IGSL Ltd

Lands at Halverstown

Ground Investigation & Geotechnical Interpretative Report

Project No. 24330

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TABLE OF CONTENTS

FIGURES

TABLES

APPENDICES

FOREWORD

The following conditions and notes on the geotechnical site investigation procedures should be read in conjunction with this report.

Standards

The ground investigation works for this project (**Lands at Halverstown**) have been carried out by IGSL in accordance with Eurocode 7 - Part 2: Ground Investigation & Testing (EN 1997-2:2007). This has been used together with complementary documents such as Engineers Ireland Specification for Ground Investigation (2nd Ed, 2016), BS 5930 (2015+A1:2020) and BS 1377 (Parts 1 to 9) and the following European Norms:

- EN 1997-2 Eurocode 7: 2007 – Geotechnical Design – Part 2: Ground Investigation & Testing
- EN ISO 22475-1:2006 Geotechnical Investigation and Sampling – Sampling Methods & Groundwater Measurements
- EN ISO 14688-1:2017 Geotechnical Investigation and Testing – Identification and Classification of Soil, Part 1: Identification and Description
- EN ISO 14688-2:2017 Geotechnical Investigation and Testing – Identification and Classification of Soil, Part 2: Principles for a classification
- EN ISO 14689-1:2017 Geotechnical Investigation and Testing – Identification, description & classification of rock

The Eurocode 7, Part 2 – Ground Investigation and Testing GI specification shall be read in conjunction with the Specification and Related Documents for Ground Investigation in Ireland, 2nd Edition, published by Engineers Ireland in 2016.

Reporting

No responsibility can be held by IGSL Ltd for ground conditions between exploratory hole locations. The engineering logs provide ground profiles and configuration of strata relevant to the investigation depths achieved and caution should be taken when extrapolating between exploratory points. No liability is accepted for ground conditions extraneous to the investigation points. Unless specifically stated, no account has been taken of possible subsidence due to mineral extraction, mining works or karstification below or close to the site.

This report has been prepared for DOBA Consulting Engineers and the information should not be used without their prior written permission. IGSL Ltd accepts no responsibility or liability for this document being used other than for the purposes for which it was intended.

Boring Procedures

Where required, ‘shell and auger' or cable percussive boring technique is employed as defined by Section 6.3 of IS EN ISO 22475-1:2006. The boring operations, sampling and in-situ testing meet with the recommendations set out in IS EN 1997-2:2007 and BS 1377:1990 and EN ISO 22476-3:2005. The shell and auger boring technique allows for continuous sampling in clay and silt above the water table and sand and gravel below the water table (Table 2 of IS EN ISO 22475-1:2006).

It is highlighted that some disturbance and variation is unavoidable in particular ground (e.g. blowing sands, gravel / cobble dominant glacial deposits etc). Attention is drawn to this condition, whenever it is suspected. Where cobbles and boulders are recorded, no conclusion should be drawn concerning the size, presence, lithological nature, or numbers per unit volume of ground.

In-Situ Testing

Where required, Standard Penetration Tests (SPT’s) are conducted strictly in accordance with Section 4.6 of IS EN 1997-2:2007. The SPT equipment (hammer energy test) has been calibrated in accordance with EN ISO 22476-3:2005 and the Energy Ratio (E_r). A calibration certificate is available upon request. The E_r is defined as the ratio of the actual energy E_{meas} (measured energy during calibration) delivered to the drive weight assembly into the drive rod below the anvil, to the theoretical energy (E_{theor}) as calculated from the drive weight assembly. The measured number of blows (N) reported on the engineering logs are uncorrected. In sands, the energy losses due to rod length and the effect of the overburden pressure should be taken into account (see IS EN ISO 22476-3:2005).

Soil Sampling

Three categories of sampling methods are outlined in EN ISO 22475-1:2006. The categories are referenced A, B and C for any given ground conditions and are shown in Tables 1 and 2 of EN ISO 22475-1:2006. Reference should be made to EN 1997-2:2002 for guidelines on sample class and quality for strength and compressibility testing. Samples of quality classes 1 or 2 can only be obtained by using Category A sampling methods.

Class 1 thin wall undisturbed tube samples (UT100) were obtained in fine grained soils and strictly meet the requirements of EN 1997-2:2002 and EN ISO 22475-1:2006. Soil samples for laboratory tests are divided into five classes with respect to the soil properties that are assumed to remain unchanged during sampling, handling transport and storage. The minimum sample quality required for testing purposes to Eurocode 7 compatibility (EN 1997-2:2002) is shown in Table A.

