries. Two further small trees are in the north gardens

It must be emphasised that the probability of determining the maximum depth of roots from a narrow diameter borehole is low. A direct observation such as from within a trial pit is necessary to gain a better indication of the maximum root depth.

2.5 Groundwater

Groundwater was not encountered during the investigation.

Changes in groundwater level occur for reasons including seasonal effects and variations in drainage. The investigation was conducted in February (2021) when groundwater levels should be rising from their annual minimum (lowest) elevation, which typically occurs around September to the annual maximum (highest) which typically occurs around March.

Groundwater equilibrium conditions may only be conclusively established, if a series of observations are made via groundwater monitoring wells, which was beyond the scope of this investigation.

Section 3 Discussion of Geotechnical In-Situ and Laboratory Testing

3.1 Dynamic Probe Tests

Dynamic probing (DPSH) was undertaken at four locations (DP01 to DP04) adjacent and prior to the drilling of WS1 to WS04 to depths ranging between 2.60m and 6.00m bgl. The results were converted to equivalent SPT "N60" values based on dynamic energy using commercial computer software (Geostru). The results were then interpreted based on the classifications outlined in Appendix B.1,Table B.1.1 to Table B.1.2.

The SPT "N60" values presented have been corrected in accordance with BS EN 22476 Part 3, to account for the rig hammer efficiency, borehole depth, overburden factors etc. Further correction of the 'N' values should therefore not be necessary. The energy ratio of the drilling rig was 80.28%. The energy ratio for each location is presented on the individual logs within Appendix A.1.

The River Terrace Deposits recorded equivalent SPT "N60" values between 0 and 11 within cohesive beds and 12 to >50 in granular beds. The cohesive beds were classified as extremely low to medium strength with an inferred undrained cohesive strength of <10kPa to 55kPa. The underlying granular beds were classified as medium dense to very dense relative density.

The Selsey Sand Formation recorded equivalent SPT "N60" values ranging between 8 and 23. As the Selsey Sand Formation was not directly encountered, the soil types are unknown. If cohesive, the beds were classified as medium to high strength with an inferred undrained cohesive strength of 40kPa to 115kPa. If granular, the beds were classified as loose to medium dense relative density.

A full interpretation of the DPSH tests are outlined in Appendix B.2, Table B.2.1.

3.2 Atterberg Limit Tests

Atterberg Limit tests were performed on three samples obtained from the cohesive soils of the River Terrace Deposits and one from the granular soils of the River Terrace Deposits. The results were classified in accordance with BRE Digest 240 and NHBC Standards Chapter 4.2.

The cohesive soils of the River Terrace Deposits were classified as low to medium volume change potential in accordance with BRE Digest 240 and none to medium volume change potential in accordance with NHBC Standards Chapter 4.2.

The sample taken from the granular soils of the River Terrace Deposits was classified as low volume change potential in accordance with both BRE Digest 240 and NHBC Standards Chapter 4.2. It must be noted that the sample (WS01:1.80m) also recorded 38% Silt and Clay, and technically could be described as cohesive in accordance with BS5930:2015.

A full interpretation of the Atterberg Limit tests are outlined in Table B.2.2, Appendix B.2 and the laboratory report in Appendix B.3.

3.3 Particle Size Distribution Tests

Particle Size Distribution (PSD) tests were performed on three samples from the granular soils of the River Terrace Deposits, including WS01:1.80m.

The PSD tests classified the granular beds of the River Terrace Deposits as having a volume change potential in accordance BRE Digest 240 in two of the three samples. The results from grading analysis also classified that one of the samples tested had a volume change potential in accordance with NHBC Standards Chapter 4.2. It must be noted that this sample (WS01:1.80m) had very high fines content. It is considered that the dominantly granular soils of the River Terrace Deposits, which record a much lower proportion of fines, had no volume change potential.

A full interpretation of the PSD tests are outlined in Table B.2.3, Appendix B.2 and the laboratory report in Appendix B.3.

3.4 Sulphate and pH Tests

Two samples were taken from the River Terrace Deposits for water soluble sulphate (2:1) and pH testing in accordance with Building Research Establishment Special Digest 1, 2005, 'Concrete in Aggressive Ground'.

The tests recorded water soluble sulphate between <10mg/l and 11mg/l with pH values of 7.7 to 7.8.

The significance of the sulphate and pH Test results are discussed in Section 4.4 and the laboratory report in Appendix B.3.

Section 4 Foundation Design

4.1 General

An engineering appraisal of the soil types encountered during the site investigation and likely to be encountered during the redevelopment of this site is presented. Soil descriptions are based on analysis of disturbed samples taken from the trial holes.

4.1.1 Made Ground

The terms *Fill* and *Made Ground (non-engineered fill)* are used to describe material, which has been placed by man either for a particular purpose e.g. to form an embankment, or to dispose of unwanted material. For the former use, the Fill and/or Made Ground may well have been selected for the purpose and placed and compacted in a controlled manner. With the latter, great variations in material type, thickness and degree of compaction invariably occur and there can be deleterious or harmful matter, as well as potentially methanogenic organic material.

The BSI Code of Practice for Foundations, BS 8004:2015, Clause 4.1.2.2 states, *'Spread foundations should not be placed on non-engineered fill unless such use can be justified on the basis of a thorough ground investigation and detailed design.'*

Soils described as Made Ground were encountered in all four trial holes from ground level to depths ranging between 0.50m and 2.50m bgl. The Made Ground typically comprised soft dark brown silty slightly sandy, slightly gravelly CLAY. Gravel was angular to sub-rounded fine to coarse flint, with rare brick, limestone and ash.

A result of the inherent variability, particularly of uncontrolled Fill and/or Made Ground is that it is usually unpredictable in terms of bearing capacity and settlement characteristics. Foundations should, therefore, be taken through any Made Ground and either into, or onto a suitable underlying natural stratum of adequate bearing characteristics.

4.1.2 River Terrace Deposits

Soils described as River Terrace Deposits were encountered in each of the borehole from directly beneath the Made Ground to their base at depths ranging between 2.00m and 2.90m bgl. The River Terrace Deposits typically comprised a cohesive horizon directly underlying the Made Ground, underlain by a granular horizon to the base of the unit.

The cohesive soils were typically encountered to depths ranging between 1.60m and 2.00m bgl and comprised soft greyish brown silty, sandy, slightly gravelly CLAY. Gravel was angular to sub-angular, fine to coarse flint. The cohesive River Terrace Deposits were not identified within WS04 due to depth of Made Ground encountered (2.50m bgl).

The granular soils of the River Terrace Deposits were encountered underlying, and typically comprised yellowish brown, slightly clayey, very sandy GRAVEL. Gravel was angular to well rounded, fine to coarse flint.

The results from DPSH testing inferred that the cohesive soils of the River Terrace Deposits were of an **extremely low to medium strength** with an inferred undrained cohesive strength of **<10kPa to 55kPa**. It must be noted that low blow counts (0-1) were recorded within the cohesive River Terrace Deposits, to depths of up to 1.80m bgl.

The underlying granular beds were classified as medium dense to very dense relative density.

The results from Atterberg Limits tests confirmed that the cohesive soils of the River Terrace Deposits had **low to medium volume change potential** in accordance with BRE Digest 240 and **none to medium volume change potential** in accordance with NHBC Standards Chapter 4.2.

Soils of the River Terrace Deposits are normally consolidated cohesive soil and granular dominant soils, in this case. The cohesive soils are expected to display low bearing capacities with moderate to high settlement characteristics. The granular soils are expected to display moderate to high bearing capacities with low to moderate settlement characteristics. The soils of the River Terrace Deposits were considered a suitable bearing stratum for the proposed development, provided foundations are taken into the granular soils.

4.1.3 Selsey Sand Formation

The Selsey Sand Formation was not directly encountered during the investigation, but was inferred within three of the dynamic probe holes (DP01, DP2 and DP04).

The Selsey Sand Formation normally comprises sand interbedded with clay.

The Selsey Sand Formation recorded equivalent SPT "N60" values ranging between 8 and 23. As the Selsey Sand Formation was not directly encountered, the soil types are unknown. If cohesive, the beds were classified as medium to high strength with an inferred undrained cohesive strength of 40kPa to 115kPa. If granular, the beds were classified as loose to medium dense relative density.

The Selsey Sand Formation comprises an interbedded sand and clay and is likely to display low to moderate bearing capacities and moderate to high settlement characteristics, depending on the fines content. The Selsey Sand Formation is likely to be a suitable bearing stratum for the proposed development, but given the depth encountered, a piled foundation solution would be required.

4.1.4 Roots

Roots were encountered in all four trial holes at depths ranging between 1.35m and

2.50m bgl. Roots may be found to greater depth at other locations on the site particularly close to trees and/or trees that have been removed both within the site and its close environs. Juvenile trees and mature bushes and shrubs are located on all boundaries. Two further small trees are located in the north gardens.

4.1.5 Groundwater

Groundwater was not encountered during the investigation.

Changes in groundwater level occur for reasons including seasonal effects and variations in drainage. The investigation was conducted in February (2021) when groundwater levels should be rising from their annual minimum (lowest) elevation, which typically occurs around September to the annual maximum (highest) which typically occurs around March.

4.2 Foundation Scheme General

The proposal comprised the demolition of the existing parish centre and the construction of a new, larger facility. The proposed comprised a two storey building housing two full height function halls, facilities, offices and storerooms.

Areas of soft landscaping were situated surrounding the main building with footpaths located to the north and east. Areas of vehicle parking were located to the west. No private gardens or areas identified for the growing of produce were shown on the drawings.

In compiling this report reliance was placed on drawings PA17-138-12 Site Layout GA v2020, dated September 2018 and was prepared by Plum Architects. The recommendations provided within this report are made exclusively in relation to the scheme outlined above and must not be applied to any other scheme without further consultation with Soils Limited. Soils Limited must be notified about any change or deviation from the scheme outlined.

Development plans provided by the client are presented in Appendix D.

4.2.1 Guidance on Shrinkable Soils

The Building Research Establishment (BRE) Digests 240, 241 and 242 provide guidance on 'best practice' for the design and construction of foundations on shrinkable soils.

The results from Atterberg Limits Tests showed that the cohesive soils of the River Terrace Deposits, to depths of 1.60 to 2.00m bgl at the sampling locations, had **low to medium volume change potential** in accordance with both BRE Digest 240 and NHBC Standards Chapter 4.2.

Medium volume change potential must therefore be adopted where foundations pass through the cohesive River Terrace Deposits into the granular no volume

change potential soils of the granular River Terrace Deposits.

The depth to roots and/or of desiccation may vary from that found during the investigation. The client is responsible for establishing the depth to roots and/or of desiccation on a plot by plot basis to establish an appropriate founding depth prior to the construction of foundations. This must take account of trees, substantial bushes and hedgerows that are to remain, those that have already been removed or are to be removed or those that are to be planted as part of the site landscaping. When trees are felled it can take up to twenty years for desiccation caused by roots to recover. Supplied site surveys may not include substantial shrubs or bushes and is also unlikely to have data or any trees, bushes or shrubs removed prior to or following the site survey.

The BRE Digest 241 states: *"An increasingly common, potentially damaging situation is where trees or hedges have been cut down prior to building. The subsequent long-term swelling of the zone of clay desiccated by the roots, as moisture slowly returns to the ground, can be substantial. The rate at which the ground recovers is very difficult to predict and if there is any doubt that recovery is complete then bored pile foundations with suspended beams and floors should be used".*

The stated intention of the NHBC is to ensure that shrinkage and swelling of plastic soils does not adversely affect the structural integrity of foundations to such a degree that remedial works would be required to restore the serviceability of the building. It must be borne in mind that adherence to the NHBC tables and design recommendations may not, in all cases, totally prevent foundation movement and cracking of brickwork might occur.

The BRE Digest 240 suggests: *"Two courses of action are open:*

Estimate the potential for swelling or shrinkage and try to avoid large changes in the water content, for example by not planting trees near the foundations.

Accept that swelling or shrinkage will occur and take account of it. The foundations can be designed to resist resulting ground movements or the superstructure can be designed to accommodate movement without damage."

The design of foundations suitable to withstand movements is presented in BRE Digest 241 "Low-rise buildings on shrinkable clay soils: Part 2"

4.3 Foundation Scheme

Foundations **must not** be constructed within any Made Ground and cohesive River Terrace Deposits due to the likely variability and potential for large load induced settlements both total and differential.

Roots were encountered in all four trial holes at depths ranging between 1.35m and 2.50m bgl. If roots are encountered during the construction phase foundations **must not be placed within any live root penetrated** or desiccated **cohesive soils or those with a volume change potential**. Should the foundation excavations reveal such materials, the excavations **must** be extended to greater depth in order to bypass these unsuitable soils. Excavations must be checked by a suitable person prior to concrete being poured.

Considering the type of development, a trench foundation solution was considered the most suitable.

Although not strictly applicable to non-residential structures, the proposed development is likely to be both light and brittle. It is therefore considered that foundation design is undertaken using NHBC Standards Chapter 4.2.

4.3.1 Shallow Foundations into the River Terrace Deposits

Based on a 5.00 by 0.75m strip foundation, using commercial software Table 4.1 shows the calculated bearing values and anticipated settlement characteristics. Foundations must be taken into the granular soils of the River Terrace Deposits, with bearing capacities provided at depths accordingly. Given Made Ground was recorded to a depth of 2.50m bgl in WS04, it may be necessary to deepen foundations locally to ensure placement within suitable natural soils.

Table 4.1 Allowable Bearing Capacities within the River Terrace Deposits

Depth (m bgl)	Size (m)	Bearing Capacity (kPa)	Anticipated Settlement (mm)
1.80	5.00 x 0.75	125	15

The use of reinforced trench fill foundations is recommended at they would reduce the possibility of differential settlement affecting the foundations.

For the allowable bearing value given above, settlements should not exceed the presented values, provided that excavation bases are carefully bottomed out and blinded, or concreted as soon after excavation as possible and kept dry. The foundations design must be suitable for the conditions present at the site.

The anticipated settlement includes both elastic settlement and long-term drained settlement (in the case of cohesive soils).

Anticipated settlements may be taken as proportional to the bearing capacity adopted (for the same configuration of foundation), therefore if the bearing value is halved the anticipated settlement will halve.

All loose material and soft spots must be removed from the base of the excavations, these excavations then being either concreted or blinded as soon after excavation as possible. Failure to do so could results in increased settlements. It has been assumed that the foundations to the existing structures

have been grubbed out. Foundations must not be cast over such hard points without this being considered in the foundation design. Where foundations have been grubbed out the new foundation must be taken through the backfill material into the natural ground.

4.3.2 Ground Floor Slab

NHBC Standards 2019 states ground floors should be constructed as suspended floors where:

- *"the foundation depth dictated by the NHBC Standards 2019, Chapter 4.2.10 would exceed 1.5m bgl;"*
- *"ground floor construction is undertaken when the surface soils are seasonally desiccated;"*
- *"the depth of fill exceeds 600mm;"*
- *"there is shrinkable soil that could be subject to movement, expansive material or other unstable soils;"*
- *"the ground has been subject to vibratory improvement;" or*
- *"ground or fill is not suitable to support ground-bearing slabs."*

Given the upper soils at the site comprise Made Ground and / or cohesive River Terrace Deposits with up to medium volume change potential, suspended ground floor slabs should be adopted.

4.4 Subsurface Concrete

Sulphate concentration measured in 2:1 water/soil extracts fell into Class **DS-1** of the BRE Special Digest 1 2005, *'Concrete in Aggressive Ground'.* Table C2 of the Digest indicated ACEC (Aggressive Chemical Environment for Concrete) site classifications of **AC-1s**. The pH of the soils tested ranged between 7.7 and 7.8. The classification given was determined using the static groundwater case, in view of groundwater not being encountered. The laboratory results are presented in Appendix B.3.

Concrete to be placed in contact with soil or groundwater must be designed in accordance with the recommendations of Building Research Establishment Special Digest 1 2005, *'Concrete in Aggressive Ground'* taking into account any possible exposure of potentially pyrite bearing natural ground and the pH of the soils.

4.5 Excavations

Shallow excavations in the Made Ground and cohesive River Terrace Deposits are likely to be marginally stable in the short term at best.

Deeper excavations taken into the granular River Terrace Deposits are unlikely to be stable. Unsupported earth faces formed during excavation may be liable to collapse without warning and suitable safety precautions should therefore be taken to ensure that

such earth faces are adequately supported or battered back to a safe angle of repose.

Excavations beneath the groundwater table are likely to be unstable and dewatering of foundation trenches may be necessary.

Section 5 Determination of Chemical Analysis

5.1 Site Characterisation and Revised Conceptual Site Model

The Preliminary Investigation Report undertaken by Soils Limited (report ref: 19001/PIR dated March 2021) identified a very low to low risk of ground contamination from previous usage of the site.

The Main Investigation Report identified Made Ground to depths ranging between 0.50m and 2.50m bgl. The Made Ground typically comprised soft dark brown silty slightly sandy, slightly gravelly CLAY. Gravel was angular to sub-rounded fine to coarse flint, with rare brick, limestone and ash.

Aside from the secondary constituents noted, no visual or olfactory indicators of contamination were noted.

Superficial deposits of River Terrace Deposits were encountered underlying the Made Ground. Shallow groundwater was not encountered during the site investigation. The conceptual site model was updated to take account of the above findings and is presented in Appendix C.1.

5.2 Soil Sampling

Trial hole locations were set out to provide an overview of ground conditions across the site, together with enabling the collection of samples to enable chemical characterisation of the underlying strata.

Representative samples for potential environmental testing were obtained from the trial holes at depths of between 0.20m and 2.10m to allow a representation of the materials encountered, with additional samples to be obtained if necessary, where there was visual or olfactory evidence of contamination.

The analytical testing was based on a suite of commonly occurring inorganic and organic contaminants, considering the Conceptual Site Model and the ground conditions encountered.

5.3 Determination of Chemical Analysis

The suite of chemical analyses has been based upon the findings of the Preliminary Investigation Report (PIR) and this investigation, to examine the potential sources of contamination identified in the conceptual site model. The chemical analyses were carried out on four samples prepared from the Made Ground from across the site. The nature of the analyses is detailed below:

- 4 No. Metal suites: Arsenic, Boron, Cadmium, Chromium (trivalent & hexavalent), Copper, Lead, Mercury, Nickel, Vanadium, Selenium, Zinc

- 4 No. pH values
- 4 No. Polycyclic aromatic hydrocarbons (PAH) – USEPA 16 suite
- 4 No. Organic matter contents
- 4 No. Asbestos screens
- 4 No. Monohydric Phenols
- 3 No. Texas banded Total Petroleum Hydrocarbons
- 1 No. Speciated petroleum hydrocarbons (TPH CWG)
- 1 No. BTEX including MTBE
- 1 No. 2:1 water soluble sulphate
- 1 No. PCBs (7 Congeners)

The soil testing was carried out in accordance with the MCERTS performance standard, and the results are shown in Appendix C.2, Test Report 21-01503.

Section 6 Qualitative Risk Assessment

6.1 Assessment Criteria

The assessment criteria used to determine risks to human health are derived and explained within Appendix C.3.

