soils LIMITED

Geotechnical Investigation Report

at
Meadowbrook, 52 Grenville Road, Lostwithiel,
Cornwall PL22 0RA

for
Porthia Group Limited

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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 Porthia Group Limited to undertake an intrusive ground investigation and prepare a Geotechnical Investigation Report on Land at Meadowbrook, 52 Grenville Road, Lostwithiel, Cornwall PL22 0RA. The scope of the investigation was outlined in the Soils Limited quotation reference Q22200, dated 22nd January 2020.

This document comprises the Geotechnical Investigation Report and incorporates the results, discussion, and conclusions to this intrusive works. This Geotechnical Investigation Report must be read in conjunction with the Preliminary Investigation Report undertaken on the above site by Ian Farmer Associates Limited, Report ref: C61702, dated September 2018.

This version of the GIR (Rev1.1) supersedes all previous versions.

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 5930:2015 and BS EN ISO 22476-3:2005+A1:2011

BS EN 1997-1:2004+A1:2013 Eurocode 7.

BS EN ISO 14688-1:2002+A1:2013

BRE DG365: 2016

BRE DG240: 1993

NHBC Standards 2020

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 Porthia Group Limited to undertake an intrusive ground investigation and to prepare a Geotechnical 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 care home 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.

Limited soil samples were taken for chemical laboratory testing, but due to site constraints insufficient samples were available to provide a robust assessment of potential contamination. As such, the results that were obtained are not considered further in this report, and a separate contamination assessment report will be prepared in due course.

1.2 Limitations and Disclaimers

This Geotechnical Investigation Report relates to the site located at Meadowbrook, 52 Grenville Road, Lostwithiel, Cornwall PL22 0RA and was prepared for the sole benefit of Porthia Group Limited (The “Client”). The report was prepared solely for the brief described in Section 1.1 of this report.

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.

1.3 Location

The site was located at Meadowbrook, 52 Grenville Road, Lostwithiel, Cornwall PL22 0RA and had an approximate O.S Land Ranger Grid Reference of SX 11286 59784. The site was located due north, just off the A390 and 1.1miles due east of Lostwithiel. The site is bounded to the north and east by residential properties and private gardens, to the south by the A390, and to the west by the existing care home.

The site location plan is given in Figure 1.

1.4 Site Description

At the time of the intrusive investigation the site comprised an area of overgrown land 5 metres to the east of the existing Meadowbrook Care Home. Two small storage sheds located in the southwest corner were the only structures on the site. The site was covered in dense vegetation that inhibited access to much of the site.

Dense tree cover was noted in the north-eastern corner comprising beech, copper beech and hazel. Along with the northern and eastern boundaries tree cover consisted of pine and beech. Ruderal growth and dense brambles were noted across the site.

A tarmacadam access route to the existing care home in the south comprised the hardstanding on site.

The site had a steep slope running down to the south in line with the wider topography, with an approximate gradient of 15º.

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

1.5 Proposed Development

At the time of reporting the proposed development comprised the demolition of the existing care home and the construction of two new four-storey blocks forming a new care home and close care units. Block A comprising an L-shaped building and includes thirty-six close care units, whilst Block B comprising a new care home with a total of 82No. units. The development also included communal green space and 46 parking and three drop off spaces along the southern portion of the site. No private gardens are proposed.

Due to the topography rising from the south to the north, the proposed care home structure will be partly cut into the existing slope. It was understood that the development was going to require a large earthworks exercise with retaining structures to the rear.

In compiling this report reliance was placed on drawing numbers:

3849-PBWC-00-XX-DR-A-1102 Rev.P5, dated July 2023

3849-PBWC-01-XX-DR-A-3000 & 3001 Rev.P1, dated July 2023

3849-PBWC-02-XX-DR-A-3001 & 3002 Rev.P1, dated July 2023

All drawings were prepared by Poynton Bradbury Wynter Cole. The recommendations provided within this report are made exclusively in relation to the scheme outlined above and are subject to the following caveat. They 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.

It must be noted that this investigation was undertaken based on a previous scheme, which included a new block to the east, alongside extensions to the existing care home in the west. As such, the investigation was focused on the eastern portion of the site and does not cover the western area in detail. Whilst the general findings are applicable to the whole development, further works will be required to verify the findings and inform foundation options.

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

1.6 Anticipated Geology

The 1:50,000 BGS map showed the site to be located directly upon bedrock of the Trendrean Mudstone Formation with no overlying superficial deposits. Whilst not recorded on the BGS map, it is likely that Made Ground will be encountered on site, given parts of the site have been developed previously.

1.6.1 Made Ground

Made Ground comprises material that has been placed by man, or spread by man. It can comprise demolition material from former structures on the site or imported material placed to raise levels. Its composition can be very variable both laterally and with depth and may contain putrescible matter and voids.

1.6.2 Trendrean Mudstone Formation

Dark shales and siltstones with sporadic grey-brown sandstones and beds of decalcified shell debris. Upper part exhibits red coloration in places.

The Trendrean Mudstone Formation typically weathers to a sandy clay progressively becoming a clay bound gravel to gravel with depth. The weathered horizons overlie the intact rock that can be at some depth.

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 care home development. The intended investigation, as outlined within the Soils Limited quotation (Q22200, dated 22nd January 2020), was to comprise the following items:

- 1 day machine excavated trial pitting
- 1 day windowless sampler boreholes and dynamic probing
- Infiltration tests to BRE DG365:2016
- Geotechnical laboratory testing
- Geotechnical investigation report

2.2 Investigative Works

The actual project works were undertaken on 18th February 2020 and comprised:

- 2No. machine excavated trial pits (TP01 and TP02)
- 3No. windowless sampler boreholes (WS01, WS02 and WS04)
- 3No. dynamic probes (DP01, DP02 and DP04)
- Infiltration tests to BRE DG365:2016
- Geotechnical laboratory testing
- Geotechnical investigation report

On 18th February 2020 three windowless sampler boreholes (WS01, WS02 and WS04) were drilled, using an Premier Compact windowless sampler and dynamic probe rig, to depths ranging between 3.85m (WS01) and 5.00m (WS02) below ground level (bgl) at locations selected by Soils Limited using a development plan provided by the client.

Three super heavy dynamic probes, (DP01, DP02 and DP04) were driven prior and adjacent to their corresponding windowless sampler borehole to depths ranging between 4.00m (DP01) and 6.00m bgl (DP02).

Two machine excavated trial pits (TP01 and TP02) were undertaken using a JCB 3CX mechanical excavator, to depths of 2.40m and 2.60m bgl. Infiltration testing, in accordance with BRE DG365:2016, was undertaken in both trial pits.

Site works were impeded by dense vegetation, and steep and uneven terrain which would not allow the movement of plant and machinery across the site. WS/DP03 could not be undertaken due to dense tree cover and the steep incline.

Three windowless sampler boreholes (WS01, WS02 and WS04) were backfilled with gravel and bentonite upon completion. Two machine excavated trial pits were backfilled with arising's and mounded over for future settlement.

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.

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)
WS/ DP01	3.85 / 4.00	$TP01_{sk}$	2.60
WS/ DP02	5.00 / 6.00	$TP02_{sk}$	2.40
WS/ DP04	4.50 / 5.80		

Note: sk=Soakage testing

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 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)
Topsoil (TS)
Weathered Trendrean Mudstone Formation (TRDN)

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.	0.25	0.25	Grey sandy GRAVEL with anthropogenic fragments including brick and concrete
TS	Anthropocene	G.L.	0.50 – 0.75	0.60	Light brown slightly sandy, silty CLAY
TRDN	Devonian	0.25 – 0.50	2.60 – 6.00	Not Proven[1, 2]	Light grey slightly sandy slightly silty gravelly CLAY becoming yellowish brown clayey sandy very silty GRAVEL.

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

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 one out of the five trial holes from ground level to a depth of 0.25m (WS01). Made Ground was encountered within an area of dumped domestic furniture and household rubbish located near the western boundary.

The Made Ground typically comprised grey sandy GRAVEL. Gravel was angular to sub-rounded fine to coarse granite. Sand was medium. Anthropogenic fragments including brick and concrete were noted throughout.

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	0.25

2.3.2 Topsoil

Soils described as Topsoil were encountered in four out of the five trial holes from ground level to depths ranging between 0.50m (WS04) and 0.75m bgl (TP02).

The Topsoil comprised light brown slightly sandy silty CLAY. Sand was fine. Frequent roots and rootlets along with occasional plant matter was noted.

The depth of Topsoil has been included in Table 2.4.

Table 2.4 Final Depth of Topsoil

Trial Hole	Depth (m bgl)	Trial Hole	Depth (m bgl)
WS/DP01	0.25	TP01	0.60
WS/DP02	0.55	TP02	0.75
WS/DP04	0.50		

2.3.3 Weathered Trendrean Mudstone Formation

The Weathered Trendrean Mudstone Formation was encountered directly beneath the Made Ground or Topsoil from a depth of 0.25m (WS01) and persisted to depths between 5.00m bgl (base of WS02) and an inferred depth of 6.00m bgl (DP02).