Table A – Details of Sample Quality Requirements

EN 1997 Clause	Test	Minimum Sample Quality Class
5.5.3	Water Content	3
5.5.4	Bulk Density	2
5.5.5	Particle Density	N/S
5.5.6	Particle Size Analysis	N/S
5.5.7	Consistency Limits	4
5.5.8	Density Index	N/S
5.5.9	Soil Dispersivity	N/S
5.5.10	Frost Susceptibility	N/S
5.6.2	Organic Content	4
5.6.3	Carbonate Content	3
5.6.4	Sulphate Content	3
5.6.5	pH	3
5.6.6	Chloride Content	3
5.7	Strength Index	1
5.8	Strength Tests	1
5.9	Compressibility Tests	1
5.10	Compaction Tests	N/S
5.11	Permeability	2

N/S – not stated. Presume a representative sample of appropriate size.

Samples recovered from trial pits or trenches meet the requirements of IS EN ISO 22475-1. It is highlighted that unforeseen circumstances such as variations in geological strata may lead to lower quality sample classes being obtained.

Groundwater

The depth of entry of any influx of groundwater is recorded during the course of boring operations. However, the normal rate of boring does not usually permit the recording of an equilibrium level for any one water strike. Where possible, drilling is suspended for a period of twenty minutes to monitor the subsequent rise in water level. Groundwater conditions observed in the borings or pits are those appertaining to the period of investigation. It should be noted however, that groundwater levels are subject to diurnal, seasonal and climatic variations and can also be affected by drainage conditions, tidal variations etc.

Engineering Logging

Soil and rock identification has been based on the examination of the samples recovered and conforms with IS EN ISO 14688-1:2017 and IS EN ISO 14688-2:2017. Rock weathering classification conforms to IS EN ISO 14689-1:2017 along with discontinuities (bedding planes, joints, cleavages, faults etc) as classified in Section 6.4 of IS EN ISO 14689-1:2017 and Annex C of same. Rock mechanical indices (TCR, SCR, RQD) are defined in accordance with IS EN ISO 22475-1:2006.

Where peat has been encountered, samples have been logged in accordance with the Von Post Classification (ref. Von Post, L. 1992. Sveriges Gologiska Undersoknings torvinventering och nogra av dess hittils vunna resultat (SGU peat inventory and some preliminary results) Svenska Mosskulturforeningens Tidskrift, Jonkoping, Swedden, 36, 1-37 and Hobbs N. B. Mire morphology and the properties of some British and foreign peats. QJEG, Vol. 19, 1986.

Retention of Samples

After satisfactory completion of all the scheduled laboratory tests on any sample, the remaining material will be discarded. Unless a period of retention of samples is agreed, it is our normal practice to discard all soil samples one month after submission of our final report.

1. INTRODUCTION

At the instruction of DOBA Consulting Engineers, IGSL has carried out a ground investigation at a greenfield site in the townland of Halverstown, 2.5 kilometres west of the town of Naas, Co. Kildare. The site comprises a number of connected field enclosures, all contained within one farm, centred around a now derelict, former family homestead with functioning farmyard / outbuildings. The site is located to the south of the R409 Regional Road and directly west of the M7 Motorway. The M7 Business Park is located to the south and south east of the site with the Osberstown Industrial Park to the northeast.

Figure 1 – Site Location Plan (perimeter outlined in red)

Retrieved from Google Earth Professional 08/2022

Two high voltage transmission lines run across the property with a three-phase line also running north-south through the farm. The site is relatively flat lying, falling towards a stream which forms the southern boundary. Levels range from 85m OD in the northwest to 77.6m OD in the southeast. Intrusive investigation locations were set out as per the J&L Surveys Limited drawing entitled “Lands at Halverstown, Naas, Co. Kildare.” Micro-siting was performed where proposed locations were found to lie too close to tress, field boundaries / ditches or in proximity to the hazard zone of overhead power lines. ESB Networks HV Transmission overseers were contacted ahead of works commencing to inform them of our presence on site and of the safety measures to be employed when moving plant on site.

The investigation comprised cable percussion boreholes, machine-dug trial pits, dynamic probes, in situ plate load testing and soakaway testing (to BRE365). A resistivity survey was undertaken by Minerex Geophysics Limited.

Following a review of the findings from the initial investigation, a supplementary investigation comprising rotary cored drillholes, rotary openholes along with machine excavated trial pits and soakaway tests were undertaken. The investigations were executed in accordance with BS 5930, Code of Practice for Site Investigations (2015+A1:2020) and EN 1997-2 Eurocode 7 Part 2 Ground Investigation & Testing and supervised by an IGSL geotechnical engineer.

Geotechnical, chemical and environmental laboratory testing was scheduled on a range of soil samples with an environmental suite of testing also conducted on water samples retrieved from the standpipe wells and the neighbouring stream. The geotechnical testing included moisture contents, Atterberg Limits, compactions and MCV testing among others. Varying percentage lime and cement binder was added to samples to investigate any improvement in performance under subsequent CBR and MCV testing. Chemical testing was undertaken to BRE SD-1 on both natural 'as received' samples and on the soil stabilised samples (analysis ongoing). Environmental tests were undertaken on soil samples (RPS Suite A, B, C & E - WAC *Rilta* suite) to assess suitability for off-site disposal to landfill and/or Soil Recovery Facility. Rock strength tests were undertaken on the recovered cores.