6.2 Representative Contamination Criteria - Soil

The proposal comprised the demolition of the existing parish centre and the construction of a new, larger facility. The proposed comprised a two storey building housing two full height function halls, facilities, offices and storerooms.

Areas of soft landscaping were situated surrounding the main building with footpaths located to the north and east. Areas of vehicle parking were located to the west. No private gardens or areas identified for the growing of produce were shown on the drawings.

In compiling this report reliance was placed on drawings PA17-138-12 Site Layout GA v2020, dated September 2018 and was prepared by Plum Architects. The recommendations provided within this report are made exclusively in relation to the scheme outlined above, and must not be applied to any other scheme without further consultation with Soils Limited. Soils Limited must be notified about any change or deviation from the scheme outlined.

Based on the proposed development, the results of the chemical analysis have been compared against generic guidance values for a '***Public Open Space within Residential Area***' end use, as presented in SP1010: Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination December 2014 (C4SL), derived for the protection of human health. Where this document has not published screening values for determinants, generic screening values derived for the same end use have been adopted from the following published guidance; DEFRA Soil Guideline Values (SGV) and LQM/CIEH/Suitable 4 Use Level (S4UL).

To assess the potential toxicity of organic determinants (Petroleum Hydrocarbons and Polyaromatic Hydrocarbons) to the human health, soils samples were analysed for Soil Organic Matter (SOM). The selected samples analysed recorded SOM values of between 0.8% and 1.6%. For each soil sample tested, the resultant Soil Organic Matter allowed for the correct comparison to be made with the appropriate guideline value for each organic determinant analysed.

Table 6.1 outlines the samples that have exceeded their relevant assessment criteria. The full laboratory report is presented in Appendix C.2.

Table 6.1 Summary of Chemical Analysis of Soils Sample Exceedance

Substance	Sample locations where C4SL or S4UL adopted were exceeded for the 'Public Open Space within Residential Area' land-use scenario
None recorded.	

Asbestos locations where material found (no threshold just presence)
None recorded.

The guideline values are assessed against the "Public Open Space within Residential Area" land-use scenario, which was considered the most appropriate land-use scenario, given the type of the proposed redevelopment.

In summary, none of the substances tested recorded concentrations above the 'Public Open Space within Residential Area' end-use screening values.

6.2.1 Asbestos

Asbestos Containing Material (ACM) was not detected in any of the samples tested. However, it is possible that asbestos is present in other areas of the site. If encountered, care must be taken to ensure any such material is separated and disposed of in an appropriate manner to a licensed waste facility.

6.3 Risk to Groundwater

The site was located on superficial deposits and bedrock classified as Secondary A Aquifers with medium vulnerability. There are no Source Protection Zones recorded on site, or abstraction points within 1000m, and the nearest surface water feature is a lake recorded 255m southeast. Overall, the hydrological and hydrogeological vulnerability of the site is considered to be low.

Given the above and in light of the results of the shallow soils analysis, the risk to groundwater is deemed to be negligible.

6.4 Risk Assessment

Risk assessments are undertaken for soil, groundwater and soil gas. The CSM has been updated to take account of the assessments below and presented in Appendix C.1. The full laboratory chemical report is presented in Appendix C.2.

6.4.1 Soils

None of the substances tested recorded concentrations above the 'Public Open Space within Residential Area' end-use screening values. Asbestos Containing Material (ACM) was not detected in any of the samples tested.

The Tier 1 Quantitative risk assessment therefore established that there was **no risk to the human health receptors** of future end-users. Suitable precautions for construction workers are required.

6.4.2 Groundwater

Given the hydrological and hydrogeological vulnerability of the site and the results of the shallow soils chemical analysis, the risk to groundwater is deemed to be negligible and no further action is considered necessary.

6.4.3 Soil Gas

The Preliminary Investigation Report identified a very low risk of soil gas associated with vapours from hydrocarbons within the Made Ground or resulting from car parking on site. Given the absence of any significantly elevated levels of hydrocarbons noted within the investigation and chemical analysis of shallow soils, the risk is deemed to be negligible.

It must be noted that Made Ground was recorded to a depth of 2.50m bgl within WS04, which could be considered a source of soil gas. However, the secondary constituents noted were generally inert with no putrescible material recorded. As such, the risk is considered to be very low, and no further assessment is deemed to be necessary, subject to comment and agreement from the local authority.

6.5 Recommendations

Soil chemical analysis and an assessment of the risks to groundwater and from soil gas have been undertaken, with no significant risks identified. As such, no further works are considered necessary with respect to contamination at the site.

The above recommendations are subject to approval from the local authority, which should be sought at the earliest opportunity.

6.6 Duty of Care

Groundworkers must maintain a good standard of personal hygiene including the wearing of overalls, boots, gloves and eye protectors and the use of dust masks during periods of dry weather.

To prevent exposure to airborne dust by both the general public and construction personnel the site should be kept damp during dry weather and at other times when dust is generated as a result of construction activities. The site should be securely fenced at all times to prevent unauthorised access.

Washing facilities should be provided and eating restricted to mess huts.

6.7 Excavated Material

Excavated material as waste must be defined or classified prior to any disposal, transport, recycling or re-use at or by an appropriately licensed or exempt carrier and/or off-site disposal facility. The requirements inherent in both Duty of Care and Health and Safety must also be complied with. In order to determine what is to happen, what is

suitable, appropriate and most effective in the disposal of wastes, especially those subject to CDM waste management plan requirements, several factors must be considered and competent advice should always be sought.

The amount, type and nature of the material to be removed will in part determine the amount and type of analysis that may be required to comply with current waste guidance, and thereby allow a competent person to suitably classify the material. Often this data is uncertain or unavailable, especially in the early stages of a project, and therefore further investigation, testing and analysis may be required as additional information regarding the development becomes available.

Wastes must be classified and defined by their solid characteristics to comply with current waste guidance. Existing information and analysis derived for environmental purposes may therefore be suitable for use in this context. Waste Acceptance Criteria (WAC) report the leachability of materials and therefore cannot be used to classify, characterise or define wastes. The only purpose of a WAC analysis is to determine the suitability of a given material for acceptance at one of the three different types of available licenced landfills (inert, stable non-reactive hazardous or hazardous).

Other options are available that may lead to significant savings against disposal to landfill and expert advice should always be sought from a competent person to advise on their relative costs or benefits and advise on any additional analysis, sampling or investigation that may be required to reduce remaining uncertainties and comply with current guidance. Further consideration of results using HazWasteOnlineTM can be undertaken on request to give an indication of potentially hazardous properties in the materials analysed.

6.8 Re-use of Excavated Material On-site

The re-use of on-site soils may be undertaken either under the Environmental Permitting Regulations 2007 (EPR), in which case soils other than uncontaminated soils are classed as waste, or under the CL:AIRE Voluntary Code of Practice (CoP) which was published in September 2008 and is accepted as an alternative regime to the EPR.

Under the EPR, material that is contaminated but otherwise suitable for re-use is also classified as waste and its re-use should be in accordance with the Environmental Permitting Regulations 2007 (EPR). Environmental Permit Exemptions (EPE) are for the re-use of non-hazardous or inert waste only; hazardous waste cannot be re-used under a permit exemption. EPE apply only to imported inert waste materials; inert material arising on site and recovered on site is not classified as waste and does not require an exemption. It is possible that materials arising on-site will be classified as inert and would not need an exemption.

Environmental Permit Exemptions are only allowed for certain activities, placing controls on the quantities that can be stored and re-used. The re-use of waste shall be within areas and levels defined in planning applications and permissions for the development.

An EPE requires a site-specific risk assessment for the receptor site to demonstrate that the materials are suitable for use, i.e. that they will not give rise to harm to human health or pollution of the environment.

Under the CL:AIRE voluntary code of practice (CoP) materials excavated on-site are not deemed contaminated if suitable for re-use at specified locations or generally within the site.

Material that may have been classified as hazardous waste under the EPR may be re-used. The CoP regime requires that a 'Qualified Person' as defined under the CoP reviews the development of the Materials Management Plan, including review of Risk Assessments and Remediation Strategy/Design Statement together with documentation relating to Planning and Regulatory issues, and signs a Declaration which is forwarded to the Environment Agency and which confirms compliance with the CoP.

Should it be necessary to import materials from another site where materials are excavated and which is not material from a quarry or produced under a WRAP protocol, then an EPE would be necessary for the imported material whether the work was managed under the CoP or the EPR.

6.9 Imported Material

Any soil, which is to be imported onto the site, must undergo chemical analysis to permit classification prior to its importation and placement in order to ascertain its status with specific regard to contamination, i.e. to prove that it is suitable for the purpose for which it is intended.

6.10 Discovery Strategy

There may be areas of contamination not identified during the course of the investigation. Such occurrences may also be discovered during the demolition and construction phases for the redevelopment of the site.

Care should be taken during excavation works especially to investigate any soils, which appear by eye (e.g. such as fibrous materials, large amounts of ash and unusual discolouration), odour (e.g. fuel, oil and chemical type odours or unusual odours such as sweet odours or fishy odours) or wellbeing (e.g. light headedness and/or nausea, burning of nasal passages and blistering or reddening of skin due to contact with soil) to be contaminated or of unusual and/or different character to standard soils or those analysed.

In the event of any discovery of potentially contaminated soils or materials, this discovery should be quarantined and reported to the most senior member of site staff or the designated responsible person at the site for action. The location, type and quantity must be recorded and the Local Authority, and a competent and appropriate third party Engineer/Environmental consultant notified immediately. An approval from the Local

authority must be sought prior to implementing any proposed mitigation action.

The discovery strategy must remain on site at all times and must demonstrate a clear allocation of responsibility for reporting and dealing with contamination. A copy of the strategy must be placed on the health and safety notice board and /or displayed in a prominent area where all site staff are able to take note of and consult the document at any time. Any member of the workforce entering the site to undertake any excavation must be made aware of the potential to discover contamination and the discovery strategy.

List of Figures

List of Appendices

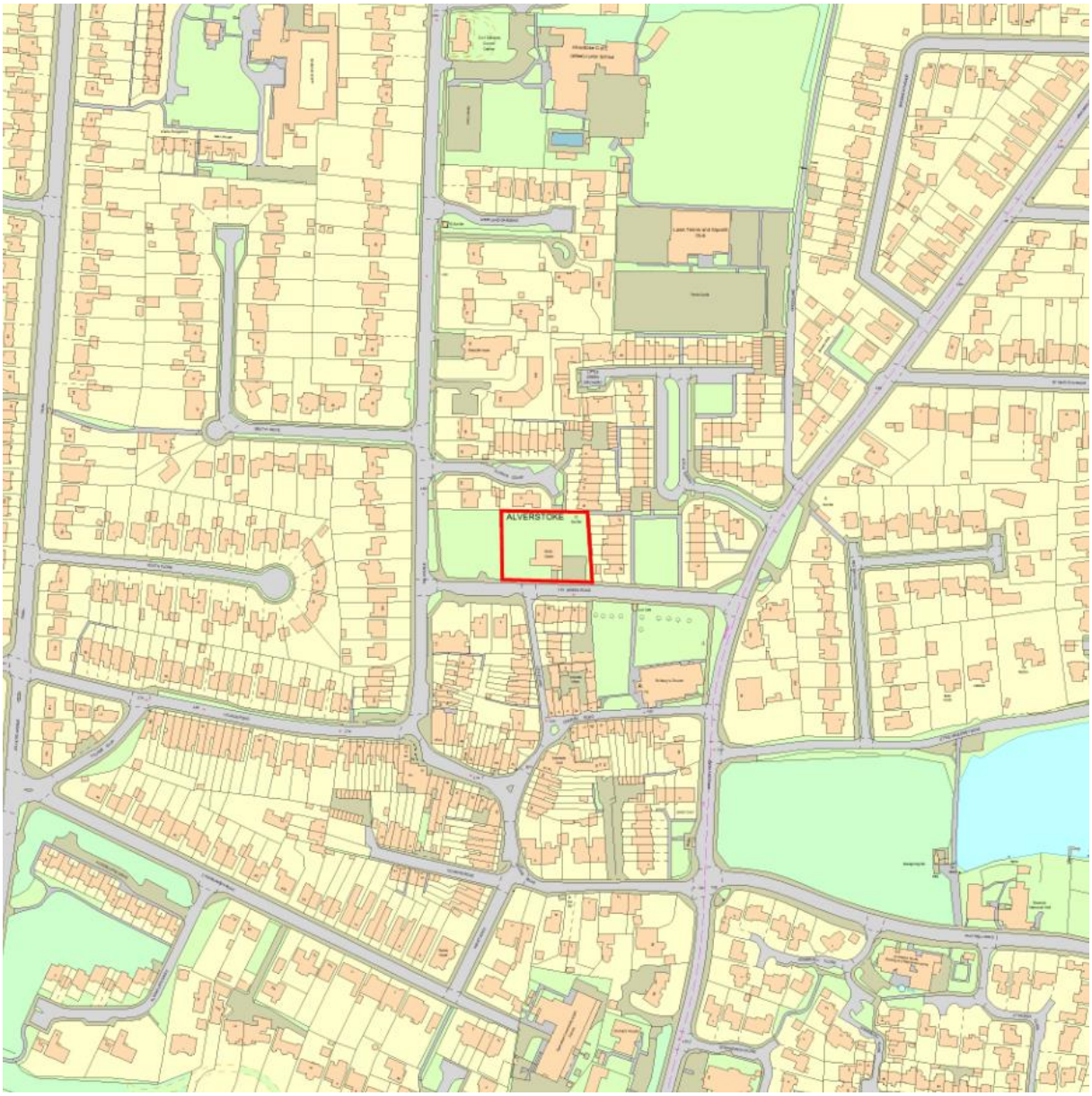


Figure 1 – Site Location Map

N

Job Number 19001	**Project** St Mary's Parish Centre, Alverstoke, Gosport, Hampshire PO12 2ET
Client Plum Architects	**Date** May 2021

Figure 2 – Aerial Photograph

Project
St Mary's Parish Centre,
Alverstoke, Gosport, Hampshire
PO12 2ET

Client
Plum Architects

Date
May 2021

Job Number
19001

Figure 3 – Trial Hole Plan

Project
St Mary's Parish Centre,
Alverstoke, Gosport, Hampshire
PO12 2ET

Client
Plum Architects

Date
May 2021

Job Number
19001

Appendix A Field Work

Appendix A.1 Engineers Logs

soils LIMITED

Contract Name:		Client:			Hole ID:
St Marys Parish Centre,		Plum Architects			**WS01**
Contract Number:	Start and End Date:	Logged By:	Checked By:	Status:	Hole Type:
19001	28/01/21	DW	JH	FINAL	**WS**
Easting:	Northing:	Ground Level:	Plant Used:	Print Date:	Scale:
				14/05/2021	1:50

Weather: Clear | Termination: Hole terminated due to dense gravel beds. | Sheet 1 of 1

Samples & In Situ Testing			Strata Details				Groundwater	
Depth	Type	Results	Level (mAOD)	Depth (m) (Thickness)	Legend	Strata Description	Water Strike	Backfill/ Installation
0.20	D ES			(0.70)		Soft dark brown, slightly sandy, slightly gravelly silty CLAY. Gravel is angular to sub-rounded, fine to coarse flint, with rare brick and clinker. Frequent rootlets and occasional woody roots. MADE GROUND. *Gravelly from 0.1 - 0.25m bgl. Woody root 4mm diameter at 0.2m bgl.*		
0.50	D ES			0.70		Soft greyish brown, slightly sandy, silty CLAY. Occasional angular to sub-angular, fine to coarse flint gravel, with a sandy gravelly lens at base of stratum. Occasional rootlets. RIVER TERRACE DEPOSITS *Sample compressed in liner from 1.0 - 1.5m bgl.*		
0.90	D ES			(1.00)				
1.50	D			1.70		Soft to firm brown and yellowish brown mottled and thinly bedded, interbedded slightly sandy silty CLAY and silty SAND. Sand is fine to medium. RIVER TERRACE DEPOSITS *Sample compressed in liner.*		
1.80	D			1.90				
1.95	D			2.00		Yellowish brown and brown mottled, slightly gravelly, SAND. Sand is predominantly coarse. Gravel is angular to sub-angular, fine to medium flint. RIVER TERRACE DEPOSITS *Thin black lamination with lignite at top of stratum.*		
2.10	D			(0.30)				
				2.30		Brown, slightly clayey, sandy GRAVEL. Gravel is angular to sub-angular, fine to coarse flint. Rare clay lenses. RIVER TERRACE DEPOSITS		
						End of Borehole at 2.30m		

1 2 3 4 5 6 7 8 9 10

Start & End of Shift Observations					Borehole Diameter		Casing Diameter	
Date	Time	Depth (m)	Casing (m)	Water (m)	Depth (m)	Dia (mm)	Depth (m)	Dia (mm)
02-02-2021	00:00			Dry				

Remarks:
Rootlets observed to 1.7m bgl.

Chiselling				Installation			
From (m)	To (m)	Duration	Remarks	Top (m)	Base (m)	Type	Dia (mm)

Water Strikes					
Strike (m)	Casing (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks
			0	0.00	No groundwater encountered.

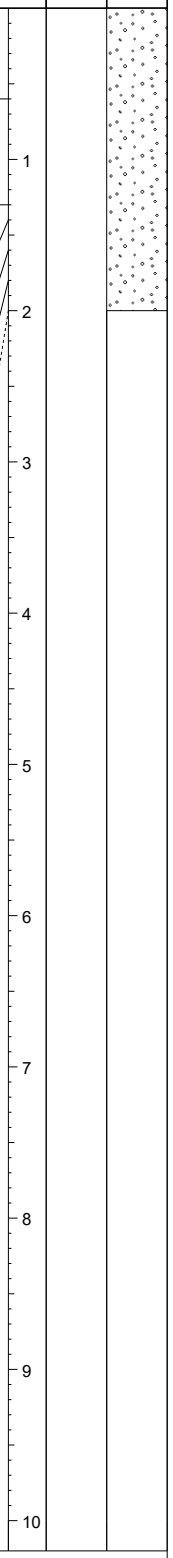
Hand vane (HV), Hand penetrometer (HP) reported in kPa. PID reported in ppm.

soils LIMITED

Contract Name:		Client:			Hole ID:
St Marys Parish Centre,		Plum Architects			**WS02**
Contract Number:	Start and End Date:	Logged By:	Checked By:	Status:	Hole Type:
19001	28/01/21	DW	JH	FINAL	**WS**
Easting:	Northing:	Ground Level:	Plant Used:	Print Date:	Scale:
				14/05/2021	1:50

Weather: Clear | Termination: Hole terminated due to dense gravel beds. | Sheet 1 of 1

Samples & In Situ Testing			Strata Details				Groundwater	
Depth	Type	Results	Level (mAOD)	Depth (m) (Thickness)	Legend	Strata Description	Water Strike	Backfill/ Installation
0.20	D			(0.60)		Soft dark brown, slightly sandy, slightly gravelly silty CLAY. Gravel is angular to sub-rounded, fine to coarse flint, rare brick, oolitic limestone and clinker. Frequent rootlets. MADE GROUND.		
0.40	ES D							
0.70	ES D			0.60		Soft slightly yellowish brown mottled, greyish brown, slightly sandy, silty CLAY. Occasional angular to sub-angular, fine to medium flint gravel. Occasional rootlets. Very rare sub-angular medium ironstone gravel. Possibly re-worked material. RIVER TERRACE DEPOSITS		
1.10	ES D			(0.70)				
1.35	ES D			1.30				
1.50	D			1.40		Firm black speckled and greyish brown mottled, yellowish brown, slightly clayey, sandy SILT. Sand is fine. Occasional coarse sand sized lignite. Irregular lower boundary. RIVER TERRACE DEPOSITS		
1.70	D			1.60		Yellowish brown, slightly clayey, very sandy GRAVEL. Gravel is angular to well rounded, fine to coarse flint. RIVER TERRACE DEPOSITS		
1.90	D			1.80		Stiff orangish brown mottled, yellowish brown, slightly sandy, silty CLAY. Sand is fine. Occasional angular fine to coarse flint gravel. RIVER TERRACE DEPOSITS		
				2.00		Orangish brown mottled, yellowish brown, slightly silty, very sandy GRAVEL. Gravel is angular to well rounded, fine to medium flint. RIVER TERRACE DEPOSITS *Clayey in top of stratum, grading from previous*		
						End of Borehole at 2.00m		



Start & End of Shift Observations					Borehole Diameter		Casing Diameter	
Date	Time	Depth (m)	Casing (m)	Water (m)	Depth (m)	Dia (mm)	Depth (m)	Dia (mm)
02-02-2021	00:00			Dry				

Remarks:
Rootlets observed to 1.35m bgl.