The Weathered Trendrean Mudstone Formation was weathered to varying degrees and typically comprised a soft to firm light grey slightly sandy slightly silty gravelly CLAY. Gravel was subangular fine to coarse tabular and laminated mudstone, sandstone and rare quartzite with occasional mudstone cobbles. The granular soils encountered typically comprised yellowish brown clayey sandy very silty GRAVEL. Gravel was subangular fine to coarse laminated mudstone, sandstone and rare quartzite. The gravel clasts were very weak and crumbled in the hand.

The upper horizon was weathered with a higher proportion of fines, becoming increasingly granular and competent with depth. The depth to the predominantly granular soils varied across the site, but was typically between 1.00m bgl (WS04) to 2.40m bgl (TP02). No trend between location within the site and the depth to granular soils was evident.

Dynamic probe tests, DP01 and DP04 refused on harder strata, possibly indicative of competent bedrock, at depths of 4.10m and 5.90m bgl, respectively. DP02 refused due to high torque readings.

2.4 Roots

Roots were encountered in all five trial holes at depths ranging between 0.90m and 1.60m 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)	Trial Hole	Depth (m bgl)
WS01	0.90	TP01	1.30
WS02	1.40	TP02	1.60
WS04	1.40		

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. Dense Oak tree cover was noted in the northern boundary with ruderal growth and dense brambles were noted across the site.

2.5 Groundwater

Groundwater was not encountered within any of the trial holes during the investigation.

Changes in groundwater level occur for reasons including seasonal effects and variations in drainage. The investigation was conducted in February (2020), 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 lay outside of the clients specification.

Section 3 Discussion of Geotechnical In-Situ and Laboratory Testing

3.1 Dynamic Probe Tests

Dynamic probing (DPSH) was undertaken at three locations (DP01, DP02 and DP04), adjacent and prior to the drilling the corresponding windowless sampler boreholes, to depths ranging between 4.00 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 1.2.

The SPT “N60” values presented have been corrected in accordance with BS EN 22476 Part 3, to account for the rig 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 72.45%. The energy ratio for each location is presented on the individual logs within Appendix A.1.

The Weathered Trendrean Mudstone Formation recorded equivalent SPT “N60” values between 3 and 10 within cohesive beds and 8 to more than 50 in granular beds. The cohesive beds were classified as very low to medium strength with an inferred undrained cohesive strength of 15 to 50kPa. The granular beds were classified as loose to very dense relative density.

It was generally recorded that relative density increased with depth, however weathered bands and silt horizons were noted in all three boreholes.

Locations DP01 and DP04 were terminated when the cone refused further penetration, which was likely to be due to encountering a lesser weathered rock or large gravel clasts or rock head.

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 from the Weathered Trendrean Mudstone Formation. The results were classified in accordance with BRE Digest 240 and NHBC Standards Chapter 4.2.

The more cohesive (near surface) weathered Trendrean Mudstone Formation was classified as having low volume change potential in accordance with both BRE Digest 240 and NHBC Standards Chapter 4.2.

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 Weathered Trendrean Mudstone Formation.

The PSD tests classified two of the samples from the granular beds of the Weathered Trendrean Mudstone Formation as having a volume change potential in accordance BRE Digest 240 and NHBC Standards Chapter 4.2.

A further sample from the Weathered Trendrean Mudstone Formation was classified as being predominately silt. During the logging and sub-sampling of the soils recovered it was noted that the gravel (clasts of mudstone rock) were highly weathered and friable. As such, it should be considered that the granular Weathered Trendrean Mudstone Formation should also be classified as having low volume change potential in accordance BRE Digest 240 and NHBC Standards Chapter 4.2.

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.

Section 4 Foundation Design

4.1 Foundation Scheme General

At the time of reporting the proposed development comprised the demolition of the existing care home and the construction of two new four-storey blocks, as detailed in Section 1.5 and Appendix C.

Due to the topography rising from the south to the north, the proposed building will be partly cut into the existing slope. It was understood that the development was going to require a large earthworks exercise and the ground floor level was to be 42.00m AOD, thus requiring retaining structures to the rear of the care home block.

4.1.1 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 Weathered Trendrean Mudstone Formation had **low volume change potential** in accordance with both BRE Digest 240 and NHBC Standards Chapter 4.2.

Low volume change potential must therefore be adopted where foundations pass through the Weathered Trendrean Mudstone Formation.

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"

4.2 Foundation Scheme

Foundations must not be constructed within any Made Ground, Topsoil or **weathered cohesive soils** of the Trendrean Mudstone Formation due to the likely variability and potential for large load induced settlements both total and differential.

Roots were encountered in all five trial holes at depths ranging between 0.90m and 1.60m 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 to bypass these unsuitable soils. Excavations must be checked by a geotechnical engineer prior to concrete being poured.

The proposed development comprised multi-storey buildings and therefore there is potential for relatively large loads. Due to the rising topography from south to north, the proposed buildings will be partly cut into the existing slope. The use of shallow foundations placed within the granular soils of the Weathered Trendrean Mudstone Formation was considered. However, given the existing ground levels vary across the footprint of the proposed, the amount of overburden removed will vary accordingly, resulting in potential differential bearing values and differential settlement.

It was understood that the development was going to require a large earthworks exercise and ground floor level was to be 42.00m AOD. The ground floor footprint of the care home block is located such that a maximum estimated 3.50m of overburden would be removed, increasing from the south to the north and northeast. It is also possible that foundations placed further into the slope will be within more competent rock, although depth to rockhead has not been established during this investigation.

Investigations were undertaken from approximately 42.10m AOD (WS01) towards the western extent and 41.50m AOD (WS04) at the southern extent of the proposed eastern flank. WS02 was located to the rear of the proposed ground floor footprint and did not encounter competent bedrock at 5.00m bgl (6.00m bgl / 41.70m AOD in DP02).

It must be noted that due to removal of overburden pressure increasing towards the north, nett allowable bearing capacities will increase accordingly. It is estimated that an overburden pressure of up to 65kPa would be removed on the northern extent of the ground floor footprint, based on a unit weight of 18kN/m^3. Accordingly, settlements will vary across the proposed footprint, depending on the location within the slope, with significant potential for differential settlement.

Given the above factors, a piled foundation is recommended, with piles taken into the competent bedrock of the Trendrean Mudstone Formation. Alternatively, further investigation could be undertaken to establish the depth to rockhead, which may allow a reinforced strip or pad spread foundation solution.

4.2.1 Piled Foundations

Piles must be taken through any Topsoil, Made Ground and Weathered Trendrean Mudstone Formation and into suitable strength bedrock of the Trendrean Mudstone Formation.

The construction of a piled foundation is a specialist job with the actual pile working load depending on the particular type pile and installation method. Prior to finalising the foundation design the advice from a reputable contractor who is familiar with the ground and groundwater conditions present at the site should be sought.

Down-the-hole hammer (DTH) drilled piles are likely to be most suitable for the ground conditions encountered at the site. Further investigation would be required to establish depth to rockhead, which in turn would inform likely pile depths.

Where piles are to be constructed in groups the bearing value of each individual pile should be reduced by a factor of about 0.8 and a calculation made to check the factor of safety against block failure.

To prevent necking of the green concrete, temporary casing may be required where the pile passes through the Topsoil, Made Ground and Weathered Trendrean Mudstone Formation and below the groundwater table (if encountered). To achieve the full bearing value a pile should penetrate the bearing stratum by at least five times the pile diameter.

No allowance has been made for negative skin friction that could be generated where piles pass through Topsoil, Made Ground and Weathered Trendrean Mudstone Formation underlying the site. The negative skin friction must be applied to the pile working load and must not be factored.

4.3 Retaining Wall

Using commercial software Table 4.1 shows the calculated characteristic values for the soils encountered on site.

Table 4.1 Retaining Wall Design Parameters

Strata	Bulk Density (kN/m^3)	Friction angle (^{o})	Effective Cohesion (KPa)	Undrained Cohesion (KPa)	Active Earth Pressure Coefficient	Passive Earth Pressure Coefficient
MG/TS – cohesive	16.0	20	0	20	0.490	2.040
MG/TS – granular	15.5	22	0	0	0.455	2.198
TRDN – granular	18.5	32	0	0	0.307	3.254

If the foundation is to include lateral load from retained soil, then the distribution of loads on the foundation will be trapezoidal and the maximum pressure will be at the toe of the foundation. The foundation must resist both overturning and sliding forces. The overturning forces are derived from the loads imposed both by the soils retained, by any line loads from structures to the rear of the wall and by groundwater.

The coefficients of active and passive earth pressure provided in Table 4.2 were estimated from the interpretation of dynamic probes. To calculate the lateral loads from the soils their coefficient of active earth pressure must be confirmed from effective stress testing.

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. Foundations must not be constructed over former structures and other hard spots. The foundation 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).