In addition to presenting the field and laboratory test records this report provides an interpretation of the data and an assessment of the key geotechnical issues. In addition, a separate Waste Characterisation Report was prepared by O'Callaghan Moran Environmental Consultants, conducted in accordance with the Environmental Protection Agency (EPA) Guidelines on the Classification of Waste (2015). It assesses the environmental test results and apportions a List of Waste classification for each of the nominated samples. Based on that appraisal, a particular waste management option is generated for each analysed sample. This report is presented separately in Appendix 13.

2. FIELDWORK

2.1 General

The initial tranche of IGSL Limited fieldworks were undertaken in October and November 2022. The works completed on site comprised the following:

- Trial Pits (34 No.)
- Cable Percussion Boreholes (14 No.)
- Dynamic Probing (55 No.)
- Plate Bearing Testing (23 No.)
- Soakaway Tests (to BRE 365) (14 No.[i])
- Resistivity Survey
- Groundwater Monitoring / Sampling
- Gas Monitoring
- Surveying of Exploratory Hole Locations

[i] A second shallow soakaway test (SA05B) was conducted at location SA05 following interception of water in SA05A at 1.70m bgl

Supplementary works were undertaken during April and May 2023 following a review of the findings from the 2022 investigation. The additional works comprised:

- Trial Pits (TP RO) (10 No.)
- Soakaway Tests (BRE SA) (6 No.[ii])
- Rotary Drilling
- Rotary Openhole Drilling
- Groundwater Monitoring
- Surveying of Exploratory Hole Locations

[ii] Soakaway tests were conducted in only two of the six pits due to sidewall instability and groundwater ingress during excavation.

2.2 Trial Pits

Trial pitting was undertaken at thirty-four locations across the site ca. 90 acre site. The locations were set out as per the J&L Surveys Limited drawing entitled “Lands at Halverstown, Naas, Co. Kildare.” The trial pits were excavated, logged and sampled under the direction of an IGSL geotechnical engineer in accordance with BS 5930 (2015+A1:2020). Bulk disturbed samples (typically 20 to 30kg) were taken as the pits progressed.

The bulk samples were placed in heavy-duty polyethylene bags and sealed before being transported to Naas for laboratory testing. The trial pits were backfilled with the as-dug arisings and reinstated to the satisfaction of IGSL’s site geotechnical engineer. The trial pit logs and photos are presented in Appendix 1 and include descriptions of the soils encountered, groundwater conditions and stability of the pit sidewalls.

Additional trial pits were undertaken in April and May 2023 at ten locations across the site. The pits were excavated with a 13 tonne tracked excavator. Pits were extended from 2.30m to 3.60m with sidewall collapse and groundwater entry generally limiting the depths attainable on site. The pit logs and photographs are presented in Appendix 1A.

2.3 Cable Percussion Boreholes

Cable percussive boring (200mm diameter) was undertaken at fourteen locations using a Dando 2000 rig. The boreholes extended to depths of between 1.10m and 3.90m. At all locations, boring commenced through hand-dug service inspection pits. Disturbed bulk samples were recovered at 1m intervals or change of strata during boring and these are denoted ‘B’ on the engineering logs.

Standard Penetration Tests (SPT's) were performed in the boreholes and given the nature of the soils, a solid cone was used. It is noted that the SPT N-Values reported are the number of blows for 300mm increment penetration (e.g. BH01 at 1.0m where N=10). These exclude the seating blow values, which represent the initial 150mm depth of penetration. Where partial penetration was achieved during testing, the number of blows is shown for the actual penetration depth achieved (e.g. BH06 at 1.0m where N=48/225mm). In accordance with Eurocode 7, the SPT hammer has been calibrated and the energy ratio (Er) value is incorporated on the engineering logs. It is highlighted that the SPT N-Values reported on the engineering logs are uncorrected for energy ratio.

Descriptions of the soils encountered, in-situ tests undertaken and samples recovered are presented on the borehole records in Appendix 2. Details of groundwater strikes and hard strata boring (i.e. chiselling) are also presented on the aforementioned records.

2.4 Dynamic Probing

In-situ “Heavy” dynamic probing (DPH) was performed at fifty-five locations using a compact crawler rig. The tracked Archway probing unit meets the requirements of BS 1377, Part 9 (1990) and IS EN 1997-2:2007. The probing rig utilized a 50kg drop weight and 500mm drop height with a 60° cone. In accordance with the standards, the number of blows required to drive the cone each 100mm increment into the sub-soil was recorded. Probing is generally terminated when blow counts, N_{100} values, exceed 25, in order to avoid damage to equipment. The probe records are presented in Appendix 3 and include blow-counts in both numerical and graphical format.