Chiselling				Installation			
From (m)	To (m)	Duration	Remarks	Top (m)	Base (m)	Type	Dia (mm)

Water Strikes					
Strike (m)	Casing (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks
			0	0.00	No groundwater encountered.

Hand vane (HV), Hand penetrometer (HP) reported in kPa. PID reported in ppm.

soils LIMITED

Contract Name:		Client:			Hole ID:
St Marys Parish Centre,		Plum Architects			**WS03**
Contract Number:	Start and End Date:	Logged By:	Checked By:	Status:	Hole Type:
19001	28/01/21	DW	JH	FINAL	**WS**
Easting:	Northing:	Ground Level:	Plant Used:	Print Date:	Scale:
				14/05/2021	1:50

Weather: Clear | Termination: Hole terminated due to dense gravel beds. | Sheet 1 of 1

Samples & In Situ Testing			Strata Details				Groundwater	
Depth	Type	Results	Level (mAOD)	Depth (m) (Thickness)	Legend	Strata Description	Water Strike	Backfill/ Installation
0.20	D ES			(0.50)		Soft dark brown and brown mottled, slightly sandy, slightly gravelly silty CLAY. Gravel is angular to sub-rounded, fine to coarse flint, brick, and clinker. Frequent rootlets. MADE GROUND.		
0.60	D ES			0.50		Soft dark brown, slightly sandy slightly gravelly SILT. Sand is fine to medium. Frequent rootlets. Gravel is angular fine flint. Possibly re-worked material. RIVER TERRACE DEPOSITS		
0.80	D ES			0.70		Soft to very soft, slightly reddish brown mottled, brown, slightly gravelly sandy CLAY. Sand is predominantly fine to medium. Gravel is angular to well rounded, fine to coarse flint. Rare rootlets. RIVER TERRACE DEPOSITS		
1.40	D			(0.90)		*Compressed in liner from 1.0 - 1.6m bgl.*		
1.70	D			1.60		Yellowish brown mottled, brown, slightly clayey, very gravelly SAND. Sand is predominantly fine to medium. Gravel is angular to well rounded, fine to coarse flint. RIVER TERRACE DEPOSITS		
1.90	D			1.80		Yellowish brown, slightly silty, very sandy GRAVEL. Gravel is angular to well rounded, fine to coarse flint. Sand is predominantly coarse. RIVER TERRACE DEPOSITS		
				2.00		End of Borehole at 2.00m		

1 2 3 4 5 6 7 8 9 10

Start & End of Shift Observations

Date	Time	Depth (m)	Casing (m)	Water (m)
02-02-2021	00:00			Dry

Borehole Diameter

Depth (m)	Dia (mm)

Casing Diameter

Depth (m)	Dia (mm)

Remarks:
Rootlets observed to 1.5m bgl.

Chiselling

From (m)	To (m)	Duration	Remarks

Installation

Top (m)	Base (m)	Type	Dia (mm)

Water Strikes

Strike (m)	Casing (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks
			0	0.00	No groundwater encountered.

Hand vane (HV), Hand penetrometer (HP) reported in kPa. PID reported in ppm.

soils LIMITED

Contract Name:		Client:			Hole ID:
St Marys Parish Centre,		Plum Architects			**WS04**
Contract Number:	Start and End Date:	Logged By:	Checked By:	Status:	Hole Type:
19001	28/01/21	DW	JH	FINAL	**WS**
Easting:	Northing:	Ground Level:	Plant Used:	Print Date:	Scale:
				14/05/2021	1:50

Weather: Clear | Termination: Hole terminated due to dense gravel beds. | Sheet 1 of 1

Samples & In Situ Testing			Strata Details				Groundwater	
Depth	Type	Results	Level (mAOD)	Depth (m) (Thickness)	Legend	Strata Description	Water Strike	Backfill/ Installation
0.20	D ES					Firm brown and yellowish brown mottled, dark brown, slightly sandy, slightly gravelly SILT. Gravel is angular to well rounded, fine to coarse flint, brick, clinker, tarmacadam, road base limestone, and oolitic limestone. Frequent rootlets. MADE GROUND.		
0.50	D ES					*Fine yellow sand lens at 0.5m gl. Tarmac and road base lens at 0.6m bgl.*		
0.80	D ES			(1.60)				
1.40	D ES							
1.70	D ES			1.60 (0.40)		Soft greyish brown, brown and yellowish brown mottled, interbedded sandy SILT and silty SAND. Sand is fine to medium. Occasional clay laminations. Occasional angular fine to medium flint, brick, and rare desiccated concrete and chalk gravel. MADE GROUND.		
2.10	D ES			2.00 (0.50)		*Coarse sand lamination at base of stratum.* Firm brown, dark brown, and yellowish brown mottled, slightly sandy, slightly gravelly SILT. Gravel is angular to sub-rounded, fine to coarse flint, brick, clinker, and concrete. Frequent rootlets. MADE GROUND.		
2.60	D ES			2.50 (0.40)		Brown clayey SAND AND GRAVEL. Gravel is angular to sub-angular, fine to coarse flint. Occasional clay lenses. RIVER TERRACE DEPOSITS		
				2.90		End of Borehole at 2.90m		

1 2 3 4 5 6 7 8 9 10

Start & End of Shift Observations					Borehole Diameter		Casing Diameter	
Date	Time	Depth (m)	Casing (m)	Water (m)	Depth (m)	Dia (mm)	Depth (m)	Dia (mm)
02-02-2021	00:00			Dry				

Remarks:
Rootlets observed to 2.5m bgl.

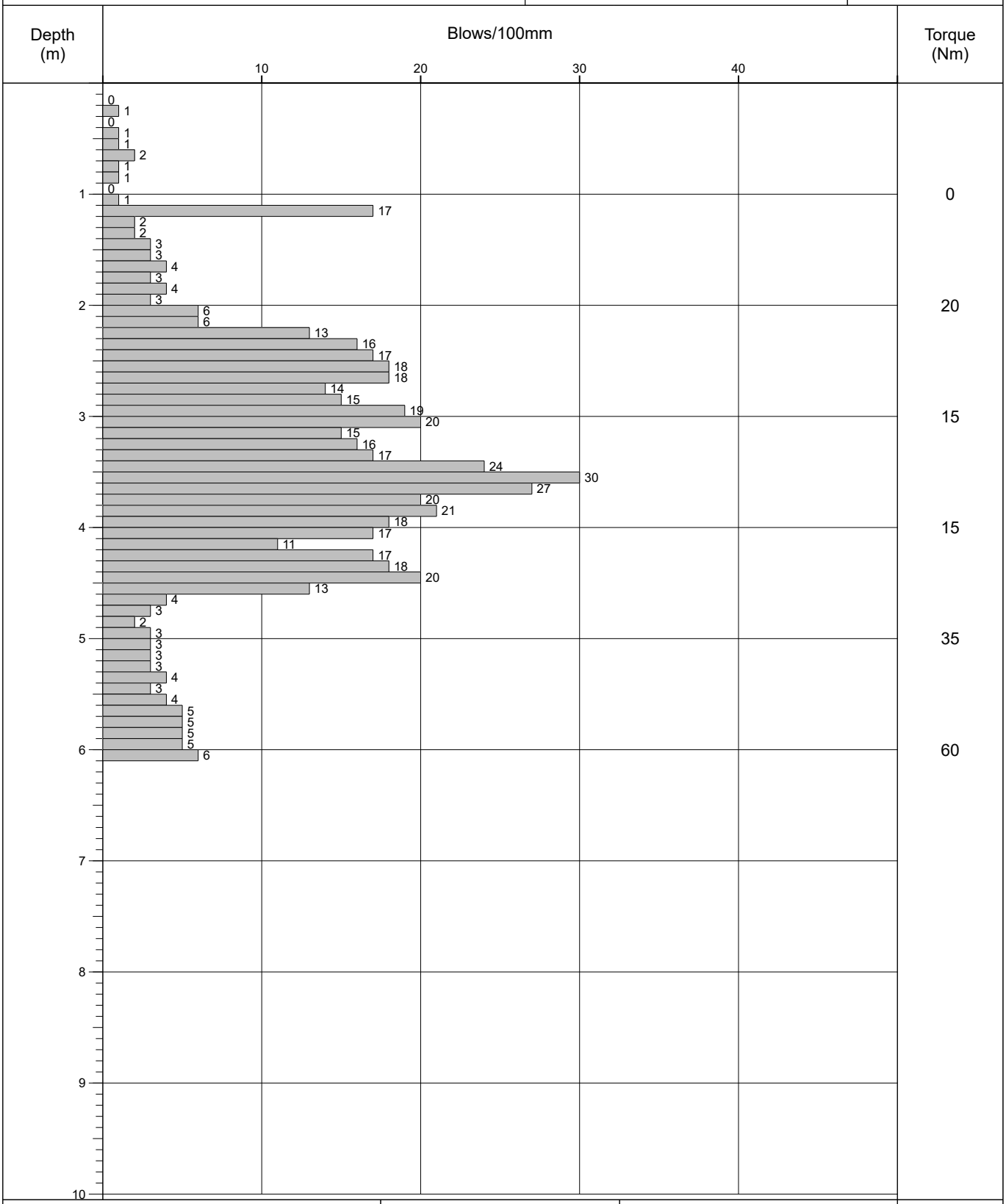
Chiselling				Installation			
From (m)	To (m)	Duration	Remarks	Top (m)	Base (m)	Type	Dia (mm)

Water Strikes					
Strike (m)	Casing (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks
			0	0.00	No groundwater encountered.

Hand vane (HV), Hand penetrometer (HP) reported in kPa. PID reported in ppm.

Soils Limited Newton House, Cross Road, Tadworth KT20 5SR Tel: 01737 814221 Email: admin@soilslimited.co.uk	**Probe Log**	Probe No. **DP01** Sheet 1 of 1

Project Name:	St Marys Parish Centre,	Project No. 19001	Co-ords:	Hole Type DP
Location:	Alverstoke, Gosport, Hampshire PO12 2ET		Level: m AOD	Scale 1:50
Client:	Plum Architects		Dates: 28/01/2021	Logged By

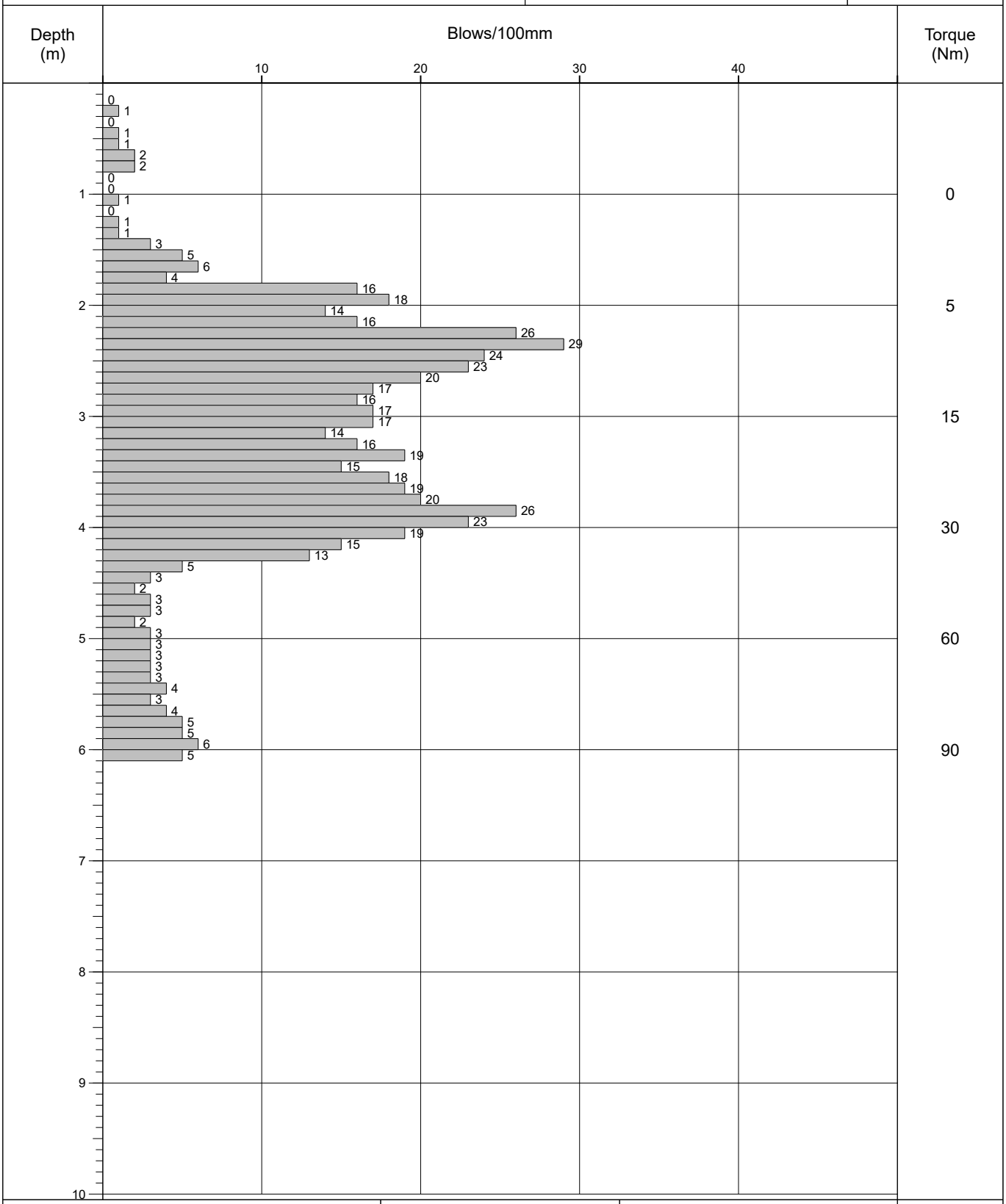


Remarks		Fall Height	750mm	Cone Base Diameter	50.5mm
		Hammer Weight	63.5kg	Final Depth	6m
		Probe Type	DPSH	Energy Ratio (Er)	%

AGS REGISTERED USER 2020

Soils Limited Newton House, Cross Road, Tadworth KT20 5SR Tel: 01737 814221 Email: admin@soilslimited.co.uk	**Probe Log**	Probe No. **DP02** Sheet 1 of 1

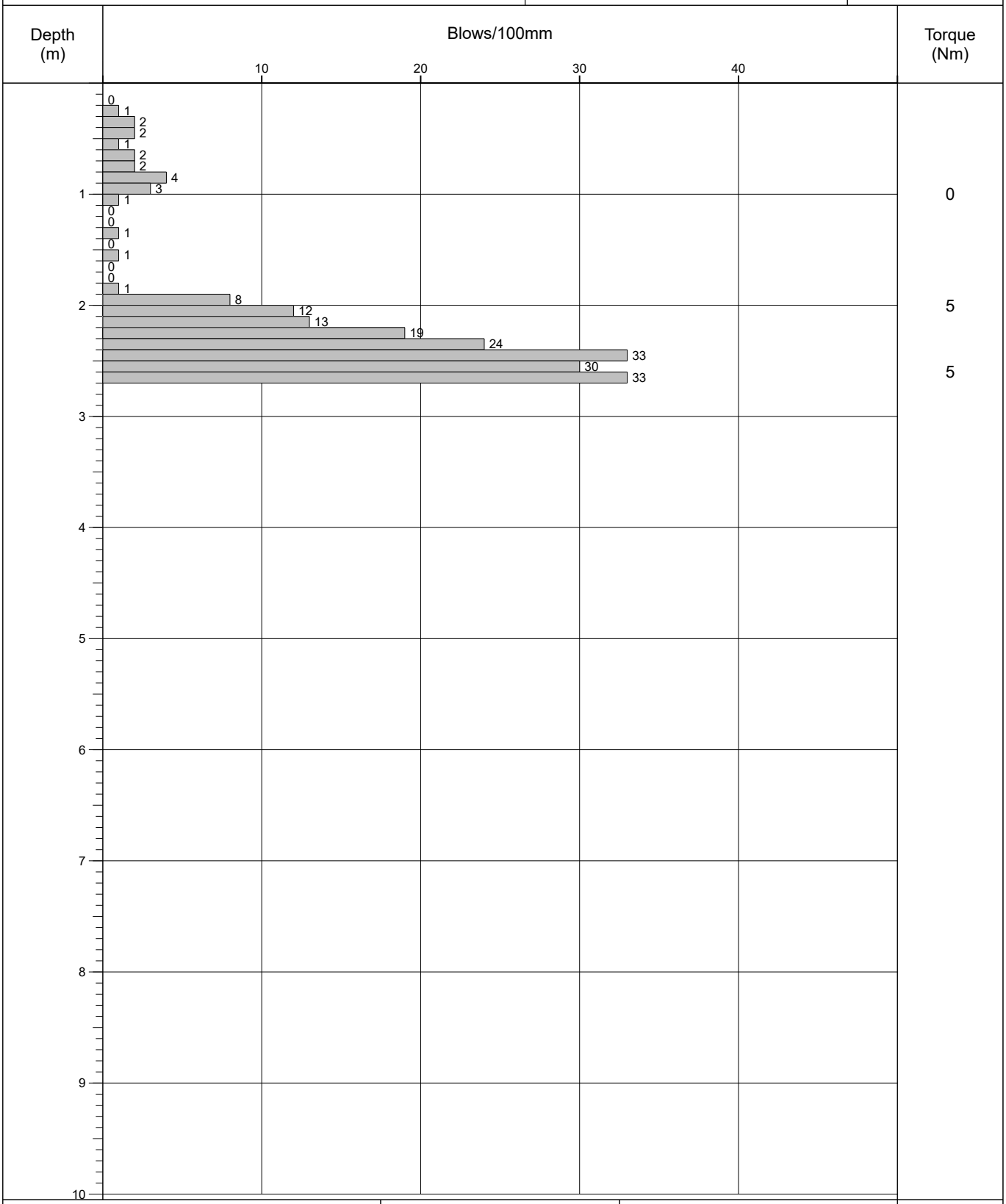
Project Name:	St Marys Parish Centre,	Project No. 19001	Co-ords:	Hole Type DP
Location:	Alverstoke, Gosport, Hampshire PO12 2ET		Level: m AOD	Scale 1:50
Client:	Plum Architects		Dates: 28/01/2021	Logged By