4.4 Subsurface Concrete

Two samples from the Weathered Trendrean Mudstone Formation were tested 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 at <10mg/l with pH values of 6.7 to 8.0.
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 the pH of the soils.

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 indicates a ACEC (Aggressive Chemical Environment for Concrete) site classification of **AC-1s**. The pH of the soils tested ranged between 6.9 and 7.4. 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.

4.5 Excavations

Excavations in the Made Ground, Topsoil or Weathered Trendrean Mudstone Formation are likely to be unstable and must be retained.

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 before excavations are entered by personnel.

4.6 Soakaways

Infiltration testing was undertaken in TP01 and TP02 within the Weathered Trendrean Mudstone Formation following the principles of BRE Digest 365 Soakaway design: 2016. BRE 365 states that for an accurate infiltration rate to be obtained a soakage pit needs to be filled three times in quick succession. Each test can only be ended once 75% of the water present has drained away.

Three full tests were undertaken in TP01 ending once 75% of the water had drained away. Due to the slow infiltration rates observed, only one complete test was undertaken within TP02. BRE software BRESOAK was used to calculate the infiltration rates and the results outlined in Table 4.2.

Table 4.2 Infiltration Rates

Trial Hole	Test No.	Test Strata	Start Depth (m)	End Depth (m)	Time Elapsed (m)	Infiltration Rate (m/s)
TP01	1	TRDN	1.40	2.55	16	4.115E-04
	2	TRDN	1.55	2.60	17	3.149E-04
	3	TRDN	1.55	2.60	21	2.691E-04
TP02	1	TRDN	1.45	2.40	200	1.581E-05

It is recommended that the results of infiltration tests are passed to a drainage engineer for their consideration.

4.7 Duty of Care

During ground works, some simple measures may have to be put in place to mitigate the risk of any contamination affecting the site workers and the environs. The majority of the proposed measures represent good practice for the construction industry and include:

- Informing the site workers of any contamination on site and the potential health effects from exposure.
- Where appropriate, the provision of suitable Personal Protective Equipment (PPE) for workers who may be potentially impacted by working in areas of the contamination.
- Ensuring good hygiene is enforced on site and washing facilities are maintained on the site. Workers are discouraged from smoking, eating or drinking without washing their hands first.
- Dust monitoring, and if necessary, suppression measures should be put into practice where contamination is becoming airborne.
- Site drainage should be prevented from entering any adjacent watercourse.

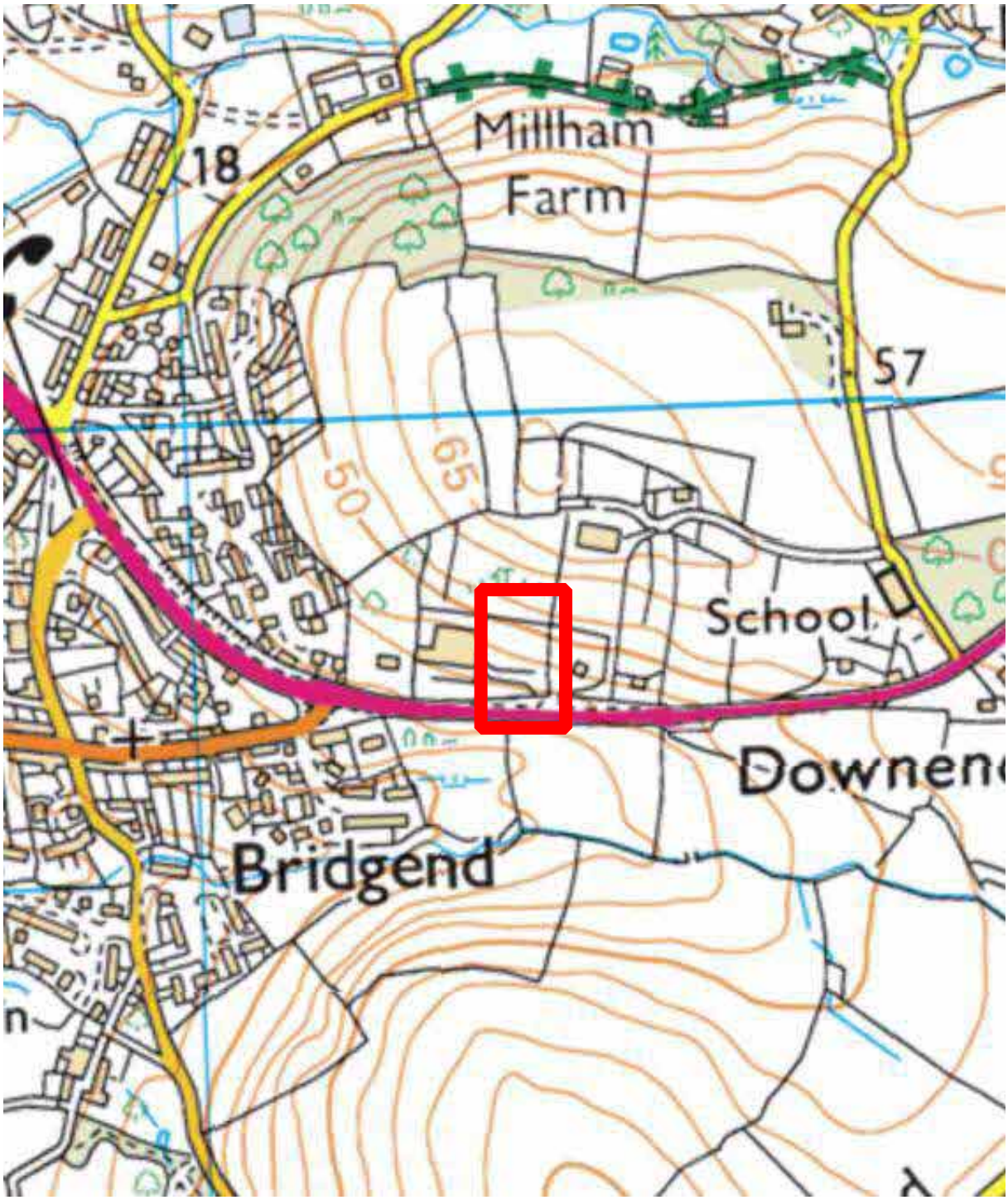
Where materials are being removed from the site they should be disposed of at a suitably licensed landfill, with a ‘duty of care’ system in place and maintained throughout the disposal operations.

The site should be securely fenced at all times to prevent unauthorised access.

List of Figures

List of Appendices

Figure 1 – Site Location Map



Job Number 18216	Project Meadowbrook, 52 Grenville Road, Lostwithiel, Cornwall, PL22 0RA
Client Porthia Group Limited	Date September 2020