2.5 Plate Bearing Testing

Plate bearing tests were conducted at twenty-three locations at depths ranging 0.40m to 0.60m below ground level [bgl]. Plate testing was undertaken to evaluate the modulus of sub-grade reaction (Ks) and equivalent CBR value. A 450mm diameter plate was used for the tests with kentledge provided by a mechanical excavator. Two load cycle tests were performed and the load / settlement plots, Ks and equivalent CBR values are presented in Appendix 4.

2.6 Soakaway Tests (to BRE 365)

Fourteen number infiltration tests were performed to assess the suitability of the sub-soils for dispersion of storm water through a soakaway system. The infiltration tests were each performed in accordance with BRE Digest 365 ‘Soakaway Design’. To obtain a measure of the infiltration rate of the sub-soils, water was poured into each test pit, with records taken of the fall in water level against time. Following the first soak cycle, the procedure was repeated to ensure saturation of the sub-soils. The infiltration rate is the volume of water dispersed per unit of exposed area per unit of time, and is generally expressed as metres / minute or metres / second. Designs are based on the slowest infiltration rate, which is generally calculated from the final soak cycle. The soakaway design logs are presented in Appendix 5. Two soak test locations (a deep soak pit initially followed by a shallow soak pit) were constructed at location SA05 due to water ingress in the first attempted pit.

Additional soakaway tests were scheduled for the April 2023 re-visit. Of the six locations, actual tests were only possible in two of the opened pits. This was attributable to the poor sidewall stability witnessed during pit construction. Instability was often accompanied by groundwater entry. Where groundwater entered prior to achieving test depth, no soakaway test was performed. SA01 and SA06 saw tests run with limited success. As with the additional pits, the soak pits were excavated using a 13 tonne tracked excavator. The soakaway test logs together with pit logs and photographs are presented in Appendix 5A.

2.7 Resistivity Survey

A resistivity survey was conducted by Minerex Geophysics Limited. It consisted of two different methods. The methodology employed used both Vertical Electrical Sounding (VES) and Soil Resistivity (SR) in the Wenner electrode configuration at a range of electrode spacing agreed with the client prior to the fieldwork. The increase in the electrode spacing leads to an increase in the depth - the VES permitting deeper soundings and Soil Resistivity Tests shallow. The Minerex report is presented in Appendix 6.

2.8 Rotary Drilling - *Additional Works April-May '23*
Rotary drilling was carried out at five locations (holes denoted RC_) using a tracked Comacchio GEO-205 top-drive rig. This hydraulic rig utilised Symmetrex drilling system within the superficial deposits and through initial fractured rockhead, with coring techniques deployed in the underlying bedrock. Coring was also attempted in CLAY intercepted at depth in RC01A. Rotary core drilling produced 78mm diameter cores which, in bedrock, was logged as variably weak to strong, thickly to thinly bedded, pale to mid bluish grey fine-grained LIMESTONE. The limestone was likely locally slightly dolomitised, with stromatctic structure and abundant calcite veining. The rock was further described as slightly weathered. In the case of RC01 and RC01A, crystalline calcite was noted at depth in the rock record with a complete absence of competent limestone bedrock.

The cores were placed in 3m capacity timber boxes and logged by an IGSL engineering geologist. This included photography of the cores with a digital camera. Where rock core was recovered, a graphic fracture log is also presented alongside the mechanical indices. This illustrates the fracture state of the rock cores and allows easy identification of highly fractured / non-intact zones and discontinuity spacings. It should be noted that no correction for dip of the joints has been made and that the spacings shown are successive joint / core intersections within the core.

The core log record is presented in Appendix 7 and this includes engineering geological descriptions, details of the bedding / discontinuities and mechanical indices (TCR, SCR and RQD's) for each core run. Core photographs are also presented in Appendix 7 and these illustrate the structure and fracture state of the bedrock.

2.9 Rotary Open Hole Drilling - *Additional Works April-May '23*
Rotary Open-Hole [TPRO-_] drilling was carried out at ten locations on site. The holes (TPRO-01 to TPRO-10) were carried out using a tracked Comacchio GEO-205 top-drive drill rig and extended to a maximum depth of 5.20m bgl. Wells installed in the holes permit groundwater monitoring. SPT testing was undertaken during open-hole drilling with the resulting test records featuring on the logs in Appendix 8.

Symmetrex open-hole drilling was utilised within the overlying superficial deposits stopping shy of the underlying bedrock (not intercepted). The groundwater monitoring standpipes installed consisted of 50mm diameter HDPE pipework with proprietary 1mm slots and incorporated a pea gravel filter pack and cement / bentonite grout seal. Headwork covers were concreted in place. The drilling records are presented in Appendix 8.