Remarks				
	Fall Height	750mm	Cone Base Diameter	50.5mm
	Hammer Weight	63.5kg	Final Depth	6m
	Probe Type	DPSH	Energy Ratio (Er)	%

AGS REGISTERED USER 2020

Soils Limited Newton House, Cross Road, Tadworth KT20 5SR Tel: 01737 814221 Email: admin@soilslimited.co.uk		**Probe Log**	Probe No. **DP03** Sheet 1 of 1
Project Name: St Marys Parish Centre,	Project No. 19001	Co-ords:	Hole Type DP
Location: Alverstoke, Gosport, Hampshire PO12 2ET		Level: m AOD	Scale 1:50
Client: Plum Architects		Dates: 28/01/2021	Logged By

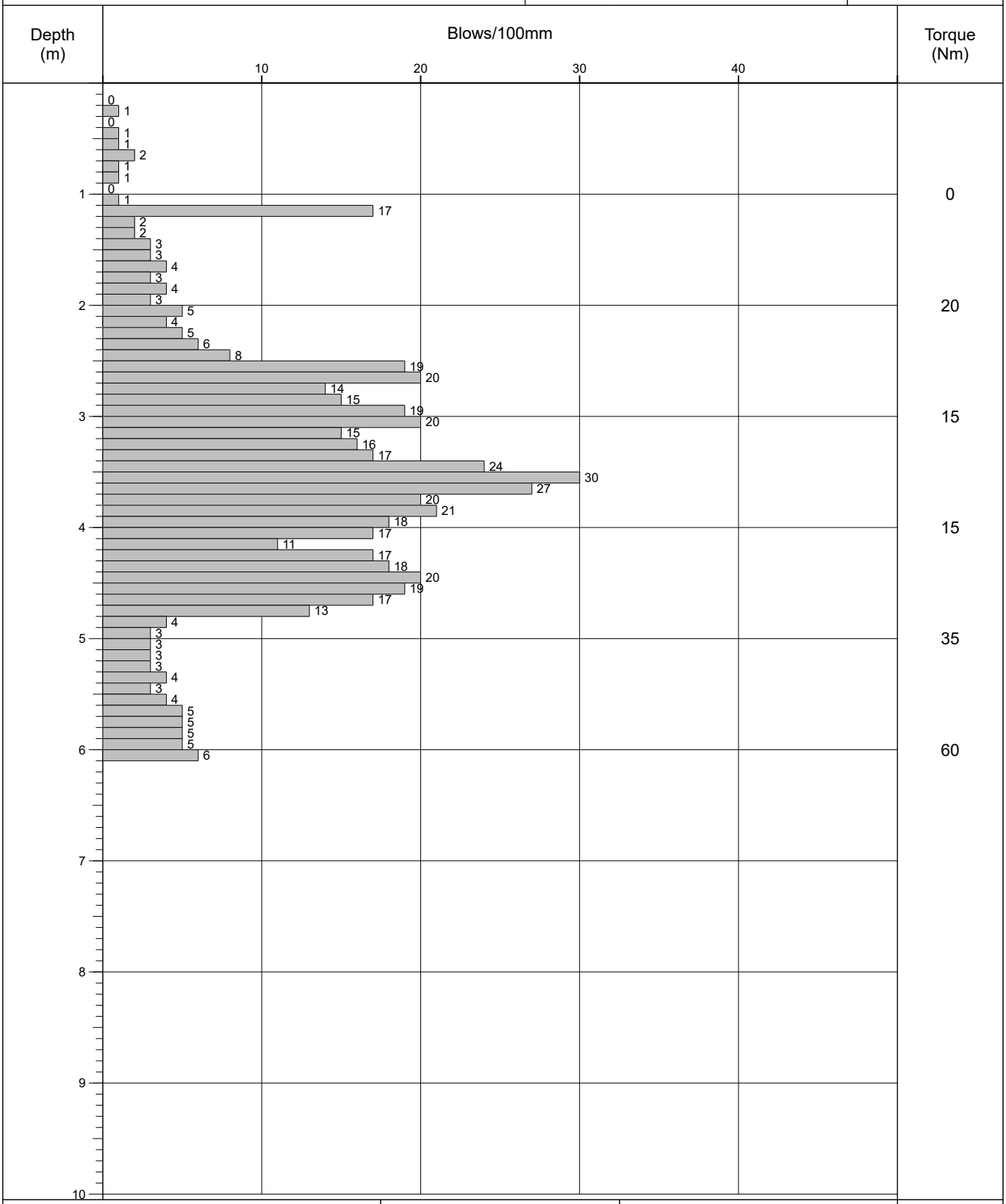


Remarks		Fall Height	750mm	Cone Base Diameter	50.5mm
		Hammer Weight	63.5kg	Final Depth	2.6m
		Probe Type	DPSH	Energy Ratio (Er)	%

AGS REGISTERED USER 2020

Soils Limited Newton House, Cross Road, Tadworth KT20 5SR Tel: 01737 814221 Email: admin@soilslimited.co.uk	**Probe Log**	Probe No. **DP04** Sheet 1 of 1

Project Name:	St Marys Parish Centre,	Project No. 19001	Co-ords:	Hole Type DP
Location:	Alverstoke, Gosport, Hampshire PO12 2ET		Level: m AOD	Scale 1:50
Client:	Plum Architects		Dates: 28/01/2021	Logged By



Remarks	Fall Height	750mm	Cone Base Diameter	50.5mm	AGS REGISTERED USER 2020
	Hammer Weight	63.5kg	Final Depth	6m	
	Probe Type	DPSH	Energy Ratio (Er)	%	

Appendix B Geotechnical In-Situ and Laboratory Testing

Appendix B.1 Classification

Classification based on SPT "N" values:

The inferred undrained strength of the cohesive soils was based on the SPT "N" blow counts, derived from the relationship suggested by Stroud (1974) and classified using Table B.1.1. (Ref: Stroud, M. A. 1974, "The Standard Penetration Test – its application and interpretation", Proc. ICE Conf. on Penetration Testing in the UK, Birmingham. Thomas Telford, London.).

Table B.1.1 SPT "N" Blow Count Cohesive Classification

Classification	Undrained Cohesive Strength C_u (kPa)
Extremely low	<10
Very low	10 – 20
Low	20 – 40
Medium	40 – 75
High	75 – 150
Very high	150 – 300
Extremely high	> 300

Note: (Ref: BS EN ISO 14688-2:2004+A1:2013 Clause 5.3.)

The relative density of granular soils was classified based of the relationship given in Table B.1.2.

The *UK National Annex to Eurocode 7: Geotechnical design – Part 2: Ground investigation and testing, NA 3.7 SPT test, BS EN 1997-2:2007, Annex F* states "Relative density descriptions on borehole records should also be based on uncorrected SPT N values, unless significantly disturbed, using the density classification in BS 5930:2015, Table 7.

Table B.1.2 SPT "N" Blow Count Granular Classification

Classification	SPT "N" blow count (blows/300mm)
Very loose	0 to 4
Loose	4 to 10
Medium dense	10 to 30
Dense	30 to 50
Very dense	Greater than 50

Note: (Ref: The Standard Penetration Test (SPT): Methods and Use, CIRIA Report 143, 1995)

Appendix B.2 Interpretation

Table B.2.1 Interpretation of DPSH Blow Counts

DP	Strata	Equivalent SPT N60 Blow Counts	Inferred Cohesive Strength/Granular Density
DP01	RTD 0.70 – 1.70 Gravelly CLAY	4 – 11	Medium Cu = 20 – 55kPa
	RTD 1.70 – 2.00 Clayey GRAVEL	12	Medium dense
	RTD 2.00 – 4.70 Sandy GRAVEL	19 – >50	Medium dense to very dense
	SLSY 4.70 – 6.00 CLAY / SAND[1]	8 – 23	Medium to high / Loose to medium dense Cu = 40 – 115kPa
DP02	RTD 0.70 – 1.40 Gravelly CLAY	0 – 6	Extremely low to low Cu = <10 – 30kPa
	RTD 1.70 – 2.00 Clayey GRAVEL	18	Medium dense
	RTD 2.00 – 4.30 Sandy GRAVEL	>50	Very dense
	SLSY 4.30 – 6.00 CLAY / SAND[1]	8 – 23	Medium to high / Loose to medium dense Cu = 40 – 115kPa
DP03	RTD 0.50 – 1.90 Gravelly CLAY	0 – 8	Extremely low to low Cu = <10 – 40kPa
	RTD 1.90 – 2.60 Sandy GRAVEL	>50	Very dense
DP04	RTD 0.70 – 1.70 Gravelly CLAY	4 – 11	Medium Cu = 20 – 55kPa
	RTD 1.70 – 2.00 Clayey GRAVEL	12	Medium dense
	RTD 2.00 – 4.70 Sandy GRAVEL	19 – >50	Medium Dense to Very Dense
	SLSY 4.70 – 6.00 CLAY / SAND[1]	11 – 23	Medium to high / Medium dense Cu = 55 – 115kPa

Note: [1] Ground conditions inferred past the base of windowless sampler boreholes.

Table B.2.2 Interpretation of Atterberg Limit Tests

Stratum	Moisture Content (%)	Plasticity Index (%)	Passing 425µm Sieve (%)	Modified Plasticity Index (%)	Soil Classification	Volume Change Potential	
						BRE	NHBC
ALV	16 – 20	9 – 45	79 – 83	7 – 37	CL – CH	Low to Medium	None to Medium

Note: BRE Volume Change Potential refers to BRE Digest 240 (based on Atterberg results)
NHBC Volume Change Potential refers to NHBC Standards Chapter 4.2
Soils Classification based on British Soil Classification System
The most common use of the term clay is to describe a soil that contains enough clay-sized material or clay minerals to exhibit cohesive properties. The fraction of clay-sized material required varies, but can be as low as 15%. Unless stated otherwise, this is the sense used in Digest 240. The term can be used to denote the clay minerals. These are specific, naturally occurring chemical compounds, predominately silicates. The term is often used as a particle size descriptor. Soil particles that have a nominal diameter of less than 2 µm are normally considered to be of clay size, but they are not necessarily clay minerals. Some clay minerals are larger than 2 µm and some particles, 'rock flour' for example, can be finer than 2 µm but are not clay minerals.
(The Atterberg Limit Tests were undertaken in accordance with BS 1377:Part 2:1990 Clauses 3.2, 4.3 and 5)

Table B.2.3 Interpretation of PSD Tests

Location	Depth (m bgl)	Soil Description	Volume Change Potential		Passing 63µm Sieve (%)
			BRE	NHBC	
WS01	1.80	Brown slightly fine to medium gravelly silty/ clayey fine to coarse SAND	Yes	Yes	38
WS02	1.90	Brown slightly silty/ clayey fine to coarse sandy fine to coarse GRAVEL	No	No	5
WS03	1.70	Brown silty/ clayey fine to medium gravelly fine to coarse SAND	Yes	No	21

Note: BRE 240 states that a soil has a volume change potential when the clay fraction **exceeds 15%**. Only the silt and clay combined fraction are determined by sieving therefore the volume change potential is estimated from the percentage passing the 63µm sieve. NHBC Standards Chapter 4.2 states that a soil is shrinkable if the percentage of silt and clay passing the 63µm sieve is greater than **35%** and the Plasticity Index is greater than 10%.
(The Particle Size Distribution Tests were undertaken in accordance with BS 1377: Part 2: 1990 Clause 9)

Appendix B.3 Geotechnical In-Situ and Laboratory Results

Laboratory Report

2788

GEO Site & Testing Services Ltd

Contract Number: 52571

Client Ref: **19001**
Client PO: **19001**

Report Date: **19-02-2021**

Client **Soils Limited**
Newton House
Cross Road
Tadworth
Surrey
KT20 5SR

Contract Title: **St Mary Parish**
For the attention of: **John Hills**

Date Received: **10-02-2021**
Date Completed: **19-02-2021**

Test Description	Qty
Moisture Content BS 1377:1990 - Part 2 : 3.2 - * UKAS	4
1 Point Liquid & Plastic Limit BS 1377:1990 - Part 2 : 4.4 & 5.3 - * UKAS	4
PSD Wet Sieve method BS 1377:1990 - Part 2 : 9.2 - * UKAS	3
Samples Received - @ Non Accredited Test	6
Disposal of samples for job	1

Notes: **Observations and Interpretations are outside the UKAS Accreditation**
*** - denotes test included in laboratory scope of accreditation**
 # - denotes test carried out by approved contractor
@ - denotes non accredited tests

Approved Signatories:
Emma Sharp (Office Manager) - Paul Evans (Quality/Technical Manager) - Richard John (Advanced Testing Manager)
Shaun Jones (Laboratory manager) - Wayne Honey (Administrative/Quality Assistant)

GEO Site & Testing Services Ltd
Unit 3-4, Heol Aur, Dafen Ind Estate, Dafen, Llanelli, Carmarthenshire SA14 8QN
Tel: 01554 784040 Fax: 01554 784041 info@gstl.co.uk gstl.co.uk

GSTL	NATURAL MOISTURE, LIQUID LIMIT, PLASTIC LIMIT AND PLASTICITY INDEX (BS 1377 : Part 2 : 1990 Method 5)	
Contract Number	52571	
Site Name	St Mary Parish	
Date Tested	18/02/2021	
	DESCRIPTIONS	

Sample/Hole Reference	Sample Number	Sample Type	Depth (m)			Descriptions
WS1		D	0.90	-		Brown fine gravelly sandy silty CLAY
WS1		D	1.80	-		Brown slightly fine to medium gravelly silty/ clayey fine to coarse SAND
WS2		D	1.70	-		Brown fine to medium gravelly silty sandy CLAY
WS3		D	1.40	-		Brown fine gravelly silty sandy CLAY
				-		
				-		
				-		
				-		
				-		
				-		
				-		
				-		
				-		
				-		
				-		
				-		
				-		
				-		
				-		
				-		
				-		
				-		
				-		
				-		

Operators	Checked	19/02/2021	Wayne Honey (Administrative/Quality Assistant)
Daniel Bassett	Approved	19/02/2021	Paul Evans (Quality/Technical Manager)

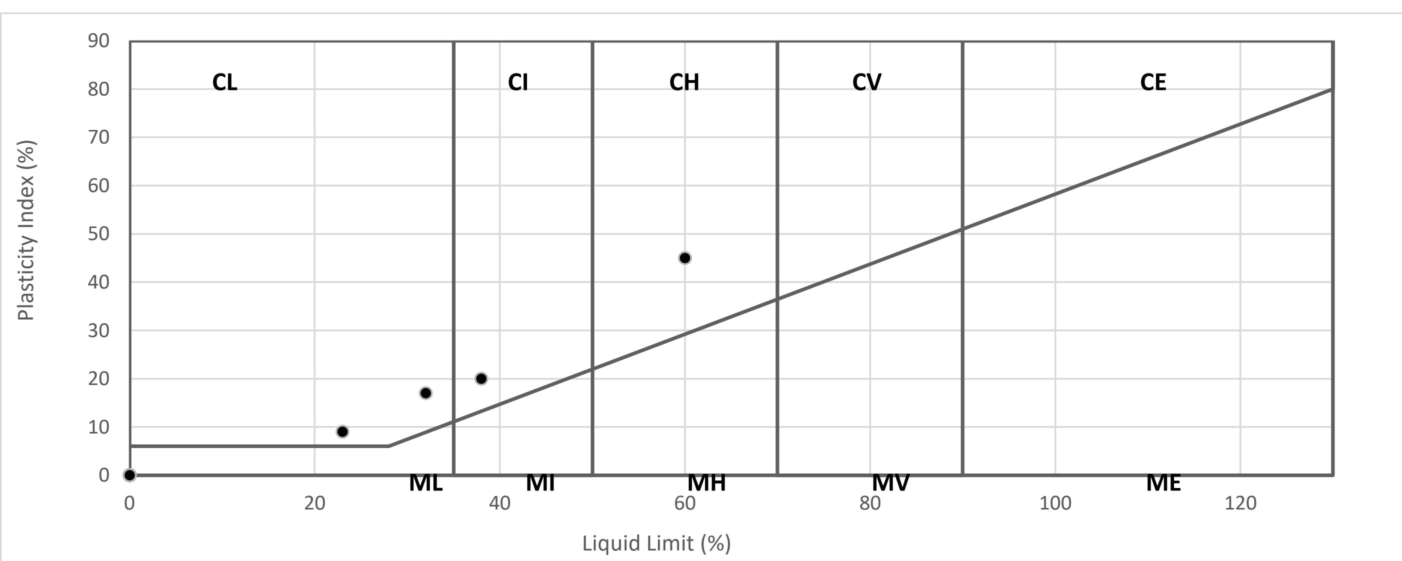
UKAS TESTING
2788

GSTL	NATURAL MOISTURE, LIQUID LIMIT, PLASTIC LIMIT AND PLASTICITY INDEX (BS 1377 : Part 2 : 1990 Method 5)	
Contract Number	**52571**	
Project Location	**St Mary Parish**	
Date Tested	**18/02/2021**	

Sample/Hole Reference	Sample Number	Sample Type	Depth (m)			Moisture Content %	Liquid Limit %	Plastic Limit %	Plasticity index %	Passing 0.425mm %	Remarks
WS1		D	0.90	-		16	23	14	9	83	CL Low Plasticity
WS1		D	1.80	-		20	38	18	20	92	CI Intermediate Plasticity
WS2		D	1.70	-		17	60	15	45	82	CH High Plasticity
WS3		D	1.40	-		17	32	15	17	79	CL Low Plasticity
				-							
				-							
				-							
				-							
				-							
				-							
				-							
				-							
				-							
				-							
				-							
				-							
				-							
				-							
				-							
				-							
				-							
				-							
				-							
				-							