Figure 2 – Aerial Photograph

Project
Meadowbrook, 52 Grenville Road, Lostwithiel, Cornwall, PL22 0RA

Client
Porthia Group Limited

Date
September 2020

Job Number
18216

Figure 3 – Trial Hole Plan

Project
Meadowbrook, 52 Grenville Road, Lostwithiel, Cornwall, PL22 0RA

Client
Porthia Group Limited

Date
September 2020

Job Number
18216

Appendix A Field Work

Appendix A.1 Engineers Logs

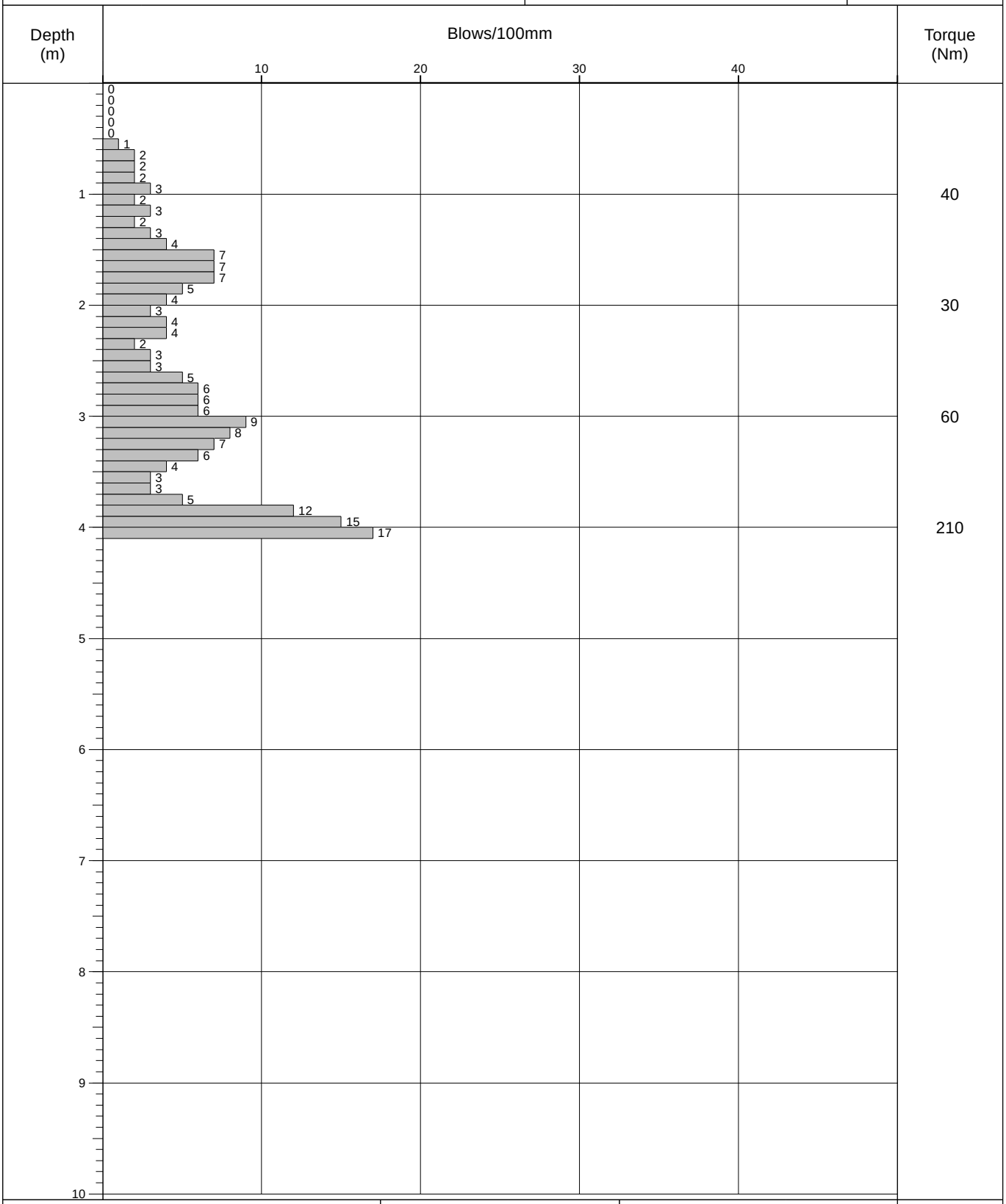
Samples & In Situ Testing			Strata Details		
Depth	Type	Results	Level (mAOD)	Depth (m) (Thickness)	Legend
			41.99	0.08	
			41.82	0.25	
				(1.10)	
			40.72	1.35	
				(2.35)	
			38.37	3.70	
			38.22	3.85	

Samples & In Situ Testing			Strata Details		
Depth	Type	Results	Level (mAOD)	Depth (m) (Thickness)	Legend
				(0.55)	
			47.14	0.55	
				(0.70)	
			46.44	1.25	
				(0.55)	
			45.89	1.80	
			45.69	2.00	
				(3.00)	
			42.69	5.00	

Samples & In Situ Testing			Strata Details		
Depth	Type	Results	Level (mAOD)	Depth (m) (Thickness)	Legend
				(0.50)	
			41.07	0.50	
				(0.50)	
			40.57	1.00	
				(3.50)	
			37.07	4.50	

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

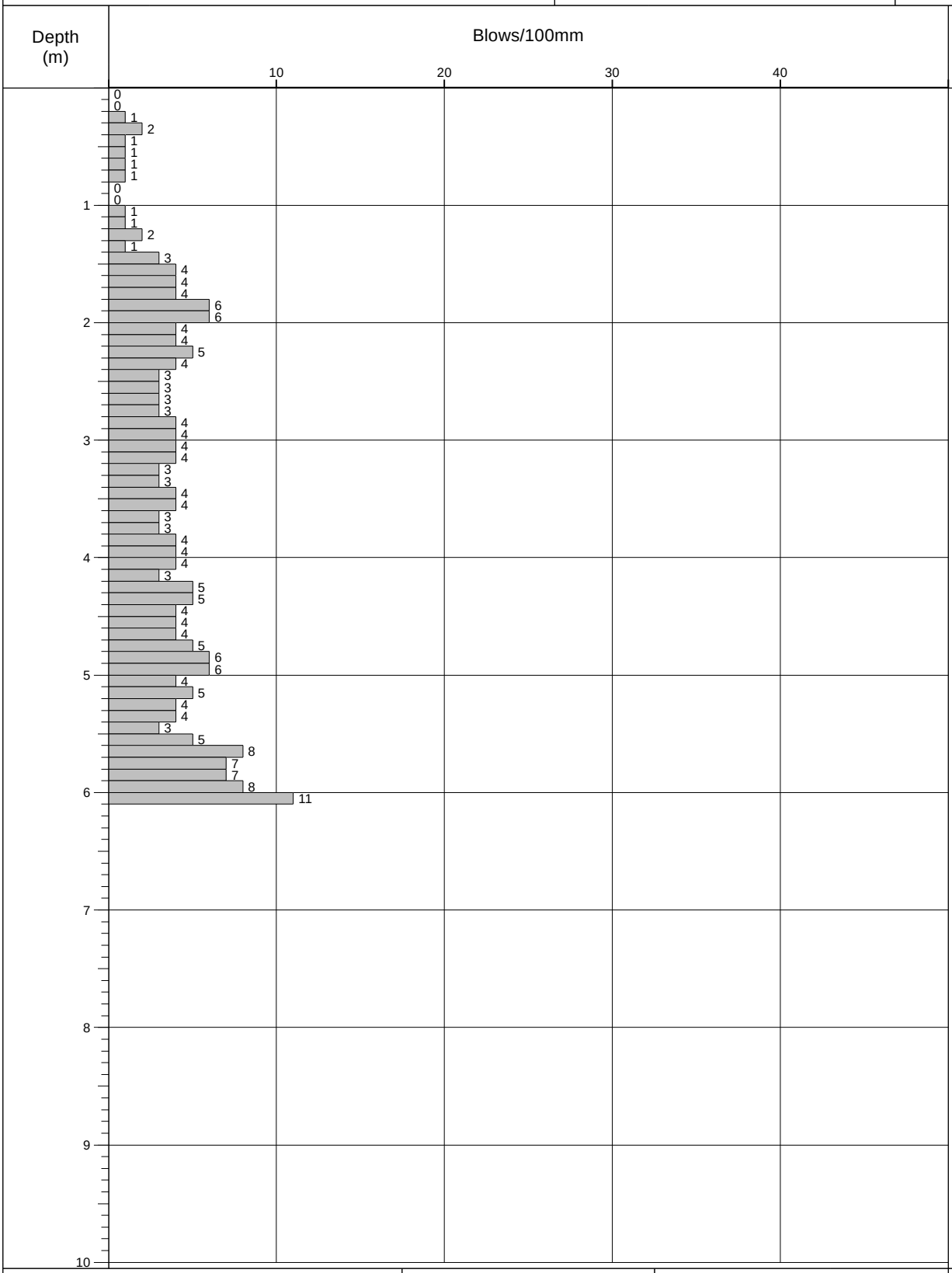
Project Name:	Meadowbank	Project No. 18216	Co-ords:	Hole Type DP
Location:	52 Grenville Road, Lostwithiel PL22 0RA		Level: 42.07m AOD	Scale 1:50
Client:	Porthia Limited		Dates: 18/02/2020	Logged By



Remarks Ground level is approximate.	Fall Height	750mm	Cone Base Diameter	50.5mm	AGS
	Hammer Weight	63.5kg	Final Depth	4m	
	Probe Type	DPSH-B	Energy Ratio (Er)	72.45%	