2.10 Groundwater Monitoring
The initial fieldworks period saw the installation of standpipes in five newly constructed cable percussion boreholes. The standing groundwater levels in each of the installations was measured following the fieldworks. Groundwater levels were measured using an electric dipmeter. The levels recorded are shown in Appendix 9. The dates of monitoring are shown in Table 1.

Water sampling was undertaken during the first monitoring visit (02-Dec-22). Prior to sampling, installations were developed in accordance with ISO 14868 (2003) and then purged of three times well volume (in accordance with BS 6068). Water samples were dispatched to Chemtest Laboratories (UK) under controlled conditions (ice packed cooler box) to preserve the integrity of the individual samples.

The additional works saw the introduction of a further fourteen wells across the site. Of the fourteen, ten were placed in the holes constructed using Symmetrex openholing methods with a further four in the rotary core drillholes.

Table 1 – Water Monitoring and Sampling Dates at on site wells

Borehole Water Monitoring Dates	Borehole Water Sampling Date
02-12-22	02-12-22 (excl. BH05)
19-12-22	-
10-07-23	-

2.11 Gas Monitoring

Following installation of 50mm diameter standpipes in the four cable percussion boreholes, a gas tap was fitted to each well (BH03, BH10, BH12, BH13). This enabled gas monitoring post project completion. Gas level measurements, taken in accordance with CIRIA C665:2007, were performed using a calibrated GA5000 gas monitor. Both steady state and peak gas results are presented in Appendix 10 accompanied by groundwater measurements. The flow rate measurements recorded by the GA5000 were logged after the initial gas quantification readings were taken. The unit does not allow for simultaneous monitoring of gas quantities and gas flow. At all times the Geotech GA5000 portable gas analyser was used as per the guidelines whilst conforming to the on-screen notifications.

2.12 Surveying of Exploratory Hole Locations

Following completion of the exploratory works, surveying was carried out using GPS techniques. Co-ordinates (x, y) were measured to Irish Transverse Mercator and ground levels (z) established to Malin Head. The co-ordinates and ground levels are shown on the exploratory hole logs with locations shown on the exploratory hole plan in Appendix 16.

3. LABORATORY TESTING

Geotechnical laboratory testing was carried out at IGSL's INAB-accredited laboratory in accordance with BS1377; British Standard Methods of Test for Soils for Civil Engineering Purposes; British Standards Institute:1990. Soil testing was performed on selected trial pit samples and included tests to assess earthwork characteristics (MCV & CBR) and trial mix testing by the addition of lime to re-engineer the soils as high strength fill ('ground improvement'). A number of fine-grained samples were selected for testing with 1%, 2% and 3% lime (calcium oxide) or a combination of lime and cement binders. The geotechnical laboratory test results will feature in Appendix 11.

Five soil samples were selected for Waste Acceptance Criteria (WAC) analysis as per the *Rilta* set of testing (RPS Suite E). The results can be used to classify the material with regard to its potential for disposal to landfill. A further thirty-one soil samples were selected for analysis using RPS Suites A, B and C. These results are enclosed in Appendix 12. The chemical analysis tests on natural soil samples, in addition to testing on soils following treatment with cement / lime binders (to BRE SD1), also feature in Appendix 12.

A Waste Characterisation Report, prepared by O'Callaghan Moran Environmental Consultants, will assess the environmental test results arising from RPS Suite E / 'IGSL Rilta' testing. A 'List of Waste' classification and a particular waste management option for each of the five samples is included in that report. The reports features in Appendix 13.

Water samples were taken from three of the four wells - BH10 was found to be dry. Prior to sampling, installations were developed in accordance with ISO 14868 (2003) and then purged of three times well volume (in accordance with BS 6068). In addition to the well samples, two stream samples were collected from points along the sites' southern boundary. Samples were dispatched to Chemtest in December 2022. The resulting environmental analysis features in Appendix 14 (Report 22-47891).

Point load strength index (PLSI) tests were conducted on selected core samples. These are presented in Appendix 15.

4. DESK STUDY

The site comprises a number of field enclosures separated by mature tree-lined hedgerows. The 6" Cassini map (retrieved from the OSI website) shows the central farmyard but also reveals the presence of a bronze age 'Fulacht Fia'. The online Historic Environment Viewer on the National Monuments Service website (archaeology.ie) also highlights the presence of this prehistoric feature and notes the following;

> *"Some 30m N of a small, NW-flowing stream in well-drained, level pasture. Described in 1985 as horseshoe-shaped mound (diam. c. 6m N-S; H. 1m) open towards the S (SMR file). No obvious surface trace survived in 2000, but the area, although recently drained with a plastic field-pipe (Wth 0.5m; D 0.3m) just N of the site was still wet and rushy to the SE of the site. Sub-surface features may survive intact."*

Figure 2A & 2B – ca. 1940's OSI drawing for the Halverstown site and Modern (2013-2018) orthophotograph