Symbols: NP : Non Plastic # : Liquid Limit and Plastic Limit Wet Sieved

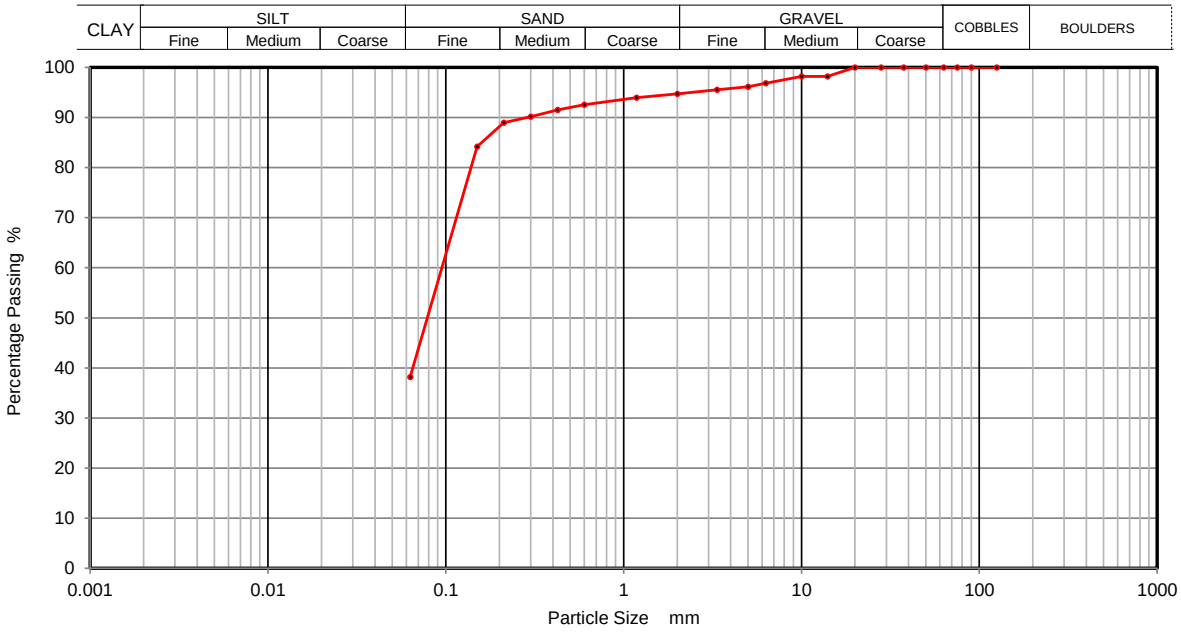
PLASTICITY CHART FOR CASAGRANDE CLASSIFICATION
BS 5930:1999+A2:2010



Operators	Checked	19/02/2021	Wayne Honey (Administrative/Quality Assistant)
Daniel Bassett	Approved	19/02/2021	Paul Evans (Quality/Technical Manager)

UKAS TESTING 2788

GSTL	PARTICLE SIZE DISTRIBUTION BS 1377 Part 2:1990 Wet Sieve, Clause 9.2	Contract Number	52571
		Borehole/Pit No.	WS1
Site Name	St Mary Parish	Sample No.	
Soil Description	Brown slightly fine to medium gravelly silty/ clayey fine to coarse SAND	Depth Top	1.80
		Depth Base	
Date Tested	15/02/2021	Sample Type	D



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	98		
10	98		
6.3	97		
5	96		
3.35	96		
2	95		
1.18	94		
0.6	93		
0.425	92		
0.3	90		
0.212	89		
0.15	84		
0.063	38		

Sample Proportions	% dry mass
Cobbles	0
Gravel	5
Sand	57
Silt and Clay	38

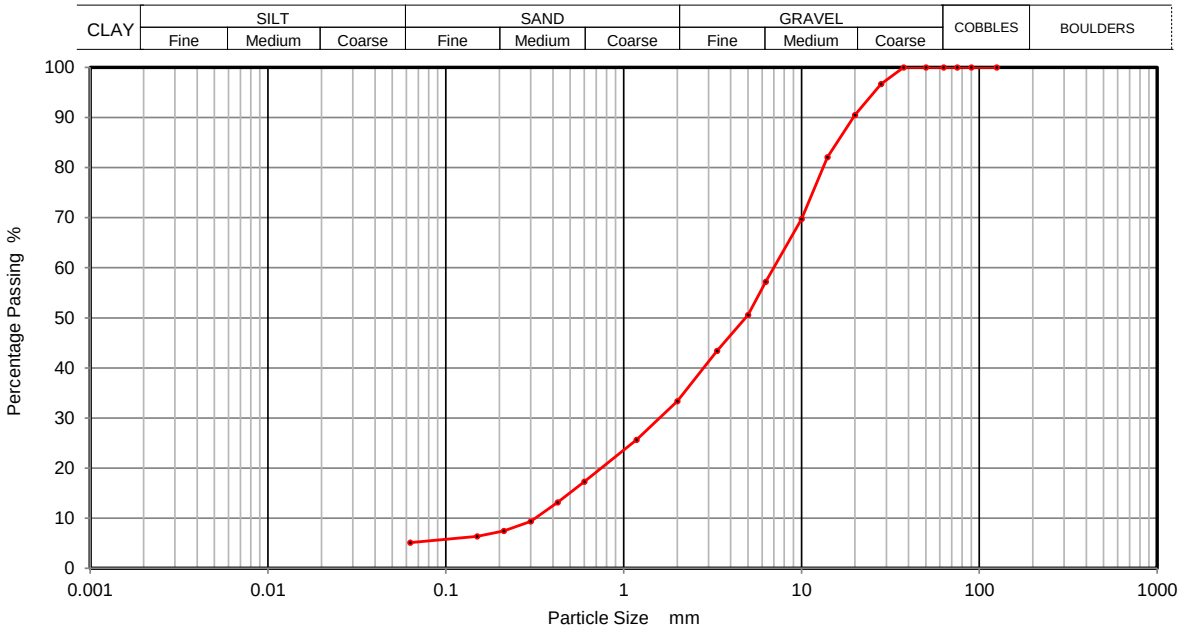
Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operators	Checked	18/02/2021	Wayne Honey	W. Honey
RO/MH	Approved	19/02/2021	Paul Evans	P Evans

UKAS TESTING 2788

GSTL	**PARTICLE SIZE DISTRIBUTION** **BS 1377 Part 2:1990** **Wet Sieve, Clause 9.2**	Contract Number	**52571**
		Borehole/Pit No.	**WS2**
Site Name	**St Mary Parish**	Sample No.	
Soil Description	Brown slightly silty/ clayey fine to coarse sandy fine to coarse GRAVEL	Depth Top	**1.90**
		Depth Base	
Date Tested	15/02/2021	Sample Type	**D**



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	97		
20	90		
14	82		
10	70		
6.3	57		
5	51		
3.35	43		
2	33		
1.18	26		
0.6	17		
0.425	13		
0.3	9		
0.212	7		
0.15	6		
0.063	5		

Sample Proportions	% dry mass
Cobbles	0
Gravel	67
Sand	28
Silt and Clay	5

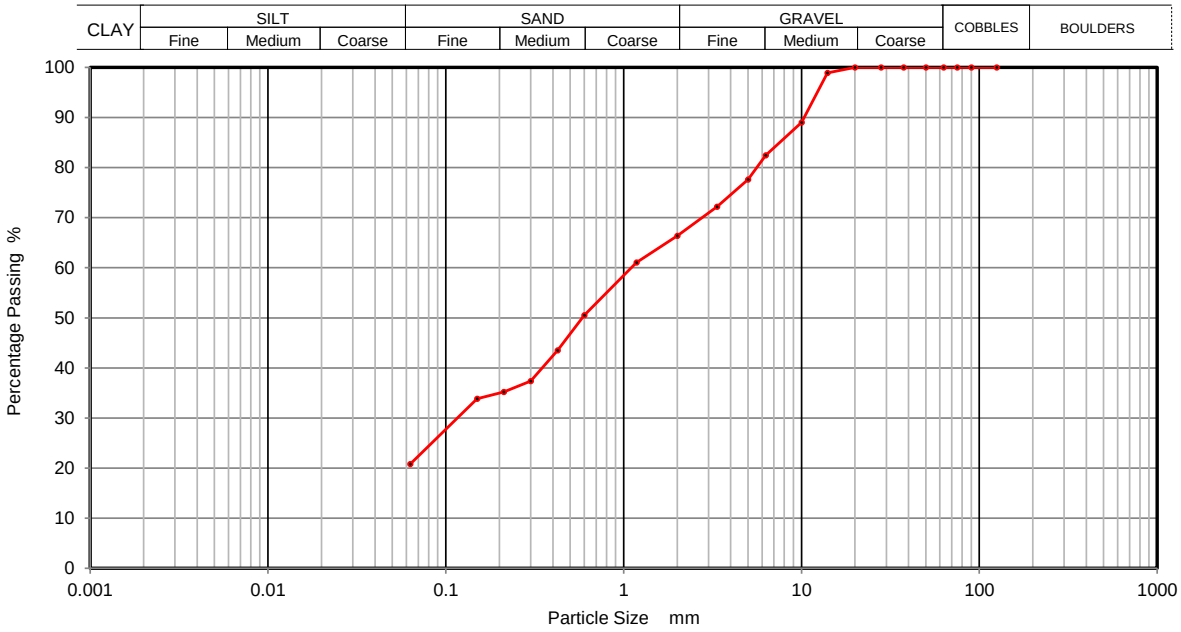
Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operators	Checked	18/02/2021	Wayne Honey	W. Honey
RO/MH	Approved	19/02/2021	Paul Evans	P Evans

UKAS TESTING 2788

GSTL	PARTICLE SIZE DISTRIBUTION BS 1377 Part 2:1990 Wet Sieve, Clause 9.2	Contract Number	52571
		Borehole/Pit No.	WS3
Site Name	St Mary Parish	Sample No.	
Soil Description	Brown silty/ clayey fine to medium gravelly fine to coarse SAND	Depth Top	1.70
		Depth Base	
Date Tested	15/02/2021	Sample Type	D



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	99		
10	89		
6.3	82		
5	78		
3.35	72		
2	66		
1.18	61		
0.6	51		
0.425	43		
0.3	37		
0.212	35		
0.15	34		
0.063	21		

Sample Proportions	% dry mass
Cobbles	0
Gravel	34
Sand	45
Silt and Clay	21

Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operators	Checked	18/02/2021	Wayne Honey	W. Honey
RO/MH	Approved	19/02/2021	Paul Evans	P Evans

UKAS TESTING 2788

Appendix C Chemical Laboratory Testing

Appendix C.1 Conceptual Site Model

Table C.1.1 CSM Revised Pre Testing

Source	Potential Contaminant	Exposure Pathway	Receptor	Assessment from Preliminary Investigation Report and Intrusive Investigation			Comments	Further Works
				Severity	Probability	Risk		
Onsite car park and Made Ground,	Metals, Semi-metals and non-metals, PAHs, TPHs, Asbestos, pH	Inhalation of dust	Site Workers/Site Maintenance	Mild	Low	Low	Both the Selsey Sand Formation and the River Terrace Deposits have Secondary A Aquifer classifications. No SPZ on site or water course within 250m. Made Ground recorded to depths of up to 2.50m bgl in one location. No significant indicators of contamination noted.	Chemical testing prior to undertaking a generic quantitative risk assessment as required.
			End Users	Mild	Low	Low		
			Off-site Users	Mild	Unlikely	Very Low		
	PAHs, TPHs	Inhalation of Vapour/gases (including Radon)	Site Workers/Site Maintenance	Mild	Low	Low		
			End Users	Mild	Low	Low		
			Off-site Users	Mild	Unlikely	Very Low		
	Metals, Semi-metals and non metals, PAHs, TPHs	Ingestion and absorption via direct contact	Site Workers/Site Maintenance	Mild	Low	Low		
			End Users	Mild	Low	Low		
	Metals, Semi-metals and non-metals, PAHs, TPHs	Migration via surface runoff	Surface Water	-	-	-		
		Migration in solution via groundwater	Surface Water	-	-	-		
			Shallow Aquifer	Mild	Low	Low		
			Deep Aquifer	Mild	Low	Low		
		Direct contact with construction material	Buried structures	Mild	Low	Low		
			Buried Services	Mild	Low	Low		
	PAHs, TPHs	Migration of gases via permeable soils	Site Workers/Site Maintenance	Mild	Unlikely	Very Low		
			End Users	Mild	Unlikely	Very Low		
			Off-site Users	Mild	Unlikely	Very Low		
			Building and confined spaces	Mild	Unlikely	Very Low		

Table C.1.2 CSM Revised Post Testing

Source	Potential Contaminant	Exposure Pathway	Receptor	Assessment from Preliminary Investigation Report and Intrusive Investigation			Comments	Further Works
				Severity	Probability	Risk		
Onsite car park and Made Ground,	None	Inhalation of dust	Site Workers/Site Maintenance	-	-	-	Both the Selsey Sand Formation and the River Terrace Deposits have Secondary A Aquifer classifications. No SPZ on site or water course within 250m. Made Ground recorded to depths of up to 2.50m bgl in one location. No significant indicators of contamination noted. No exceedances noted in shallow soils chemical analysis.	Nothing required, subject to regulatory agreement.
			End Users	-	-	-		
			Off-site Users	-	-	-		
	None	Inhalation of Vapour/gases (including Radon)	Site Workers/Site Maintenance	-	-	-		
			End Users	-	-	-		
			Off-site Users	-	-	-		
	None	Ingestion and absorption via direct contact	Site Workers/Site Maintenance	-	-	-		
			End Users	-	-	-		
	None	Migration via surface runoff	Surface Water	-	-	-		
		Migration in solution via groundwater	Surface Water	-	-	-		
			Shallow Aquifer	-	-	-		
			Deep Aquifer	-	-	-		
		Direct contact with construction material	Buried structures	-	-	-		
			Buried Services	-	-	-		
	None	Migration of gases via permeable soils	Site Workers/Site Maintenance	-	-	-		
			End Users	-	-	-		
			Off-site Users	-	-	-		
			Building and confined spaces	-	-	-		

Appendix C.2 Chemical Laboratory Results

John Hills
Soils Ltd
Thomas Telford House - Unit 11
Sun Valley Business Park
Winnall Close
Winchester
SO23 0LB

DETS Ltd
Unit 1
Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Kent
ME17 2JN
t: 01622 850410

DETS Report No: 21-01503

Site Reference:	St Marys Parish
Project / Job Ref:	19001
Order No:	19001/JH
Sample Receipt Date:	09/02/2021
Sample Scheduled Date:	09/02/2021
Report Issue Number:	1
Reporting Date:	15/02/2021

Authorised by:

Dave Ashworth
Technical Manager

Dates of laboratory activities for each tested analyte are available upon request.

Opinions and interpretations are outside the laboratory's scope of ISO 17025 accreditation. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.

DETS Ltd
Unit 1, Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Maidstone
Kent ME17 2JN
Tel : 01622 850410

4480

Soil Analysis Certificate						
DETS Report No: 21-01503	**Date Sampled**	04/02/21	04/02/21	04/02/21	04/02/21	04/02/21
Soils Ltd	**Time Sampled**	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: St Marys Parish	**TP / BH No**	WS4	WS2	WS2	WS1	WS2
Project / Job Ref: 19001	**Additional Refs**	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Order No: 19001/JH	**Depth (m)**	2.10	0.40	0.70	0.20	1.35
Reporting Date: 15/02/2021	**DETS Sample No**	524665	524666	524667	524668	524669

Determinand	Unit	RL	Accreditation					
Asbestos Screen (S)	N/a	N/a	ISO17025	Not Detected	Not Detected	Not Detected	Not Detected	
pH	pH Units	N/a	MCERTS	8.0	7.7	7.9	7.4	7.8
Total Cyanide	mg/kg	< 2	NONE		< 2			
Free Cyanide	mg/kg	< 2	NONE		< 2			
Total Sulphate as SO_4	mg/kg	< 200	MCERTS					< 200
Total Sulphate as SO_4	%	< 0.02	MCERTS					< 0.02
W/S Sulphate as SO_4 (2:1)	mg/l	< 10	MCERTS		11			< 10
W/S Sulphate as SO_4 (2:1)	g/l	< 0.01	MCERTS		0.01			< 0.01
Total Sulphur	%	< 0.02	NONE					< 0.02
Organic Matter	%	< 0.1	MCERTS	1.6	1.4	0.8	1.5	
Ammonium as NH_4	mg/kg	< 0.5	NONE					15.3
Ammonium as NH_4	mg/l	< 0.05	NONE					1.53
W/S Chloride (2:1)	mg/kg	< 1	MCERTS					21
W/S Chloride (2:1)	mg/l	< 0.5	MCERTS					10.6
Water Soluble Nitrate (2:1) as NO_3	mg/kg	< 3	MCERTS					3
Water Soluble Nitrate (2:1) as NO_3	mg/l	< 1.5	MCERTS					1.7
Arsenic (As)	mg/kg	< 2	MCERTS	8	6	5	8	
W/S Boron	mg/kg	< 1	NONE	< 1	< 1	< 1	< 1	
Cadmium (Cd)	mg/kg	< 0.2	NONE	< 0.2	< 0.2	< 0.2	< 0.2	
Chromium (Cr)	mg/kg	< 2	MCERTS	12	7	9	10	
Chromium (hexavalent)	mg/kg	< 2	NONE	< 2	< 2	< 2	< 2	
Copper (Cu)	mg/kg	< 4	MCERTS	25	12	11	13	
Lead (Pb)	mg/kg	< 3	MCERTS	430	353	39	98	
W/S Magnesium	mg/l	< 0.1	NONE					0.7
Mercury (Hg)	mg/kg	< 1	MCERTS	< 1	< 1	< 1	< 1	
Nickel (Ni)	mg/kg	< 3	MCERTS	8	4	6	6	
Selenium (Se)	mg/kg	< 2	MCERTS	< 3	< 3	< 3	< 3	
Vanadium (V)	mg/kg	< 1	MCERTS	24	16	17	19	
Zinc (Zn)	mg/kg	< 3	MCERTS	42	39	37	40	
Total Phenols (monohydric)	mg/kg	< 2	NONE	< 2	< 2	< 2	< 2	

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30°C. The Method Description page describes if the test is performed on the dried or as-received portion
Subcontracted analysis (S)

DETS Ltd
Unit 1, Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Maidstone
Kent ME17 2JN
Tel : 01622 850410

4480

Soil Analysis Certificate						
DETS Report No: 21-01503	**Date Sampled**	04/02/21				
Soils Ltd	**Time Sampled**	None Supplied				
Site Reference: St Marys Parish	**TP / BH No**	WS3				
Project / Job Ref: 19001	**Additional Refs**	None Supplied				
Order No: 19001/JH	**Depth (m)**	1.90				
Reporting Date: 15/02/2021	**DETS Sample No**	524670				