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

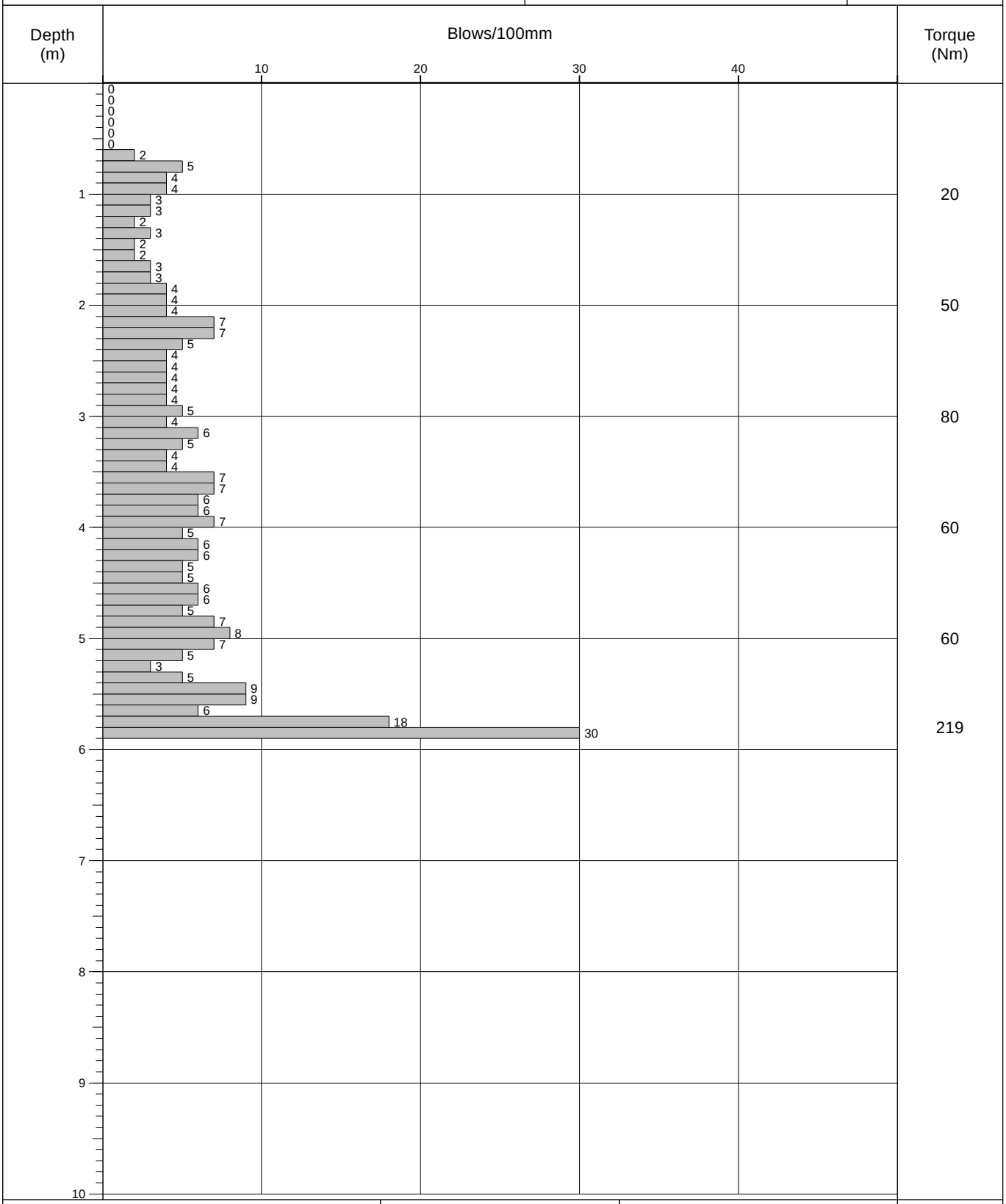
Project Name:	Meadowbank	Project No. 18216	Co-ords:	Hole Type DP
Location:	52 Grenville Road, Lostwithiel PL22 0RA		Level: 47.69m AOD	Scale 1:50
Client:	Porthia Limited		Dates: 18/02/2020	Logged By



Remarks Ground level is approximate.	Fall Height	750mm	Cone Base Diameter	50.5mm	AGS
	Hammer Weight	63.5kg	Final Depth	6m	
	Probe Type	DPSH-B	Energy Ratio (Er)	72.45%	

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:	Meadowbank	Project No. 18216	Co-ords:	Hole Type DP
Location:	52 Grenville Road, Lostwithiel PL22 0RA		Level: 41.57m AOD	Scale 1:50
Client:	Porthia Limited		Dates: 18/02/2020	Logged By



Remarks Ground level is approximate.	Fall Height	750mm	Cone Base Diameter	50.5mm	AGS
	Hammer Weight	63.5kg	Final Depth	5.8m	
	Probe Type	DPSH-B	Energy Ratio (Er)	72.45%	

Water Strike	Samples & In Situ Testing			Depth (m)	Level (mAOD)	Legend
	Depth	Type	Results			
				0.60	42.67	
				1.30	41.97	
				2.25	41.02	
				2.60	40.67	

Water Strike	Samples & In Situ Testing			Depth (m)	Level (mAOD)	Legend
	Depth	Type	Results			
				0.75	40.32	
				1.80	39.27	
				2.20	38.87	
				2.40	38.67	

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 N 60 Blow Counts	Inferred Cohesive Strength/Granular Density
DP 01	TRDN 0.25 – 1.35 Sandy SILT	3 - 6	Very low to low (C_u = 15 – 30kPa)
	TRDN 1.35 – 3.60 Sandy GRAVEL	9 - 28	Loose to medium dense
	TRDN 3.60 – 3.80 Clayey sandy SILT	10	Medium (C_u = 50kPa)
	TRDN 3.8 – 4.0 Sandy GRAVEL[1]	>50	Very dense
DP02	TRDN 0.55 – 2.00 Sandy SILT/CLAY	3 – 6	Very low to low (C_u = 15 – 55kPa)
	TRDN 2.00 – 6.00 Sandy Silty GRAVEL[1]	10 - 30	Medium dense
DP04	TRDN 0.55 – 2.00 Sandy Silty GRAVEL	8 - 12	Loose to medium dense
	TRDN 2.00 – 5.50 Sandy Silty GRAVEL	14 - 24	Medium dense
	TRDN 5.50 – 5.80 Sandy Silty GRAVEL[1]	>50	Very dense

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
TRDN	18 – 26	29 - 30	51 - 62	15 – 18	CL - CH	Low	Low

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	
TP01	2.30	Brown clayey fine to coarse sandy silty fine to coarse GRAVEL	Yes	Yes	44
TP02	2.20	Brown clayey fine to coarse gravelly silty fine to coarse SAND	Yes	Yes	43
WS01	3.80	Brown slightly fine gravelly slightly clayey fine to coarse sandy SILT	Yes	Yes	51

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

UKAS TESTING
2788

GSTL
GEO Site & Testing Services Ltd

Contract Number: 47969

Client Ref:
Client PO: **18216/Geo/JH18216**

Report Date: **09-03-2020**

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

Contract Title: **Meadowbank**
For the attention of: **John Hills**

Date Received: **28-02-2020**
Date Completed: **09-03-2020**

Test Description	Qty
Moisture Content BS 1377:1990 - Part 2 : 3.2 - * UKAS	3
1 Point Liquid & Plastic Limit BS 1377:1990 - Part 2 : 4.4 & 5.3 - * UKAS	3
PSD Wet Sieve method BS 1377:1990 - Part 2 : 9.2 - * UKAS	3
PSD: Sedimentation by pipette carried out with Wet Sieve (Wet Sieve must also be selected) BS 1377:1990 - Part 2 : 9.4 - * UKAS	3
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)
Sean Penn (Administrative/Accounts Assistant) - 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	47969	
Site Name	Meadowbank	
Date Tested	04/03/2020	
	DESCRIPTIONS	

Sample/Hole Reference	Sample Number	Sample Type	Depth (m)			Descriptions
TP01		B	1.20	-		Brown fine to coarse gravelly silty CLAY
TP02		B	1.50	-		Brown fine to coarse gravelly silty CLAY
WS02		D	1.30	-		Brown fine to coarse gravelly silty CLAY
				-		
				-		
				-		
				-		
				-		
				-		
				-		
				-		
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				-		
				-		
				-		
				-		
				-		

Operators	Checked	09/03/2020	Wayne Honey (Administrative/Quality Assistant)
Clayton Jenkins	Approved	09/03/2020	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	47969	
Project Location	Meadowbank	
Date Tested	**04/03/2020**	

Sample/Hole Reference	Sample Number	Sample Type	Depth (m)			Moisture Content %	Liquid Limit %	Plastic Limit %	Plasticity index %	Passing 0.425mm %	Remarks
TP01		B	1.20	-		26	50	20	30	54	CI/H Inter/High Plasticity
TP02		B	1.50	-		18	50	20	30	51	CI/H Inter/High Plasticity
WS02		D	1.30	-		27	49	20	29	62	CI Intermediate Plasticity
				-							
				-							
				-							
				-							
				-							
				-							
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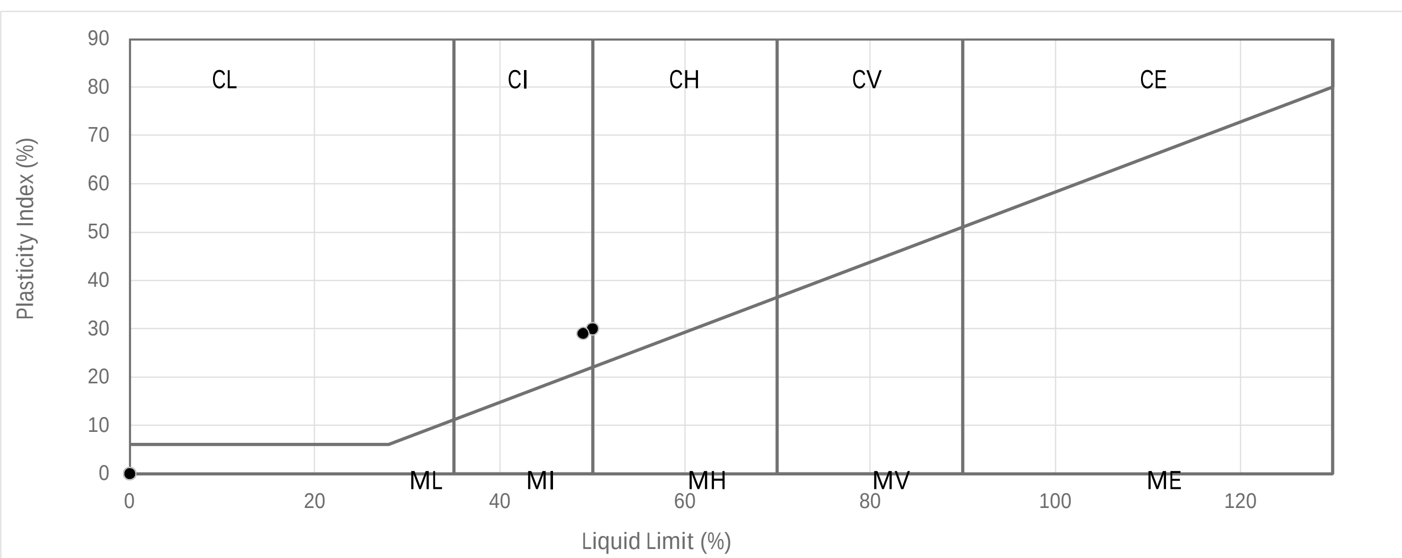
				-							
				-							
				-							