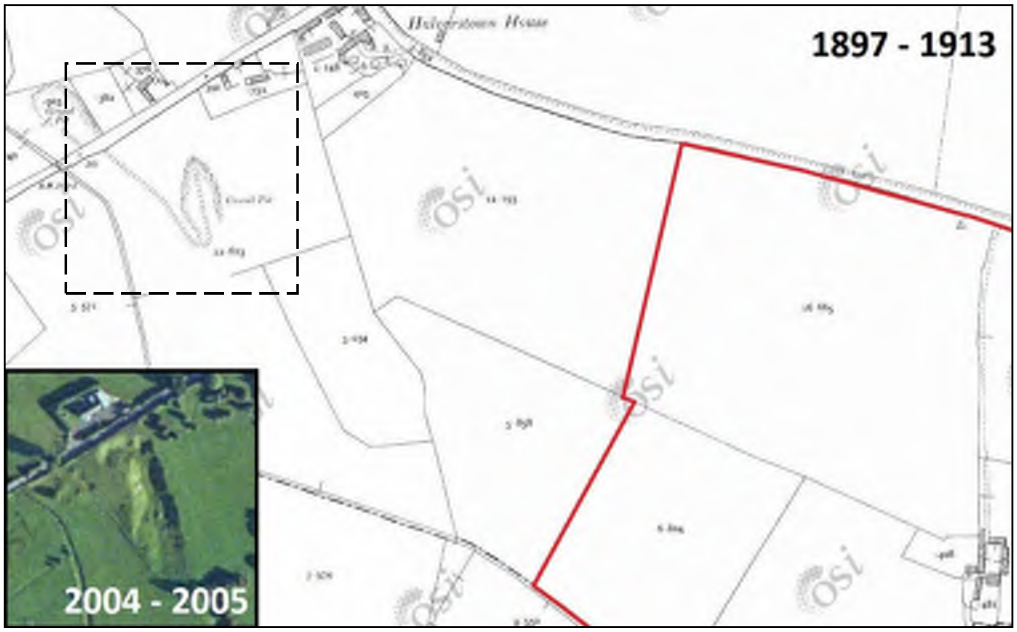
Fig 2A

Fig 2B

From the 2013-2018 aerial image (Fig 2B), some of the lower lying areas can be identified as they are covered in tussocky grasses which appear light brown in colour. The areas are located towards the southern fringe of the site and in the northeastern triangular-shaped field. The construction in 1983 of the adjacent motorway, then the Naas Motorway Bypass, bisected the farmland. Truncated hedgelines can be identified in the landscape to this day both east and west of the motorway.

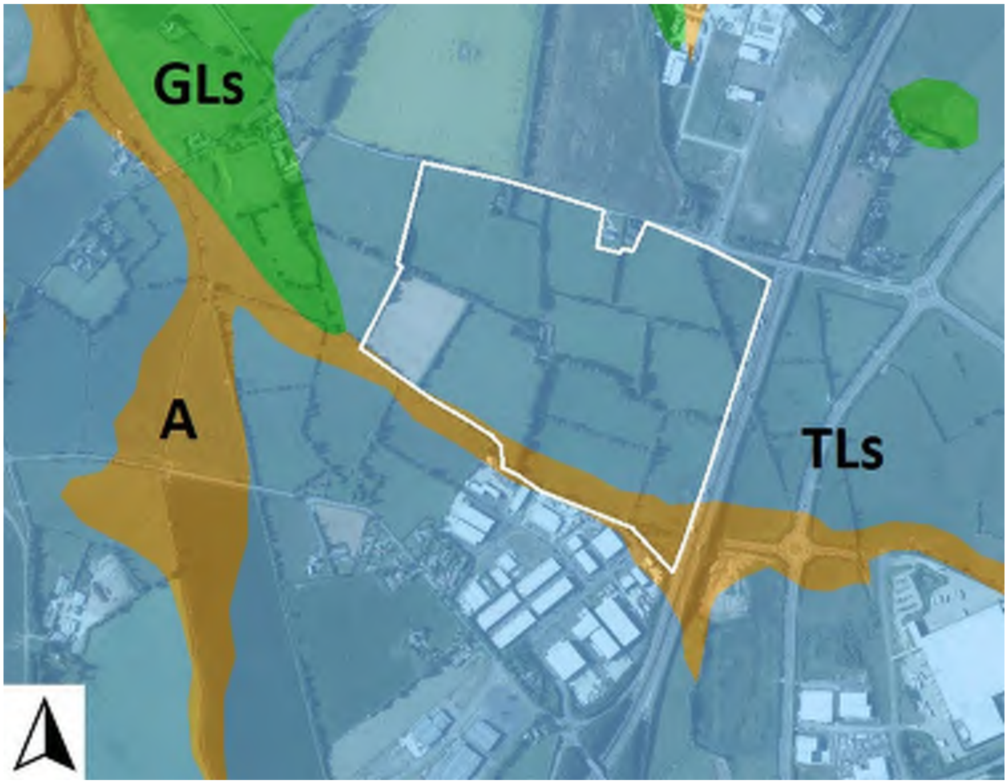
The OSI drawing dated 1897-1913 (Figure 3) shows the presence of a series of NW-SE trending '*Gravel Pit*' open pits located ca. 350m west of the site (site outlined in red). The scar on the landscape can be viewed clearly in the OSI 2004-2005 aerial image. The western site boundary is lined in red.