Determinand	**Unit**	**RL**	**Accreditation**					
Asbestos Screen (S)	N/a	N/a	**ISO17025**					
pH	pH Units	N/a	**MCERTS**	8.0				
Total Cyanide	mg/kg	< 2	NONE					
Free Cyanide	mg/kg	< 2	NONE					
Total Sulphate as SO_4	mg/kg	< 200	**MCERTS**	< 200				
Total Sulphate as SO_4	%	< 0.02	**MCERTS**	< 0.02				
W/S Sulphate as SO_4 (2:1)	mg/l	< 10	**MCERTS**	< 10				
W/S Sulphate as SO_4 (2:1)	g/l	< 0.01	**MCERTS**	< 0.01				
Total Sulphur	%	< 0.02	NONE	< 0.02				
Organic Matter	%	< 0.1	**MCERTS**					
Ammonium as NH_4	mg/kg	< 0.5	NONE	6.8				
Ammonium as NH_4	mg/l	< 0.05	NONE	0.68				
W/S Chloride (2:1)	mg/kg	< 1	**MCERTS**	4				
W/S Chloride (2:1)	mg/l	< 0.5	**MCERTS**	2.2				
Water Soluble Nitrate (2:1) as NO_3	mg/kg	< 3	**MCERTS**	< 3				
Water Soluble Nitrate (2:1) as NO_3	mg/l	< 1.5	**MCERTS**	< 1.5				
Arsenic (As)	mg/kg	< 2	**MCERTS**					
W/S Boron	mg/kg	< 1	NONE					
Cadmium (Cd)	mg/kg	< 0.2	NONE					
Chromium (Cr)	mg/kg	< 2	**MCERTS**					
Chromium (hexavalent)	mg/kg	< 2	NONE					
Copper (Cu)	mg/kg	< 4	**MCERTS**					
Lead (Pb)	mg/kg	< 3	**MCERTS**					
W/S Magnesium	mg/l	< 0.1	NONE	0.3				
Mercury (Hg)	mg/kg	< 1	**MCERTS**					
Nickel (Ni)	mg/kg	< 3	**MCERTS**					
Selenium (Se)	mg/kg	< 2	**MCERTS**					
Vanadium (V)	mg/kg	< 1	**MCERTS**					
Zinc (Zn)	mg/kg	< 3	**MCERTS**					
Total Phenols (monohydric)	mg/kg	< 2	NONE					

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30°C. The Method Description page describes if the test is performed on the dried or as-received portion
Subcontracted analysis (S)

DETS Ltd
Unit 1, Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Maidstone
Kent ME17 2JN
Tel : 01622 850410

4480

Soil Analysis Certificate - Speciated PAHs						
DETS Report No: 21-01503	Date Sampled	04/02/21	04/02/21	04/02/21	04/02/21	
Soils Ltd	Time Sampled	None Supplied	None Supplied	None Supplied	None Supplied	
Site Reference: St Marys Parish	TP / BH No	WS4	WS2	WS2	WS1	
Project / Job Ref: 19001	Additional Refs	None Supplied	None Supplied	None Supplied	None Supplied	
Order No: 19001/JH	Depth (m)	2.10	0.40	0.70	0.20	
Reporting Date: 15/02/2021	DETS Sample No	524665	524666	524667	524668	

Determinand	Unit	RL	Accreditation					
Naphthalene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	
Acenaphthylene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	
Acenaphthene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	
Fluorene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	
Phenanthrene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	0.34	
Anthracene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	
Fluoranthene	mg/kg	< 0.1	MCERTS	0.12	0.26	< 0.1	0.76	
Pyrene	mg/kg	< 0.1	MCERTS	< 0.1	0.24	< 0.1	0.62	
Benzo(a)anthracene	mg/kg	< 0.1	MCERTS	< 0.1	0.13	< 0.1	0.46	
Chrysene	mg/kg	< 0.1	MCERTS	< 0.1	0.16	< 0.1	0.44	
Benzo(b)fluoranthene	mg/kg	< 0.1	MCERTS	< 0.1	0.18	< 0.1	0.47	
Benzo(k)fluoranthene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	0.20	
Benzo(a)pyrene	mg/kg	< 0.1	MCERTS	< 0.1	0.14	< 0.1	0.36	
Indeno(1,2,3-cd)pyrene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	0.28	
Dibenz(a,h)anthracene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	
Benzo(ghi)perylene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	0.28	
Total EPA-16 PAHs	mg/kg	< 1.6	MCERTS	< 1.6	< 1.6	< 1.6	4.2	

DETS Ltd
Unit 1, Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Maidstone
Kent ME17 2JN
Tel : 01622 850410

4480

Soil Analysis Certificate - EPH Texas Banded							
DETS Report No: 21-01503	**Date Sampled**	04/02/21	04/02/21	04/02/21		
Soils Ltd	**Time Sampled**	None Supplied	None Supplied	None Supplied		
Site Reference: St Marys Parish	**TP / BH No**	WS4	WS2	WS1		
Project / Job Ref: 19001	**Additional Refs**	None Supplied	None Supplied	None Supplied		
Order No: 19001/JH	**Depth (m)**	2.10	0.70	0.20		
Reporting Date: 15/02/2021	**DETS Sample No**	524665	524667	524668		

Determinand	Unit	RL	Accreditation					
EPH Texas (C6 - C8)	mg/kg	< 0.05	NONE	< 0.05	< 0.05	< 0.05		
EPH Texas (>C8 - C10)	mg/kg	< 1	**MCERTS**	< 1	< 1	< 1		
EPH Texas (>C10 - C12)	mg/kg	< 1	**MCERTS**	< 1	< 1	< 1		
EPH Texas (>C12 - C16)	mg/kg	< 1	**MCERTS**	< 1	< 1	< 1		
EPH Texas (>C16 - C21)	mg/kg	< 1	**MCERTS**	< 1	< 1	6		
EPH Texas (>C21 - C40)	mg/kg	< 6	**MCERTS**	< 6	< 6	37		
EPH Texas (C6 - C40)	mg/kg	< 6	NONE	< 6	< 6	43		

DETS Ltd
Unit 1, Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Maidstone
Kent ME17 2JN
Tel : 01622 850410

4480

Soil Analysis Certificate - TPH CWG Banded						
DETS Report No: 21-01503	**Date Sampled**	04/02/21				
Soils Ltd	**Time Sampled**	None Supplied				
Site Reference: St Marys Parish	**TP / BH No**	WS2				
Project / Job Ref: 19001	**Additional Refs**	None Supplied				
Order No: 19001/JH	**Depth (m)**	0.40				
Reporting Date: 15/02/2021	**DETS Sample No**	524666				

Determinand	Unit	RL	Accreditation					
Aliphatic >C5 - C6	mg/kg	< 0.01	NONE	< 0.01				
Aliphatic >C6 - C8	mg/kg	< 0.05	NONE	< 0.05				
Aliphatic >C8 - C10	mg/kg	< 2	**MCERTS**	< 2				
Aliphatic >C10 - C12	mg/kg	< 2	**MCERTS**	< 2				
Aliphatic >C12 - C16	mg/kg	< 3	**MCERTS**	< 3				
Aliphatic >C16 - C21	mg/kg	< 3	**MCERTS**	< 3				
Aliphatic >C21 - C34	mg/kg	< 10	**MCERTS**	< 10				
Aliphatic (C5 - C34)	mg/kg	< 21	NONE	< 21				
Aromatic >C5 - C7	mg/kg	< 0.01	NONE	< 0.01				
Aromatic >C7 - C8	mg/kg	< 0.05	NONE	< 0.05				
Aromatic >C8 - C10	mg/kg	< 2	**MCERTS**	< 2				
Aromatic >C10 - C12	mg/kg	< 2	**MCERTS**	< 2				
Aromatic >C12 - C16	mg/kg	< 2	**MCERTS**	< 2				
Aromatic >C16 - C21	mg/kg	< 3	**MCERTS**	< 3				
Aromatic >C21 - C35	mg/kg	< 10	**MCERTS**	< 10				
Aromatic (C5 - C35)	mg/kg	< 21	NONE	< 21				
Total >C5 - C35	mg/kg	< 42	NONE	< 42				

DETS Ltd
Unit 1, Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Maidstone
Kent ME17 2JN
Tel : 01622 850410

4480

Soil Analysis Certificate - BTEX / MTBE							
DETS Report No: 21-01503	**Date Sampled**	04/02/21					
Soils Ltd	**Time Sampled**	None Supplied					
Site Reference: St Marys Parish	**TP / BH No**	WS2					
Project / Job Ref: 19001	**Additional Refs**	None Supplied					
Order No: 19001/JH	**Depth (m)**	0.40					
Reporting Date: 15/02/2021	**DETS Sample No**	524666					

Determinand	Unit	RL	Accreditation					
Benzene	ug/kg	< 2	MCERTS	< 2				
Toluene	ug/kg	< 5	MCERTS	< 5				
Ethylbenzene	ug/kg	< 2	MCERTS	< 2				
p & m-xylene	ug/kg	< 2	MCERTS	< 2				
o-xylene	ug/kg	< 2	MCERTS	< 2				
MTBE	ug/kg	< 5	MCERTS	< 5				

DETS Ltd
Unit 1, Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Maidstone
Kent ME17 2JN
Tel : 01622 850410

Soil Analysis Certificate - PCB (7 Congeners)						
DETS Report No: 21-01503	**Date Sampled**	04/02/21				
Soils Ltd	**Time Sampled**	None Supplied				
Site Reference: St Marys Parish	**TP / BH No**	WS2				
Project / Job Ref: 19001	**Additional Refs**	None Supplied				
Order No: 19001/JH	**Depth (m)**	0.40				
Reporting Date: 15/02/2021	**DETS Sample No**	524666				

Determinand	**Unit**	**RL**	**Accreditation**				
PCB Congener 28	mg/kg	< 0.008	NONE	< 0.008			
PCB Congener 52	mg/kg	< 0.008	NONE	< 0.008			
PCB Congener 101	mg/kg	< 0.008	NONE	< 0.008			
PCB Congener 118	mg/kg	< 0.008	NONE	< 0.008			
PCB Congener 138	mg/kg	< 0.008	NONE	< 0.008			
PCB Congener 153	mg/kg	< 0.008	NONE	< 0.008			
PCB Congener 180	mg/kg	< 0.008	NONE	< 0.008			
Total PCB (7 Congeners)	mg/kg	< 0.1	NONE	< 0.1			

DETS Ltd
Unit 1, Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Maidstone
Kent ME17 2JN
Tel : 01622 850410

4480

Soil Analysis Certificate - Sample Descriptions
DETS Report No: 21-01503
Soils Ltd
Site Reference: St Marys Parish
Project / Job Ref: 19001
Order No: 19001/JH
Reporting Date: 15/02/2021

DETS Sample No	TP / BH No	Additional Refs	Depth (m)	Moisture Content (%)	Sample Matrix Description
& 524665	WS4	None Supplied	2.10	14.2	Brown sandy clay with stones and brick
& 524666	WS2	None Supplied	0.40	12.5	Brown sandy clay with brick
& 524667	WS2	None Supplied	0.70	12.3	Brown sandy clay with stones
& 524668	WS1	None Supplied	0.20	10.8	Brown sandy clay with stones
524669	WS2	None Supplied	1.35	12.6	Light brown sandy clay
524670	WS3	None Supplied	1.90	5.3	Light brown gravelly sand with stones

Moisture content is part of procedure E003 & is not an accredited test
Insufficient Sample I/S
& samples received in inappropriate containers for hydrocarbon analysis

DETS Ltd
Unit 1, Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Maidstone
Kent ME17 2JN
Tel : 01622 850410

4480

Soil Analysis Certificate - Methodology & Miscellaneous Information
DETS Report No: 21-01503
Soils Ltd
Site Reference: St Marys Parish
Project / Job Ref: 19001
Order No: 19001/JH
Reporting Date: 15/02/2021

Matrix	Analysed On	Determinand	Brief Method Description	Method No
Soil	D	Boron - Water Soluble	Determination of water soluble boron in soil by 2:1 hot water extract followed by ICP-OES	E012
Soil	AR	BTEX	Determination of BTEX by headspace GC-MS	E001
Soil	D	Cations	Determination of cations in soil by aqua-regia digestion followed by ICP-OES	E002
Soil	D	Chloride - Water Soluble (2:1)	Determination of chloride by extraction with water & analysed by ion chromatography	E009
Soil	AR	Chromium - Hexavalent	Determination of hexavalent chromium in soil by extraction in water then by acidification, addition of 1,5 diphenylcarbazide followed by colorimetry	E016
Soil	AR	Cyanide - Complex	Determination of complex cyanide by distillation followed by colorimetry	E015
Soil	AR	Cyanide - Free	Determination of free cyanide by distillation followed by colorimetry	E015
Soil	AR	Cyanide - Total	Determination of total cyanide by distillation followed by colorimetry	E015
Soil	D	Cyclohexane Extractable Matter (CEM)	Gravimetrically determined through extraction with cyclohexane	E011
Soil	AR	Diesel Range Organics (C10 - C24)	Determination of hexane/acetone extractable hydrocarbons by GC-FID	E004
Soil	AR	Electrical Conductivity	Determination of electrical conductivity by addition of saturated calcium sulphate followed by electrometric measurement	E022
Soil	AR	Electrical Conductivity	Determination of electrical conductivity by addition of water followed by electrometric measurement	E023
Soil	D	Elemental Sulphur	Determination of elemental sulphur by solvent extraction followed by GC-MS	E020
Soil	AR	EPH (C10 – C40)	Determination of acetone/hexane extractable hydrocarbons by GC-FID	E004
Soil	AR	EPH Product ID	Determination of acetone/hexane extractable hydrocarbons by GC-FID	E004
Soil	AR	EPH TEXAS (C6-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C40)	Determination of acetone/hexane extractable hydrocarbons by GC-FID for C8 to C40. C6 to C8 by headspace GC-MS	E004
Soil	D	Fluoride - Water Soluble	Determination of Fluoride by extraction with water & analysed by ion chromatography	E009
Soil	D	Fraction Organic Carbon (FOC)	Determination of TOC by combustion analyser.	E027
Soil	D	Organic Matter (SOM)	Determination of TOC by combustion analyser.	E027
Soil	D	TOC (Total Organic Carbon)	Determination of TOC by combustion analyser.	E027
Soil	AR	Exchangeable Ammonium	Determination of ammonium by discrete analyser.	E029
Soil	D	FOC (Fraction Organic Carbon)	Determination of fraction of organic carbon by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	D	Loss on Ignition @ 450oC	Determination of loss on ignition in soil by gravimetrically with the sample being ignited in a muffle furnace	E019
Soil	D	Magnesium - Water Soluble	Determination of water soluble magnesium by extraction with water followed by ICP-OES	E025
Soil	D	Metals	Determination of metals by aqua-regia digestion followed by ICP-OES	E002
Soil	AR	Mineral Oil (C10 - C40)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge	E004
Soil	AR	Moisture Content	Moisture content; determined gravimetrically	E003
Soil	D	Nitrate - Water Soluble (2:1)	Determination of nitrate by extraction with water & analysed by ion chromatography	E009
Soil	D	Organic Matter	Determination of organic matter by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	AR	PAH - Speciated (EPA 16)	Determination of PAH compounds by extraction in acetone and hexane followed by GC-MS with the use of surrogate and internal standards	E005
Soil	AR	PCB - 7 Congeners	Determination of PCB by extraction with acetone and hexane followed by GC-MS	E008
Soil	D	Petroleum Ether Extract (PEE)	Gravimetrically determined through extraction with petroleum ether	E011
Soil	AR	pH	Determination of pH by addition of water followed by electrometric measurement	E007
Soil	AR	Phenols - Total (monohydric)	Determination of phenols by distillation followed by colorimetry	E021
Soil	D	Phosphate - Water Soluble (2:1)	Determination of phosphate by extraction with water & analysed by ion chromatography	E009
Soil	D	Sulphate (as SO4) - Total	Determination of total sulphate by extraction with 10% HCl followed by ICP-OES	E013
Soil	D	Sulphate (as SO4) - Water Soluble (2:1)	Determination of sulphate by extraction with water & analysed by ion chromatography	E009
Soil	D	Sulphate (as SO4) - Water Soluble (2:1)	Determination of water soluble sulphate by extraction with water followed by ICP-OES	E014
Soil	AR	Sulphide	Determination of sulphide by distillation followed by colorimetry	E018
Soil	D	Sulphur - Total	Determination of total sulphur by extraction with aqua-regia followed by ICP-OES	E024
Soil	AR	SVOC	Determination of semi-volatile organic compounds by extraction in acetone and hexane followed by GC-MS	E006
Soil	AR	Thiocyanate (as SCN)	Determination of thiocyanate by extraction in caustic soda followed by acidification followed by addition of ferric nitrate followed by colorimetry	E017
Soil	D	Toluene Extractable Matter (TEM)	Gravimetrically determined through extraction with toluene	E011
Soil	D	Total Organic Carbon (TOC)	Determination of organic matter by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	AR	TPH CWG (ali: C5- C6, C6-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C34, aro: C5-C7, C7-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C35)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge for C8 to C35. C5 to C8 by headspace GC-MS	E004
Soil	AR	TPH LQM (ali: C5-C6, C6-C8, C8-C10, C10-C12, C12-C16, C16-C35, C35-C44, aro: C5-C7, C7-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C35, C35-C44)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge for C8 to C44. C5 to C8 by headspace GC-MS	E004
Soil	AR	VOCs	Determination of volatile organic compounds by headspace GC-MS	E001
Soil	AR	VPH (C6-C8 & C8-C10)	Determination of hydrocarbons C6-C8 by headspace GC-MS & C8-C10 by GC-FID	E001

D Dried

AR As Received

Appendix C.3 General Assessment Criteria

HUMAN HEALTH RISK ASSESSMENT

Introduction

The statutory definition of contaminated land is defined in the Environmental Protection Act 1990, ref. 1.1, which was introduced by the Environment Act 1995, ref. 1.2;

'Land which appears to the local authority in whose area it is situated to be in such a condition, by reason of substances in, on or under the land, that –

(a) significant harm is being caused or there is a significant possibility of such harm being caused; or

(b) pollution of controlled waters is being, or is likely to be, caused.'

The UK guidance on the assessment of contaminated has developed as a direct result of the introduction of these two Acts. The technical guidance supporting the new legislation has been summarised in a number of key documents collectively known as the Contaminated Land Reports (CLRs), a proposed series of twelve documents. Seven were originally published in March 1994, four more were published in April 2002, while the last remaining guidance document, CLR 11, ref 1.3 was published in 2004. In 2008 CLR reports 7 to 10 were withdrawn by DEFRA and the Environment Agency and updated version of CLR 9 and 10 were produced in the form of Science Reports SR2, ref. 1.4 and SR3, ref. 1.5.

In establishing whether a site fulfils the statutory definition of 'contaminated land' it is necessary to identify, whether a pollutant linkage exists in respect of the land in question and whether the pollutant linkage:

- is resulting in significant harm being caused to the receptor in the pollutant linkage,
- presents a significant possibility of significant harm being caused to that receptor,
- is resulting in the pollution of the controlled waters which constitute the receptor, or
- is likely to result in such pollution.

A 'pollutant linkage' may be defined as the link between a contaminant 'source' and a 'receptor' by means of a 'pathway'.

Assessment Methodology

The guidance proposes a four-stage assessment process for identifying potential pollutant linkages on a site. These stages are set out in the table below:

No.	Process	Description
1	Hazard Identification	Establishing contaminant sources, pathways and receptors (the conceptual model).
2	Hazard Assessment	Analysing the potential for unacceptable risks (what linkages could be present, what could be the effects).
3	Risk Estimation	Trying to establish the magnitude and probability of the possible consequences (what degree of harm might result and to what receptors, and how likely is it).
4	Risk Evaluation	Deciding whether the risk is unacceptable.