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

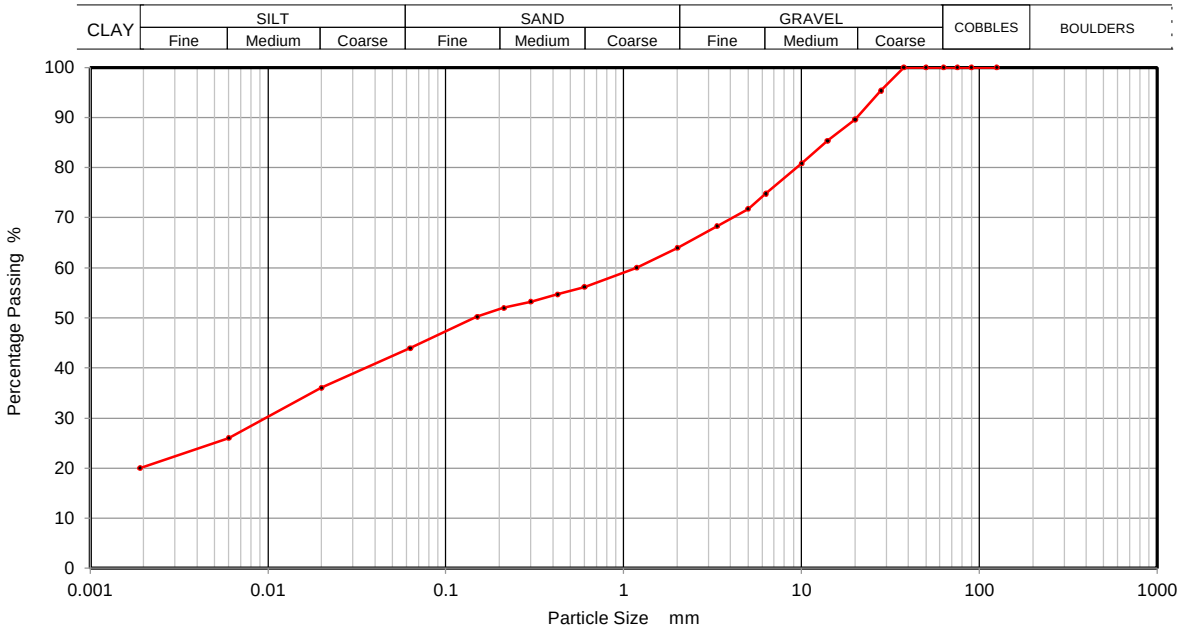
PLASTICITY CHART FOR CASAGRANDE CLASSIFICATION
BS 5930:1999+A2:2010



Operators	Checked	09/03/2020	Wayne Honey (Administrative/Quality Assistant)
Clayton Jenkins	Approved	09/03/2020	Paul Evans (Quality/Technical Manager)

2788

GSTL	PARTICLE SIZE DISTRIBUTION BS 1377 Part 2:1990 Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4	Contract Number	47969
		Borehole/Pit No.	TP01
Site Name	Meadowbank	Sample No.	
Soil Description	Brown clayey fine to coarse sandy silty fine to coarse GRAVEL	Depth Top	2.30
		Depth Base	
Date Tested	06/03/2020	Sample Type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0200	36
90	100	0.0060	26
75	100	0.0020	20
63	100		
50	100		
37.5	100		
28	95		
20	90		
14	85		
10	81		
6.3	75		
5	72		
3.35	68		
2	64		
1.18	60		
0.6	56		
0.425	55		
0.3	53		
0.212	52		
0.15	50		
0.063	44		

Sample Proportions	% dry mass
Cobbles	0
Gravel	36
Sand	20
Silt	24
Clay	20

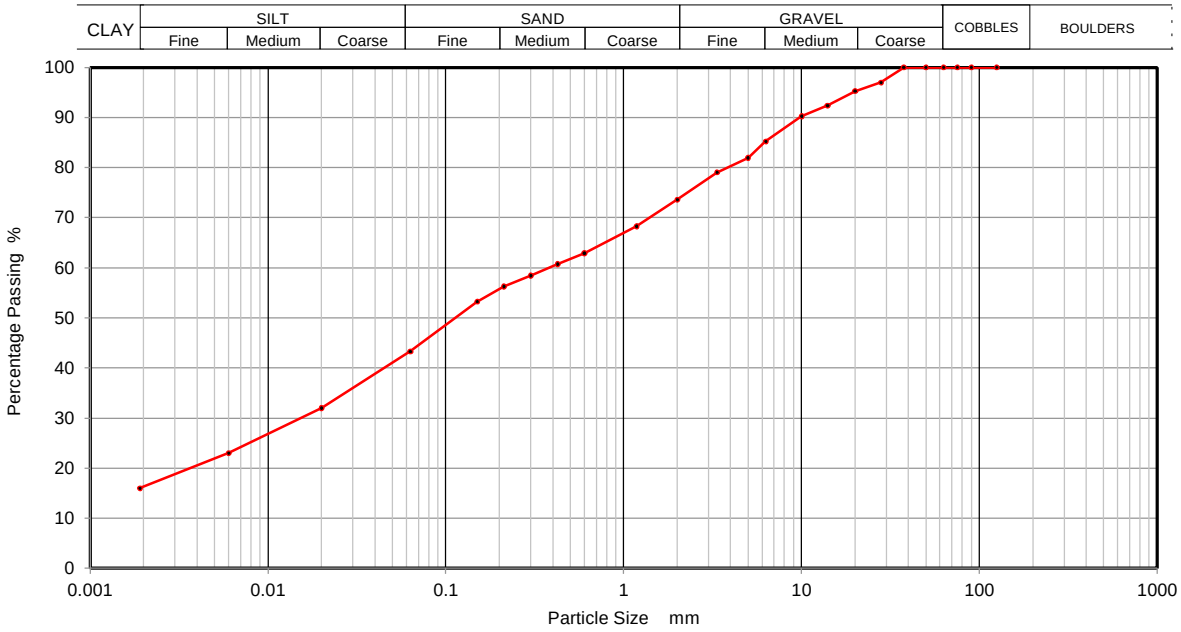
Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operators	Checked	08/03/2020	Wayne Honey	W. Honey
RO/MH	Approved	09/03/2020	Paul Evans	P Evans

UKAS TESTING
2788

GSTL	PARTICLE SIZE DISTRIBUTION BS 1377 Part 2:1990 Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4	Contract Number	47969
		Borehole/Pit No.	TP02
Site Name	Meadowbank	Sample No.	
Soil Description	Brown clayey fine to coarse gravelly silty fine to coarse SAND	Depth Top	2.20
		Depth Base	
Date Tested	06/03/2020	Sample Type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0200	32
90	100	0.0060	23
75	100	0.0020	16
63	100		
50	100		
37.5	100		
28	97		
20	95		
14	92		
10	90		
6.3	85		
5	82		
3.35	79		
2	74		
1.18	68		
0.6	63		
0.425	61		
0.3	58		
0.212	56		
0.15	53		
0.063	43		