Figure 3 – OSI 1897-1913 survey with 2004-2005 inset showing former extraction pits or 'Gravel Pit' at Halverstown, 350m west of the site. Dashed section equals approximate area shown in 2004-2005 orthophotograph.



The Quaternary Soils map indicates the presence of both natural glacial till and alluvial deposits. The majority of the site is highlighted as being underlain by 'Till derived from Limestones' (Figure 4).

Figure 4 – Quaternary Soils Plot for Halverstown Site (site outlined)



Map Key	**A**	- Alluvium
	GLs	- Gravels derived from Limestones
	TLs	- Till derived from Limestones

Reference to the GSI map for the area (Figure 5, 1:100,000 Solid Geology series) shows that the site is underlain by the Carboniferous, Viséan-aged Rickardstown Formation. The rock formation consists of cherty often dolomitised limestone. No outcrops were found on site. Rotary drilling was carried out at five locations and proved a variably weak to strong limestone bedrock described as thickly to thinly bedded, pale to mid bluish grey fine-grained LIMESTONE. Crystalline calcite was unearthed at depth in coreholes RC01 and RC01A.

Figure 5 - Bedrock Geological Map for the Halverstown Site (retrieved from GSI website)

Key: **RK** = Rickardstown Formation
BA = Ballysteen Limestone

5. GROUND CONDITIONS & GROUNDWATER

5.1 Ground Profile – Superficial Deposits

The following is a summary of the ground conditions encountered across the ca. 90 acre site. The summary is presented in three parts. The works to the west of the access lane (off the R409) comprise 'Area 1'. The fields to the east of the main access lane are termed 'Area 2'. Finally, the fields to the southeast of the centrally located farmyard are termed 'Area 3'. This area includes the lowest lying area of the farm.

The newly completed intrusive locations (April / May 2023) are included in the synopsis with the information used to enhance the findings for each of Areas 1, 2 and 3 (as per Table 2).

Table 2 – Supplementary (2023) investigation points in Areas 1, 2 and 3

Exploratory Hole Locations	Area 1 (West)	Area 2 (East)	Area 3 (South)
Trial Pits	TP/RO 01 TP/RO 02 TP/RO 03 TP/RO 04 TP/RO 09	TP/RO 05 TP/RO 06 TP/RO 07	TP/RO 08 TP/RO 10
Soakaway Pits & Tests	BRE SA01 BRE SA02 BRE SA03 BRE SA04	BRE SA06	BRE SA05
Rotary Open-Hole Wells	TPRO-01 TPRO-02 TPRO-03 TPRO-04 TPRO-09	TPRO-05 TPRO-06 TPRO-07	TPRO-08 TPRO-10
Rotary Drillhole	RC03	RC01 RC01A RC02	

5.1.1 Area 1

In the northwest, ground levels along the R409 road boundary measure approximately 85m OD (DP50). These fall to 77.3m OD (PB03) towards the M7 Business Park in the southeast. The boreholes extended to depths ranging 1.80m to 3.90m without reporting bedrock. Rotary open-holes were extended in overburden to 5.20m bgl. Rotary core drillhole RC03 proved rock at a depth of 8.80m bgl (70.57m OD).

Of the fifteen trial pits in ‘Area 1’ constructed during the initial phase of the investigation, each reported completion depths ranging 2.30m to 3.0m. The pits in the supplementary investigation (listed in Table 2) also ranged from 2.30m to 3.0m in depth. Twenty-nine probes were undertaken, the deepest of which achieved a termination depth of 4.90m (DP14). Some probes terminated at a shallow 1.0m bgl. In 2023, four additional soakaway pits were excavated to depths ranging 2.50m to 3.0m. However, due to sidewall instability and water ingress, soakaway testing was only undertaken in one pit (SA BRE01).

TOPSOIL

- In the northern half of ‘Area 1’ (the northernmost field), the topsoil noted varies in thickness from 0.15 to 0.40m. In the case of BH13, no topsoil was remarked. Given the consistent recording of between 0.30m and 0.40m of topsoil in trial pits, this is likely to be a more reliable measurement.

- In the southern half of ‘Area 1’ (the two fields to the south), a 200 to 400mm thick cover of topsoil was logged. The mantle of topsoil appears to have been omitted from the borehole records.