Stages 1 and 2 develop a *'conceptual model'* based upon information collated from desk based studies, and frequently a walkover of the site. The walkover survey should be conducted in general accordance with CLR 2, ref. 1.6. The formation of a conceptual model is an iterative process and as such, it should be updated and refined throughout each stage of the project to reflect any additional information obtained.

The extent of the desk studies and enquiries to be conducted should be in general accordance with CLR 3, ref. 1.7. The information from these enquiries is presented in a desk study report with recommendations, if necessary, for further work based upon the conceptual model. Specific DoE 'Industry Profiles' provide guidance on the nature of contaminants relating to specific industrial processes.

If potential pollutant linkages are identified within the conceptual model, a Phase 2 site investigation and report will be recommended. The investigation should be planned in general accordance with CLR 4, ref 1.8. The number of exploratory holes and samples collected for analysis should be consistent with the size of the site and the level of risk envisaged. This will enable a contamination risk assessment to be conducted, at which point the conceptual model can be updated and relevant pollutant linkages can be identified.

A two-stage investigation may be more appropriate where time constraints are less of an issue. The first stage investigation being conducted as an initial assessment for the presence of potential sources, a second being a more refined investigation to delineate wherever possible the extent of the identified contamination.

All site works should be in general accordance with the British Standards BS 10175:2011, ref. 1.9. and BS 5930:2015, ref. 1.10.

The generic contamination risk assessment screens the results of the chemical analysis against generic guidance values which are dependent on the proposed end-use of the development.

The end-use may be defined as one of the following ref. 1.15;

- Residential with homegrown produce – domestic low rise and low density housing with gardens where vegetables may be grown for home consumption
- Residential without homegrown produce – domestic low density and low density housing where no gardens are present.
- Allotments – specific areas where vegetables are grown for home consumption.
- Public open space in close proximity to residential housing – includes the predominantly grassed area adjacent to high density housing and the central green area around which houses are developed. This land-use includes the smaller areas commonly incorporated in newer developments as informal grassed areas or more formal landscaped areas with a mixture of open space and covered soil with planting.
- Public open space in use as general parkland – provided for recreational use and may be used for family visits and picnics, children's play area, sports grounds and dig walking.
- Commercial – industrial premises where there is limited exposure to soil.

Standard Land-use Scenarios

The standard land-use scenarios used to develop conceptual exposure models are presented in the following sections:

Residential with homegrown produce

Generic scenario assumes a typical two-storey house built on a ground bearing slab with a private garden having a lawn, flowerbeds and a small fruit and vegetable patch.

• Critical receptor is a young female child (zero to six years old)
• Exposure duration is six years.
• Exposure pathways include direct soil and indoor dust ingestion, consumption of home-grown produce and any adhering soil, skin contact with soils and indoor dust and inhalation of indoor and outdoor dust and vapours.
• Building type is a two-storey small terraced house.

A sub-set of the Residential land-use is **Residential without Homegrown produce**. The generic scenario assumes low density housing with communal landscaped gardens where the consumption of home grown vegetables will not occur.

Allotments

Provision of open space (about 250sq.m) commonly made available to tenants by the local authority to grow fruit and vegetable for their own consumption. Typically, there are a number of plots to a site which may have a total area of up to 1 hectare. The tenants are assumed to be adults and that young children make occasional accompanied visits.

Although some allotment holders may choose to keep animals including rabbits, hens, and ducks, potential exposure to contaminated meat and eggs is not considered.

- Critical receptor is a young female child (zero to six years old)
- Exposure duration is six years.
- Exposure pathways include direct soil ingestion, consumption of homegrown produce and any adhering soil, skin contact with soils and inhalation of outdoor dust and vapours.
- There is no building.

Commercial

The generic scenario assumes a typical commercial or light industrial property comprising a three-storey building at which employees spend most time indoors and are involved in office-based or relatively light physical work.

- Critical receptor is a working female adult (aged 16 to 65 years old).
- Exposure duration is a working lifetime of 49 years.
- Exposure pathways include direct soil and indoor dust ingestion, skin contact with soils and dusts and inhalation of dust and vapours.
- Building type is a three-storey office (pre 1970).

Public Open Space within Residential Area

The generic scenario refers to any grassed area 0.05 ha and that is close to Housing.

- Grassed area of up to 0.05 ha and a considerable proportion of this (up to 50%) may be bare soil
- Predominantly used by children for playing and may be used for activities such as a football kick about
- Sufficiently close proximity to home for tracking back of soil to occur, thus indoor exposure pathways apply
- older children as the critical receptor on basis that they will use site most frequently (Age class 4-9)
- ingestion rate 75 $mg.day^{-1}$

Public Open Space Park

This generic scenario refers to any public park that is more than 0.5ha in area:

- Public park (>0.5 ha), predominantly grassed and may also contain children's play equipment and border areas of soil containing flowers or shrubs (75% cover)
- Female child age classes 1-6
- Soil ingestion rate of 50 $mg.day^{-1}$
- Occupancy period outdoors = 2 $hours.day^{-1}$
- Exposure frequency of 170 days.year-1 for age classes 2-18 and 85
- $days.year^{-1}$ for age class 1
- Outdoor exposure pathways only (no tracking back).

Human Health Generic Quantitative Risk Assessment (GQRA) involves the comparison of contaminant concentrations measured in soil at the site with Generic Assessment Criteria (GAC).

GAC are conservative values adopted to ensure that they are applicable to the majority of possible contaminated site. These values may be published Contaminated Land Exposure Assessment Model (CLEA) derived GAC derived by a third party or the Environment Agency/ DEFRA. It is imperative to the risk assessor to understand the uncertainties and limitations associated with these GAC to ensure that they are used appropriately. Where the adoption of a GAC is not appropriate, for instance when the intended land-use is at variance the CLEA standard land-uses, then a Detailed Quantitative Risk Assessment (DQRA) may be undertaken to develop site specific values for relevant soil contaminants based on the site specific conditions.

In 2014, the publication of Category 4 Screening Levels (C4SL) ref 1.15, 1.16, as part of the Defra-funded research project SP1010, included modifications to certain exposure assumptions documented within EA Science Report SC050221/SR3 (herein after referred to as SR3) ref 1.5 used in the generation of SGVs. C4SL were published for six substances (cadmium, arsenic, benzene, benzo(a)pyrene, chromium VI and lead) for a sandy loam soil type with 6% soil organic matter, based on a low level of toxicological concern (LLTC; see Section 2.3 of research project report SP1010 ref 1.16. Where a C4SL has been published, Soils Limited has adopted them as GAC for these six substances.

For all other substances the soils will be compared to Suitable 4 Use Levels (S4ULs) published by LQM ref. 1.12, which were developed for around 85 substances and are intended to enable a screening assessment of the risks posed by soil quality on development sites. The updated LQM/CIEH GAC publication was developed to accommodate recent developments in the understanding of chemical, toxicological and routine exposure to soil-based contaminants.

Where no S4UL or C4SL is available, the assessment criteria (AC) may be generated using the Contaminated Land Exposure Assessment (CLEA) Software Version 1.07, ref. 1.13. Toxicological and physico-chemical/fate and transport data used to generate the AC has been derived from a hierarchy of data sources as follows:

1. Environment Agency or Department of Environment Food and Rural Affairs (DEFRA) documents;
2. Other documents produced by UK Government or state organisations;
3. European institution documents;
4. International organisation documents;
5. Foreign government institutions.

In the case of the majority of contaminants considered, the toxicological data has been drawn from the relevant CLR 9 TOX report, or updated toxicological data published by the Environment Agency (2009), ref. 1.6, where available. Where no TOX report is available reference has been made to the health criteria values, derived for use in Land Quality Press (2006), ref. 1.17, as this is considered to represent a peer reviewed data source. Similarly, fate and transport data has been derived in the first instance from Environment Agency (2003), ref. 1.18 and for contaminants not considered in this
document the fate and transport data used in previous versions of the CLEA model has been used.

Chemical laboratory test results are processed as follows. A statistical analysis of the results is conducted, as detailed in CIEH and CL:AIRE 'Guidance on Comparing Soil Contamination Data with a Critical Concentration', ref. 1.14. Individual concentrations are compared to the selected guideline values to identify concentrations of contaminants that are above the selected screening criteria.

Where the risk estimation identifies significant concentrations of one or more contaminants, a further risk evaluation needs to be undertaken.

References

1.1 The Environmental Protection Act, Part IIA, Section 78, DoE 1990.

1.2 Environment Act 1995, Section 57, DoE 1995.

1.3 CLR 11, '*Model Procedures for the Management of Contaminated Land*', DEFRA and Environment Agency, 2004.

1.4 Environment Agency Science Report SC050021/SR2 'Human health toxicological assessment of contaminants in soil'.

1.5 Science Report SC050021/SR3 '*Updated technical background to the CLEA model*', Environment Agency, 2008

1.6 CLR 2, '*Guidance on preliminary site inspection of contaminated land*', Report by Applied Environmental, DoE 1994.

1.7 CLR 3 '*Documentary Research on Industrial Sites*', Report by RPS Consultants Ltd., DOE, 1994

1.8 CLR 4, '*Sampling strategies for contaminated land*', Report by The Centre for Research into the Built Environment, the Nottingham Trent University, DoE, 1994

1.9 BS 10175: 2011 '*Investigation of potentially contaminated sites. Code of practice*', British Standards Institute, 2011

1.10 BS 5930: 2015 '*Code of practice for ground investigations*', British Standards Institute, 2015

1.11 Science Report SC050021 '*Contaminants in Soil: Updated Collation of Toxicological Data and Intake Values for Humans*', Environment Agency, 2009

1.12 The LQM/S4ULs for Human Health Risk Assessment, Nathanail P, McCaffery C, Gillett A, Ogden R, and Nathanail J, Land Quality Press, Nottingham, published 2015.

1.13 CLEA '*Software Version 1.071*' (downloaded from the Environment Agency website, http://www.environment-agency.gov.uk)

1.14 CIEH '*Guidance on Comparing Soil Contamination Data with a Critical Concentration*', Chartered Institute of Environmental Health (CIEH) and Contaminated Land: Applications in Real Environments (CL:AIRE), May 2008.

1.15 DEFRA SP1010: Development of Category 4 Screening Levels for the Assessment of Land Affected by Contamination, published March 2014.

1.16 Contaminated Land: Applications in Real Environment (CL:AIRE) (2014). 'Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination', Revision 2, DEFRA research project SP1010.

1.17 Generic Assessment Criteria for Human Health Risk Assessment, Nathanial CP, McCaffery C, Ashmore M, Cheng Y, Gillett A, Hooker P and Ogden RC

1.18 CLR 2, '*Guidance on preliminary site inspection of contaminated land*', Report by Applied Environmental, DoE 1994.

				Residential with home-grown produce			Residential without home-grown produce			Allotments			Commercial			Public Open Space - Resi			Public Open Space -Park					
			SOM	1.0	2.5	6	1	2.5	6	1	2.5	6	1	2.5	6	1	2.5	6	1	2.5	6			
Type	Contaminants	Species	Year																					
Metals	Antimony		2010					550						7500								EIC/AGS/	CL:AIRE	2010
	Arsenic		2014		37			40			49			640			79			168		C4SL	DEFRA	2014
			2015		~~37~~			40			40			640			79			170		S4UL	LQM/CIEH	2015
	Beryllium		2015		1.7			1.7			35			12			2.2			63		S4UL	LQM/CIEH	2015
	Boron		2015		290			11000			45			240000			21000			46000		S4UL	LQM/CIEH	2015
	Cadmium		2015		~~11~~			85			1.9			190			120			532		S4UL	LQM/CIEH	2015
			2014		26			149			4.9			410			220			880		C4SL	DEFRA	2014
	Chromium	III	2015		910			910			18000			8600			1500			33000		S4UL	LQM/CIEH	2015
		VI	2014		21			21			170			49			23			250		C4SL	DEFRA	2014
		VI	2015		6			6			1.8			33			7.7			220		S4UL	LQM/CIEH	2015
	Copper		2015		2400			7100			520			68000			12000			44000		S4UL	LQM/CIEH	2015
	Lead		2014		200			310			80			2330			630			1300		C4SL	DEFRA	2014
	Mercury	Elemental	2015		1.2			1.2			21			*58*			16			*30*		S4UL	LQM/CIEH	2015
		Inorganic	2015		40			56			19			1100			120			240		S4UL	LQM/CIEH	2015
		Methyl	2015		11			15			6			320			40			68		S4UL	LQM/CIEH	2015
	Nickel		2015		130			180			53			980			230			800		S4UL	LQM/CIEH	2015
	Selenium		2015		250			430			88			12000			1100			1800		S4UL	LQM/CIEH	2015
	Vanadium		2015		410			1200			91			9000			2000			5000		S4UL	LQM/CIEH	2015
	Zinc		2015		3700			40000			620			730000			81000			170000		S4UL	LQM/CIEH	2015
	Benzene		2014		0.87			3.3			0.18			98			140			230		C4SL	DEFRA	2014
			2015	0.087	0.17	0.37	0.38	0.7	1.4	0.017	0.034	0.075	27	47	90	72	72	73	90	100	110	S4UL	LQM/CIEH	2015
	Toluene		2015	130	290	660	*880*	1900	3900	22	51	120	*65000*	*110000*	*180000*	56000	56000	56000	*87000*	*95000*	*100000*	S4UL	LQM/CIEH	2015
	Ethylbenzene		2015	47	110	260	83	190	440	16	39	91	*4700*	*13000*	*27000*	24000	24000	25000	*17000*	*22000*	*27000*	S4UL	LQM/CIEH	2015
	Xylenes	o-xylene	2015	60	140	330	88	210	480	28	67	160	*6600*	*15000*	*33000*	41000	42000	43000	*17000*	*24000*	*33000*	S4UL	LQM/CIEH	2015
		m-xylene	2015	59	140	320	82	190	450	31	74	170	*6200*	*14000*	*31000*	41000	42000	43000	*17000*	*24000*	*32000*	S4UL	LQM/CIEH	2015
		p-xylene	2015	56	130	310	79	180	310	29	69	160	*5900*	*14000*	*30000*	41000	42000	43000	*17000*	*23000*	*31000*	S4UL	LQM/CIEH	2015
Petroleum Hydrocarbons Fractions	Aliphatic >C5 - C6		2015	42	78	160	42	78	160	730	1700	3900	*3200*	*5900*	*12000*	*570000*	590000	600000	*95000*	*130000*	*180000*	S4UL	LQM/CIEH	2015
	Aliphatic >C6 - C8		2015	100	230	530	100	230	530	2300	5600	13000	*7800*	*17000*	*40000*	600000	610000	620000	*150000*	*220000*	*320000*	S4UL	LQM/CIEH	2015
	Aliphatic >C8 - C10		2015	27	65	150	27	65	150	320	770	1700	*2000*	*4800*	*11000*	13000	13000	13000	*14000*	*18000*	*21000*	S4UL	LQM/CIEH	2015
	Aliphatic >C10 - C12		2015	*130*	*330*	*760*	*130*	*330*	*770*	2200	4400	7300	*9700*	*23000*	*47000*	13000	13000	13000	*21000*	*23000*	*24000*	S4UL	LQM/CIEH	2015
	Aliphatic >C12 - C16		2015	*1100*	*2400*	*4300*	*1100*	*2400*	*4400*	11000	13000	13000	*59000*	*82000*	*90000*	13000	13000	13000	*25000*	*25000*	*26000*	S4UL	LQM/CIEH	2015
	Aliphatic >C16 - C35		2015	*65000*	*92000*	*110000*	*65000*	*92000*	110000	260000	270000	270000	1600000	1700000	1800000	250000	250000	250000	450000	480000	490000	S4UL	LQM/CIEH	2015
	Aliphatic >C35 - C44		2015	*65000*	*92000*	*140000*	*65000*	*92000*	110000	260000	270000	270000	1600000	1700000	1800000	250000	250000	250000	450000	480000	490000	S4UL	LQM/CIEH	2015
	Aromatic >C5 - C7		2015	70	140	300	370	690	1400	13	27	57	*26000*	*46000*	*86000*	56000	56000	56000	*76000*	*84000*	*92000*	S4UL	LQM/CIEH	2015
	Aromatic >C7 - C8		2015	130	290	660	860	1800	3900	22	51	120	*56000*	*110000*	*180000*	56000	56000	56000	*87000*	*95000*	*100000*	S4UL	LQM/CIEH	2015
	Aromatic >C8 - C10		2015	34	83	190	47	110	270	8.6	21	51	*3500*	*8100*	*17000*	5000	5000	5000	*7200*	*8500*	*9300*	S4UL	LQM/CIEH	2015
	Aromatic >C10 - C12		2015	74	180	380	250	590	1200	13	31	74	*16000*	*28000*	*34000*	5000	5000	5000	*9200*	*9700*	*10000*	S4UL	LQM/CIEH	2015
	Aromatic >C12 - C16		2015	140	330	660	1800	2300	2500	23	57	130	*36000*	*37000*	*38000*	5100	5100	5000	10000	10000	10000	S4UL	LQM/CIEH	2015
	Aromatic >C16 - C21		2015	260	540	930	1900	1900	1900	46	110	260	28000	28000	28000	3800	3800	3800	7600	7700	7800	S4UL	LQM/CIEH	2015
	Aromatic >C21 - C35		2015	1100	1500	1700	1900	1900	1900	370	820	1600	28000	28000	28000	3800	3800	3800	7800	7800	7900	S4UL	LQM/CIEH	2015
	Aromatic >C34 - C44		2015	1100	1500	1700	1900	1900	1900	370	820	1600	28000	28000	28000	3800	3800	3800	7800	7800	7900	S4UL	LQM/CIEH	2015
	Aliphatic + Aromatic >C44 - C70		2015	1600	1800	1900	1900	1900	1900	1200	2100	3000	28000	28000	28000	3800	3800	3800	7800	7800	7900	S4UL	LQM/CIEH	2015
Polycyclic Aromatic Hydrocarbons (PAH' s) (mg/kg)	Acenaphthene		2015	210	510	1100	*3000*	*4700*	*6000*	34	85	200	*84000*	*97000*	100000	15000	15000	15000	29000	30000	30000	S4UL	LQM/CIEH	2015
	Acenaphthylene		2015	170	420	920	*2900*	*4600*	*6000*	28	69	160	*83000*	*97000*	100000	15000	15000	15000	29000	30000	30000	S4UL	LQM/CIEH	2015
	Anthracene		2015	2400	5400	11000	*31000*	*35000*	*37000*	380	950	2200	520000	54000	540000	74000	74000	74000	150000	150000	150000	S4UL	LQM/CIEH	2015
	Benzo(a)anthracene		2015	7.2	11	13	11	14	15	2.9	6.5	13	170	170	180	29	29	29	49	56	62	S4UL	LQM/CIEH	2015
	Benzo(a)pyrene		2014			5			5.3			5.7			76			10			21	C4SL	DEFRA	2014
			2015	2.2	2.7	3	3.2	3.2	3.2	0.97	2	3.5	35	35	36	5.7	5.7	5.7	11	12	13	S4UL	LQM/CIEH	2015
	Benzo(b)fluoranthene		2015	2.6	3.3	3.7	3.9	4.0	4.0	0.99	2.1	3.9	44	44	45	7.1	7.2	7.2	13	15	16	S4UL	LQM/CIEH	2015
	Benzo(ghi)perylene		2015	320	340	350	360	360	360	290	470	640	3900	4000	4000	640	640	640	1400	1500	1600	S4UL	LQM/CIEH	2015
	Benzo(k)fluoranthene		2015	77	93	100	110	110	110	37	75	130	1200	1200	1200	190	190	190	370	410	440	S4UL	LQM/CIEH	2015
	Chrysene		2015	15	22	27	30	31	32	4.1	9.4	19	350	350	350	57	57	57	93	110	120	S4UL	LQM/CIEH	2015
	Dibenz(a,h)anthracene		2015	0.24	0.28	0.3	0.31	0.32	0.32	0.14	0.27	0.43	3.5	3.6	3.6	0.57	0.57	0.58	1.1	1.3	1.4	S4UL	LQM/CIEH	2015