Sample Proportions	% dry mass
Cobbles	0
Gravel	26
Sand	31
Silt	27
Clay	16

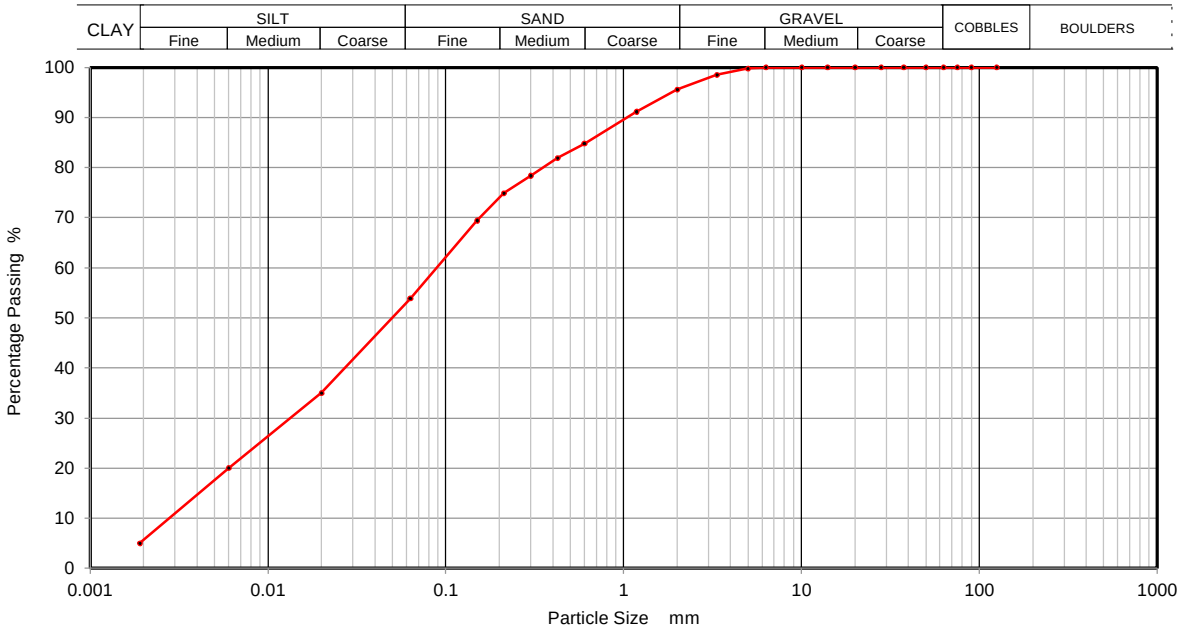
Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operators	Checked	08/03/2020	Wayne Honey	W. Honey
RO/MH	Approved	09/03/2020	Paul Evans	P Evans

UKAS TESTING 2788

GSTL	PARTICLE SIZE DISTRIBUTION BS 1377 Part 2:1990 Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4	Contract Number	47969
		Borehole/Pit No.	WS01
Site Name	Meadowbank	Sample No.	
Soil Description	Brown slightly fine gravelly slightly clayey fine to coarse sandy SILT	Depth Top	3.80
		Depth Base	
Date Tested	06/03/2020	Sample Type	D



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0200	35
90	100	0.0060	20
75	100	0.0020	5
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	99		
2	96		
1.18	91		
0.6	85		
0.425	82		
0.3	78		
0.212	75		
0.15	69		
0.063	54		

Sample Proportions	% dry mass
Cobbles	0
Gravel	4
Sand	42
Silt	49
Clay	5

Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operators	Checked	08/03/2020	Wayne Honey	W. Honey
RO/MH	Approved	09/03/2020	Paul Evans	D P Evans

UKAS TESTING 2788

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: 20-02689

Site Reference:	Meadowbank
Project / Job Ref:	18216
Order No:	18216/BRE/JH
Sample Receipt Date:	02/03/2020
Sample Scheduled Date:	02/03/2020
Report Issue Number:	1
Reporting Date:	06/03/2020

Authorised by:

[redacted]

Ela Mysiara
Quality Manager

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

Soil Analysis Certificate						
DETS Report No: 20-02689	Date Sampled	18/02/20	18/02/20	18/02/20		
Soils Ltd	Time Sampled	None Supplied	None Supplied	None Supplied		
Site Reference: Meadowbank	TP / BH No	WS01	WS04	WS02		
Project / Job Ref: 18216	Additional Refs	None Supplied	None Supplied	None Supplied		
Order No: 18216/BRE/JH	Depth (m)	1.90	2.10	1.70		
Reporting Date: 06/03/2020	DETS Sample No	466017	466018	466019		

Determinand	Unit	RL	Accreditation					
pH	pH Units	N/a	MCERTS	8.0	6.7	6.8		
W/S Sulphate as SO_4 (2:1)	mg/l	< 10	MCERTS	< 10	< 10	< 10		
W/S Sulphate as SO_4 (2:1)	g/l	< 0.01	MCERTS	< 0.01	< 0.01	< 0.01		

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30°C
Subcontracted analysis (S)

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

Soil Analysis Certificate - Sample Descriptions	
DETS Report No: 20-02689	
Soils Ltd	
Site Reference: Meadowbank	
Project / Job Ref: 18216	
Order No: 18216/BRE/JH	
Reporting Date: 06/03/2020	

DETS Sample No	TP / BH No	Additional Refs	Depth (m)	Moisture Content (%)	Sample Matrix Description
$ 466017	WS01	None Supplied	1.90	16.4	Orange sandy clay with stones
$ 466018	WS04	None Supplied	2.10	8.6	Light brown sandy clay
$ 466019	WS02	None Supplied	1.70	9.1	Brown sandy clay with stones

Moisture content is part of procedure E003 & is not an accredited test

Insufficient Sample I/S

Unsuitable Sample U/S

$ samples exceeded recommended holding times

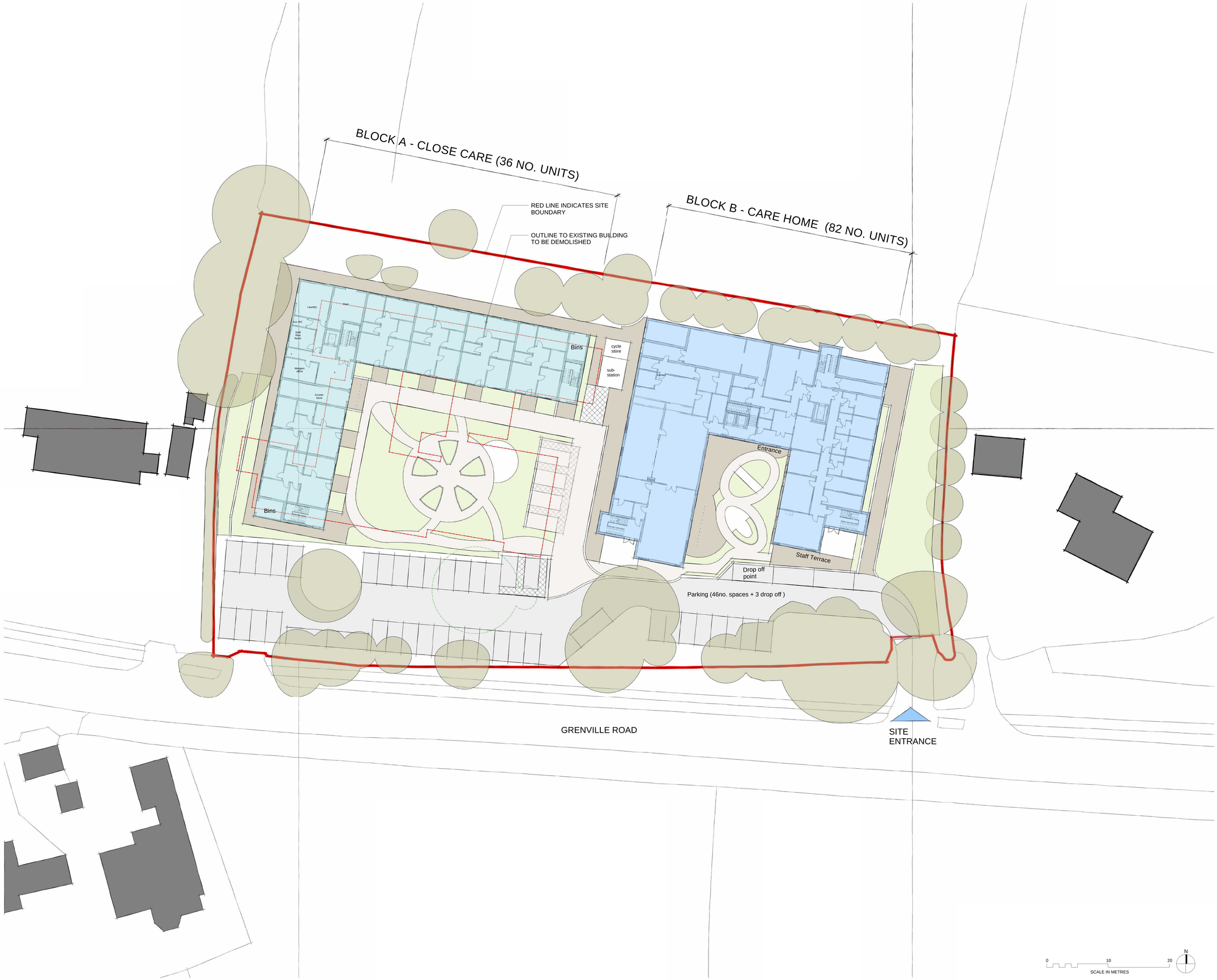
DETS Ltd
Unit 1, Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Maidstone
Kent ME17 2JN
Tel : 01622 850410

Soil Analysis Certificate - Methodology & Miscellaneous Information
DETS Report No: 20-02689
Soils Ltd
Site Reference: Meadowbank
Project / Job Ref: 18216
Order No: 18216/BRE/JH
Reporting Date: 06/03/2020

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	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 Information Provided by the Client



NOTES

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NOTES:

This drawings contains the following model files:

3849-PBWC-00-ZZ-M3-A-0001-Site-S1-P01

AMENDMENTS

Rev No.	Revsion Description	Rev. Date	Review by	Issued by
1	First Issue	05-04-23		PDP
2	Additional information indicated	06-04-23		PDP
3	Site Plan amended, Parking relocated, Block B no. of units increase	12-04-23		PDP
4	Care home repositioned, close care reduced in size following Town Council presentation	17-05-23		PDP
5	Site plan updated to align with draft Mei Loci Landscape Design	27.07.23		CF

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Client
Client Name/Logo

Job
Meadowbrook Care Home
Grenville Road, Lostwithiel

Title
Proposed Site Plan

Project\Sheet
3849 -PBWC -00 -XX -DR -A -1102

Purpose of Issue
Information

Status S2 Revision P5

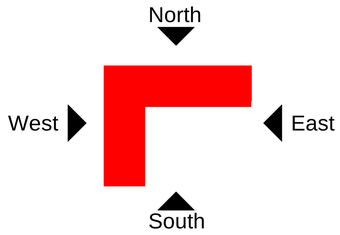
Scale
1 : 200@A0

Director In Charge	Project Lead	Off. Project No.
CT	CF	3849

1 South Elevation -Planning
1 : 100

2 West Elevation -Planning
1 : 100

0 5 10
SCALE IN METRES



KEY

WALLS

- Brick cladding
- Aluminium cladding
- Spandrel panels
- Glass
- Timber cladding

WINDOWS

Aluminium PPC windows with integrated louvres

RAINWATER GOODS

Aluminium PPC downpipes and gutters

DOORS

Aluminium PPC glazed doors
Automatic entrance doors

ROOF

Aluminium roof

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NOTES:

This drawings contains the following model files:

XXX-PBW-XX-XX-M3-A-0001-Name [S1] [P1]

AMENDMENTS

Rev. No	Revision Description	Rev. Date	Issued by
P1	First Issue	26.07.23	CF

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Client
Cornwallis Care Services Ltd

Job
Meadowbrook Care Home

Grenville Road, Lostwithiel

Title
South & West Elevations

Project
3849 -PBWC -01 -XX -DR -A -3000

Purpose of Issue	Status	Revision
Information	S2	P1

Scale
As indicated@A1

Director In Charge	Project Lead	Off. Project No.
CT	CF	3849

1 North Elevation -Planning
1 : 100

2 East Elevation -Planning
1 : 100

0 5 10
SCALE IN METRES

North
West
East
South

KEY

WALLS

- Brick cladding
- Aluminium cladding
- Spandrel panels
- Glass
- Timber cladding

WINDOWS

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DOORS

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Automatic entrance doors

RAINWATER GOODS

Aluminium PPC downpipes and gutters

ROOF

Aluminium roof

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NOTES:

This drawings contains the following model files:

XXX-PBW-XX-XX-M3-A-0001-Name [S1] [P1]

AMENDMENTS

Rev. No	Revision Description	Rev. Date	Issued by
P1	First Issue	26.07.23	CF

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Client
Cornwallis Care Services Ltd

Job
Meadowbrook Care Home

Grenville Road, Lostwithiel

Title
North & East Elevations

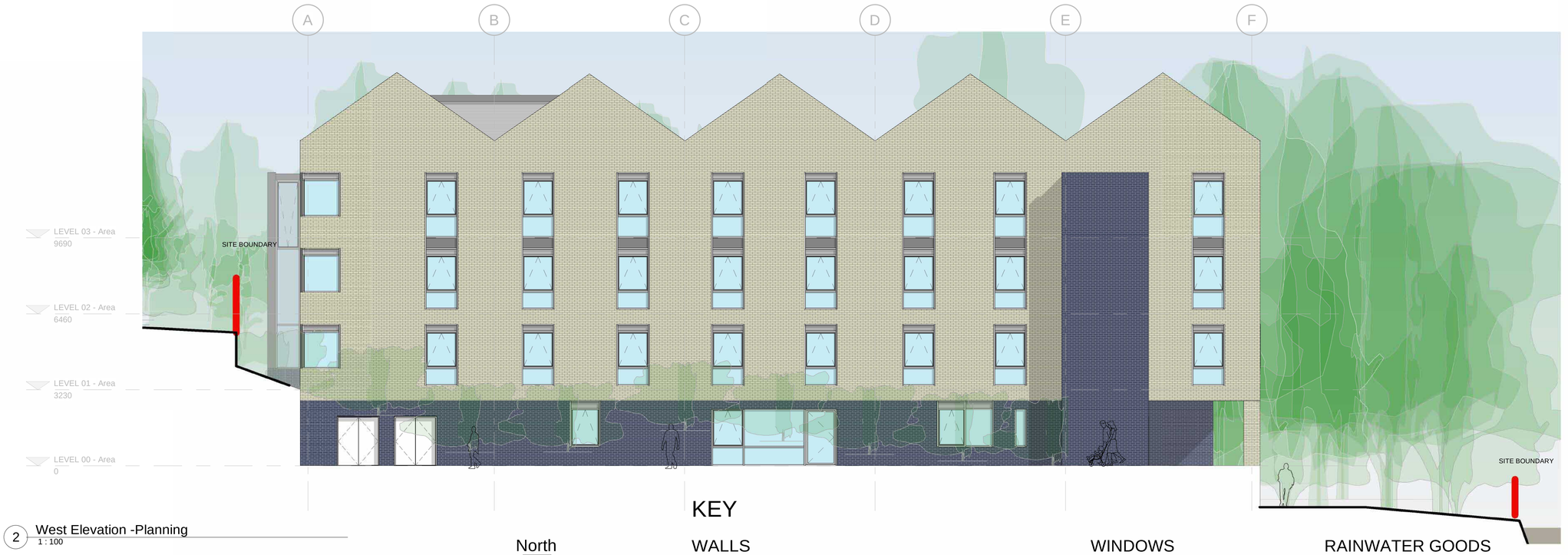
Project
3849 -PBWC -01 -XX -DR -A -3001

Purpose of Issue	Status	Revision
Information	S2	P1

Scale
As indicated@A1

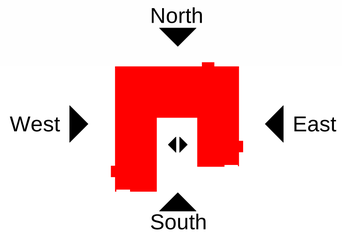
Director In Charge	Project Lead	Off. Project No.
CT	CF	3849

1 South Elevation -Planning
1 : 100



2 West Elevation -Planning
1 : 100

0 5 10
SCALE IN METRES



KEY

WALLS

- Brick cladding
- Aluminium cladding
- Spandrel panels
- Glass
- Louvres

WINDOWS

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DOORS

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RAINWATER GOODS

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ROOF

Aluminium roof

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NOTES:

This drawings contains the following model files:

3849-PBWC-02-ZZ-M3-A-0003-Care Home-S1-P01

AMENDMENTS

Rev. No	Revision Description	Rev. Date	Review by	Issued by
P1	First Issue	26/07/23		CF

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Client
Cornwallis Care Services

Job
Meadowbrook Care Home

Grenville Road, Lostwithiel

Title
South & West Elevations

Project
3849 -PBWC -02 -XX -DR -A -3001

Purpose of Issue	Status	Revision
Information	S2	P1

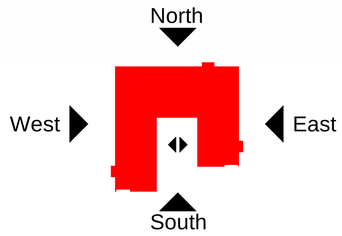
Scale
As indicated@A1

Director In Charge	Project Lead	Off. Project No.
CT	CF	3849

1 North -Elevation -Planning
1 : 100

2 East Elevation -Planning
1 : 100

0 5 10
SCALE IN METRES



KEY

WALLS

- Brick cladding
- Aluminium cladding
- Spandrel panels
- Glass
- Louvres

WINDOWS

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DOORS

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RAINWATER GOODS

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ROOF

Aluminium roof

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NOTES:

This drawings contains the following model files:

3849-PBWC-02-ZZ-M3-A-0003-Care Home-S1-P01

AMENDMENTS

Rev. No	Revision Description	Rev. Date	Review by	Issued by
P1	First Issue	26/07/23		CF

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Client
Cornwallis Care Services

Job
Meadowbrook Care Home

Grenville Road, Lostwithiel

Title
North & East Elevations

Project
3849 -PBWC -02 -XX -DR -A -3002

Purpose of Issue	Status	Revision
Information	S2	P1

Scale
As indicated@A1

Director In Charge	Project Lead	Off. Project No.
CT	CF	3849

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