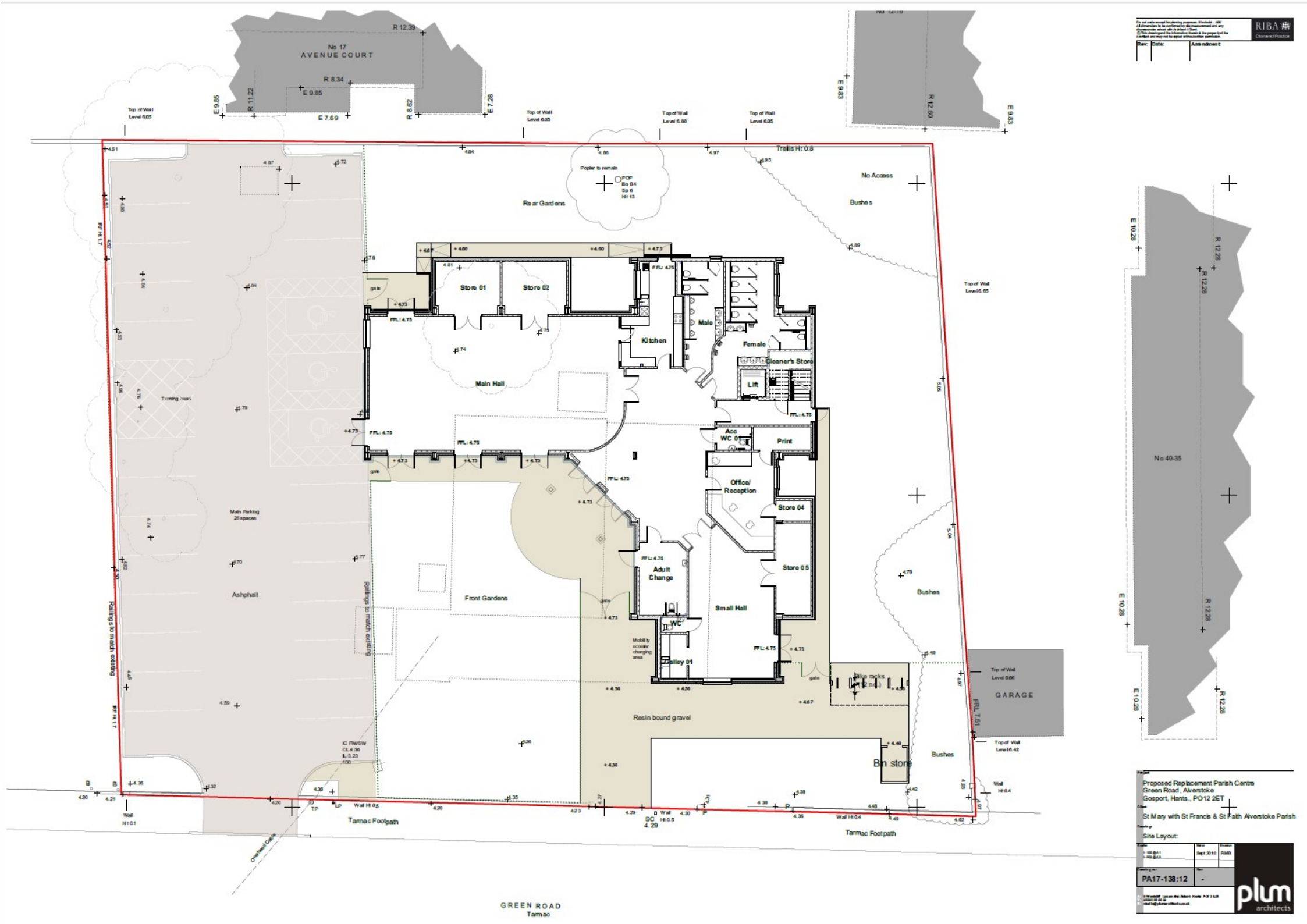
			Residential with home-grown produce			Residential without home-grown produce			Allotments			Commercial			Public Open Space - Resi			Public Open Space -Park					
		SOM	1.0	2.5	6	1	2.5	6	1	2.5	6	1	2.5	6	1	2.5	6	1	2.5	6			
Type	Contaminants Species	Year																					
	Fluoranthene	2015	280	560	890	1500	1600	1600	52	130	290	23000	23000	23000	3100	3100	3100	6300	6300	6400	S4UL	LQM/CIEH	2015
	Fluorene	2015	170	400	860	*2800*	*3800*	*4500*	27	67	160	63000	68000	71000	9900	9900	9900	20000	20000	20000	S4UL	LQM/CIEH	2015
	Indeno(1,2,3-cd)pyrene	2015	27	36	41	45	46	46	9.5	21	39	500	510	510	82	82	82	150	170	180	S4UL	LQM/CIEH	2015
	Naphthalene	2015	2.3	5.6	13	2.3	5.6	13	4.1	10	24	*190*	*460*	*1100*	4900	4900	4900	*1200*	*1900*	*3000*	S4UL	LQM/CIEH	2015
	Phenanthrene	2015	95	220	440	*1300*	*1500*	*1500*	15	38	90	22000	22000	23000	3100	3100	3100	6200	6200	6300	S4UL	LQM/CIEH	2015
	Pyrene	2015	620	1200	2000	3700	3800	3800	110	270	620	54000	54000	54000	7400	7400	7400	15000	15000	15000	S4UL	LQM/CIEH	2015
	Coal Tar(Bap as surrogate matter)	2015	0.79	0.98	1.1	1.2	1.2	1.2	0.32	0.67	1.2	15	15	15	2.2	2.2	2.2	4.4	4.7	4.8	S4UL	LQM/CIEH	2015
Chloroalkanes & alkenes	1,2 Dichloroethane	2015	0.0071	0.011	0.019	0.0092	0.013	0.023	0.0046	0.0083	0.016	0.67	0.97	1.7	29	29	29	21	24	28	S4UL	LQM/CIEH	2015
	1,1,1 Trichloroethane	2015	8.8	18	39	9	18	40	48	110	240	660	1300	3000	140000	140000	*140000*	*57000*	*76000*	*100000*	S4UL	LQM/CIEH	2015
	1,1,2,2 Tetrachloroethane	2015	1.6	3.4	7.5	3.9	8	17	0.41	0.89	2	270	550	1100	1400	1400	1400	1800	2100	2300	S4UL	LQM/CIEH	2015
	1,1,1,2 Tetrachloroethane	2015	1.2	2.8	6.4	1.5	3.5	8.2	0.79	1.9	4.4	110	250	560	1400	1400	1400	1500	1800	2100	S4UL	LQM/CIEH	2015
	Tetrachloroethene	2015	0.18	0.39	0.9	0.18	0.4	0.92	0.65	1.5	3.6	19	42	95	1400	1400	1400	*810*	*1100*	1500	S4UL	LQM/CIEH	2015
	Tetrachloromethane (Carbon Tetrachloride)	2015	0.026	0.056	0.13	0.026	0.056	0.13	0.45	1	2.4	2.9	6.3	14	890	920	950	190	270	400	S4UL	LQM/CIEH	2015
	Trichloroethene	2015	0.016	0.034	0.075	0.017	0.036	0.08	0.041	0.091	0.21	1.2	2.6	5.7	120	120	120	70	91	120	S4UL	LQM/CIEH	2015
	Trichloromethane	2015	0.91	1.7	3.4	1.2	2.1	4.2	0.42	0.83	1.7	99	170	350	2500	2500	2500	2600	2800	3100	S4UL	LQM/CIEH	2015
	Vinyl Chloride (cloroethene)	2015	0.00064	0.00087	0.0014	0.00077	0.001	0.0015	0.00055	0.001	0.0018	0.059	0.077	0.12	3.5	3.5	3.5	4.8	5	5.4	S4UL	LQM/CIEH	2015
Explosives	2,4,6 Trinitrotoluene	2015	1.6	3.7	8.1	65	66	66	0.24	0.58	1.4	1000	1000	1000	130	130	130	260	270	270	S4UL	LQM/CIEH	2015
	RDX (Hexogen/Cyclonite/1,3,5-trinitro-1,3,5-triazacyclohexane)	2015	120	250	540	13000	13000	13000	17	38	85	210000	210000	210000	26000	26000	27000	49000	51000	53000	S4UL	LQM/CIEH	2015
	HMX (Octogen/1,3,5,7-tetrenitro-1,3,5,7-tetrazacyclo-octane)	2015	5.7	13	26	6700	6700	6700	0.86	1.9	3.9	110000	110000	110000	13000	13000	13000	*23000*	*23000*	*24000*	S4UL	LQM/CIEH	2015
Pesticides	Aldrin	2015	5.7	6.6	7.1	7.3	7.4	7.5	3.2	6.1	9.6	170	170	170	18	18	18	30	31	31	S4UL	LQM/CIEH	2015
	Dieldrin	2015	0.97	2	3.5	7	7.3	7.4	0.17	0.41	0.96	170	170	170	18	18	18	30	30	31	S4UL	LQM/CIEH	2015
	Atrazine	2015	3.3	7.6	17.4	610	620	620	0.5	1.2	2.7	9300	9400	9400	1200	1200	1200	2300	2400	2400	S4UL	LQM/CIEH	2015
	Dichlorvos	2015	0.032	0.066	0.14	6.4	6.5	6.6	0.0049	0.01	0.022	140	140	140	16	16	16	26	26	27	S4UL	LQM/CIEH	2015
	Alpha - Endosulfan	2015	7.4	18	41	*160*	*280*	*410*	1.2	2.9	6.8	*5600*	*7400*	*8400*	1200	1200	1200	2400	2400	2500	S4UL	LQM/CIEH	2015
	Beta - Endosulfan	2015	7	17	39	*190*	*320*	*440*	1.1	2.7	6.4	*6300*	*7800*	*8700*	1200	1200	1200	2400	2400	2500	S4UL	LQM/CIEH	2015
	Alpha -Hexachlorocyclohexanes	2015	0.23	0.55	1.2	6.9	9.2	11	0.035	0.087	0.21	170	180	180	24	24	24	47	48	48	S4UL	LQM/CIEH	2015
	Beta -Hexachlorocyclohexanes	2015	0.085	0.2	0.46	3.7	3.8	3.8	0.013	0.032	0.077	65	65	65	8.1	8.1	8.1	15	15	16	S4UL	LQM/CIEH	2015
	Gamma -Hexachlorocyclohexanes	2015	0.06	0.14	0.33	2.9	3.3	3.5	0.0092	0.023	0.054	67	69	70	8.2	8.2	8.2	14	15	15	S4UL	LQM/CIEH	2015
Chlorobenzenes	Chlorobenzene	2015	0.46	1	2.4	0.46	1	2.4	5.9	14	32	56	130	290	11000	13000	14000	*1300*	*2000*	*2900*	S4UL	LQM/CIEH	2015
	1,2-Dichlorobenzene	2015	23	55	130	24	57	130	94	230	540	*2000*	*4800*	*11000*	90000	95000	98000	*24000*	*36000*	*51000*	S4UL	LQM/CIEH	2015
	1,3-Dichlorobenzene	2015	0.4	1	2.3	0.44	1.1	2.5	0.25	0.6	1.5	30	73	170	300	300	300	390	440	470	S4UL	LQM/CIEH	2015
	1,4-Dichlorobenzene	2015	61	150	350	61	150	350	15	37	88	*4400*	*10000*	*25000*	17000	17000	1700	*36000*	*36000*	*36000*	S4UL	LQM/CIEH	2015
	1,2,3,-Trichlorobenzene	2015	1.5	3.6	8.6	1.5	3.7	8.8	4.7	12	28	102	250	590	1800	1800	1800	*770*	*1100*	*1600*	S4UL	LQM/CIEH	2015
	1,2,4,-Trichlorobenzene	2015	2.6	6.4	15	2.6	6.4	15	55	140	320	220	530	1300	15000	17000	19000	*1700*	*2600*	*4000*	S4UL	LQM/CIEH	2015
	1,3,5,-Trichlorobenzene	2015	**0.33**	**0.81**	**1.9**	**0.33**	**0.81**	**1.9**	**4.7**	**12**	**28**	**23**	**55**	**130**	**1700**	**1700**	**1800**	***380***	***580***	***860***	S4UL	LQM/CIEH	2015
	1,2,3,4,-Tetrachlorobenzene	2015	**15**	**36**	**78**	**24**	**56**	**120**	**4.4**	**11**	**26**	**1700**	**3080**	**4400**	**830**	**830**	**830**	***1500***	***1600***	***1600***	S4UL	LQM/CIEH	2015
	1,2,3,5,- Tetrachlobenzene	2015	**0.66**	**1.6**	**3.7**	**0.75**	**1.9**	**4.3**	**0.38**	**0.9**	**2.2**	***49***	***120***	***240***	**78**	**79**	**79**	***110***	***120***	***130***	S4UL	LQM/CIEH	2015
	1,2,4, 5,- Tetrachlobenzene	2015	**0.33**	**0.77**	**1.6**	**0.73**	**1.7**	**3.5**	**0.06**	**0.16**	**0.37**	***42***	***72***	***96***	**13**	**13**	**13**	**25**	**26**	**26**	S4UL	LQM/CIEH	2015
	Pentachlrobenzene	2015	**5.8**	**12**	**22**	**19**	**30**	**38**	**1.2**	**3.1**	**7**	***640***	***770***	***830***	**100**	**100**	**100**	**190**	**190**	**190**	S4UL	LQM/CIEH	2015
	Hexachlorobenzene	2015	***1.8***	***3.3***	**4.9**	***4.1***	***5.7***	***6.7***	**0.47**	**1.1**	**2.5**	***110***	**120**	**120**	**16**	**16**	**16**	**30**	**30**	**30**	S4UL	LQM/CIEH	2015
Phenols & Chlorophenols																							
	Phenols	2015	120	200	380	440	690	1200	23	42	83	*440*	*690*	*1300*	*440*	*690*	*1300*	*440*	*690*	*1300*	S4UL	LQM/CIEH	2015
	Chlorophenols (4 Congeners)	2015	**0.87**	**2**	**4.5**	**94**	**150**	**210**	**0.13**	**0.3**	**0.7**	**3500**	**4000**	**4300**	**620**	**620**	**620**	**1100**	**1100**	**1100**	S4UL	LQM/CIEH	2015
	Pentachlorophenols	2015	**0.22**	**0.52**	**1.2**	***27***	**29**	**31**	**0.03**	**0.08**	**0.19**	**400**	**400**	**400**	**60**	**60**	**60**	**110**	**120**	**120**	S4UL	LQM/CIEH	2015
Others																							
	Carbon Disulphide	2015	**0.14**	**0.29**	**0.62**	**0.14**	**0.29**	**0.62**	**4.8**	**10**	**23**	**11**	**22**	**47**	**11000**	**11000**	**12000**	**1300**	**1900**	**2700**	S4UL	LQM/CIEH	2015
	Hexachloro-1,3-Butadiene	2015	**0.29**	**0.7**	**1.6**	**0.32**	**0.78**	**1.8**	**0.25**	**0.61**	**1.4**	**31**	**66**	**120**	**25**	**25**	**25**	**48**	**50**	**51**	S4UL	LQM/CIEH	2015
	Sum of PCDDs, PCDFs and dioxin-like PCB's.	2012			8			8			8			240							SGV	DEFRA	2012

NOTE

Priority	Guideline (mg kg^{-1})

				Residential with home-grown produce			Residential without home-grown produce			Allotments			Commercial			Public Open Space - Resi			Public Open Space -Park		
			SOM	1.0	2.5	6	1	2.5	6	1	2.5	6	1	2.5	6	1	2.5	6	1	2.5	6
Type	Contaminants	Species	Year																		
	1	Site Specific Assessment Criteria (SSAC) (Soils Limited)																			
	2	2014: Category 4 Screening Level (C4SL) (Contaminated Land: Application in Real Environment (CL:ARE), 2014)																			
	3	2012: Soil Guideline Value (SGV) (Environment Agency, 2009)																			
	4	2015: Suitable 4 Use Level (S4UL) (Nathanail *et al*, 2015)																			
		For Generic Risk Assessment, the values in Bold have priority																			
		Table reviewed February 2020																			

Appendix D Information Provided by the Client


No 17
AVENUE COURT
R 12.39
R 8.34
E 9.85
E 7.69
R 11.22
E 9.85
R 8.62
E 7.28
R 12.60
E 9.83
E 9.83
Top of Wall Level 6.05
Top of Wall Level 6.05
Top of Wall Level 6.00
Top of Wall Level 6.05
Trellis Ht 0.8
No Access
Bushes
Poplar to remain
POP
Bo 0.4
Sp 6
Ht 13
Rear Gardens
Top of Wall Level 6.05
Store 01
Store 02
Kitchen
Male
Female
Cleaner's Store
Lift
Main Hall
Acc WC 01
Print
Office/ Reception
Store 04
Store 05
Adult Change
Small Hall
WC
Galley 01
Mobility scooter charging area
Bike racks
Front Gardens
Main Parking 26 spaces
Ashphalt
Railing to match existing
Resin bound gravel
Bin store
Bushes
Top of Wall Level 6.66
GARAGE
FRL 7.51
Top of Wall Level 6.42
Bushes
Wall Ht 0.4
IC FWSW
CL 4.36
I. 3.23
100
Wall Ht 0.1
Wall Ht 0.5
Tarmac Footpath
SC 4.29
Wall Ht 0.5
Tarmac Footpath
Overhead Cable
GREEN ROAD
Tarmac
E 10.28
R 12.29
R 12.28
No 40-35
R 12.28
E 10.28
R 12.28
E 10.28
RIBA
Chartered Practice
Rev:
Date:
Amendment:
Proposed Replacement Parish Centre
Green Road, Alverstoke
Gosport, Hants., PO12 2ET
St Mary with St Francis & St Faith Alverstoke Parish
Site Layout:
Sept 2018
RMB
PA17-138:12
-
plm
architects

Soils Limited
Geotechnical & Environmental Consultants

Newton House
Cross Road, Tadworth
Surrey KT20 5SR

T 01737 814221
W soilslimited.co.uk