GLACIAL DEPOSITS

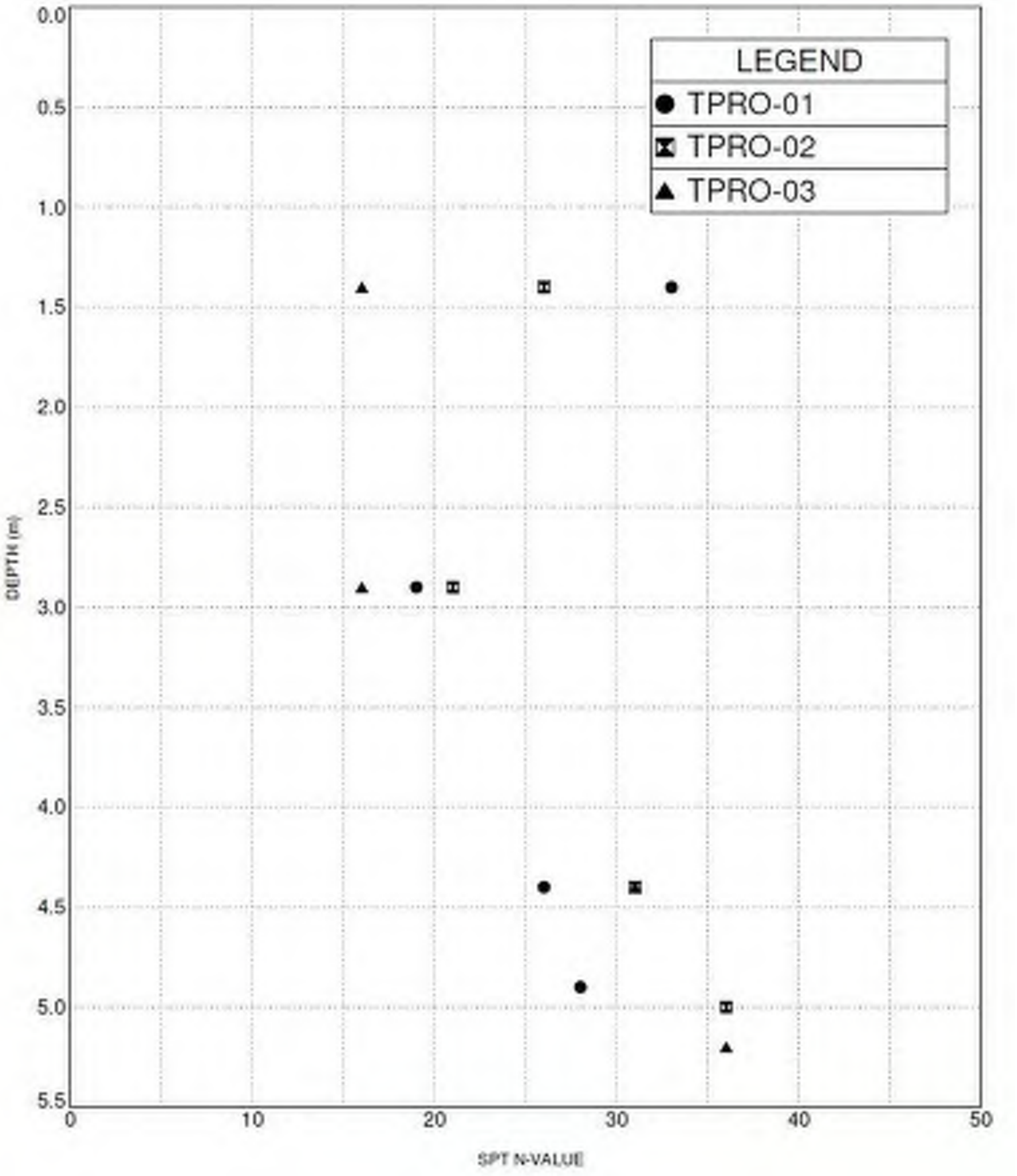
Area 1 - Northern Field

- A firm brown and brownish orange very sandy gravelly slightly silty CLAY was reported underlying topsoil in all trial pits in the northern half of ‘Area 1’. Hand vanes were regularly undertaken in this layer which extended to a depth of between 0.80m and 0.90m bgl. Resulting shear vane values show a progressive stiffening with depth, with an improvement in values when comparing test results obtained from 0.20m bgl to 0.50m bgl depth. The values from the 0.50m horizon measured between 60 and 80kPa indicative of firm to stiff soils. Vanes attempted at ca. 0.70m bgl in the additional pits returned shear values ranging 65 – 110 indicative of stiff and firm to stiff soil. It was remarked that the soils at this depth were often ‘too gravelly’ to complete a vane test.

- The four trial pits in the northern section of ‘Area 1’ each reported firm to stiff and stiff becoming very stiff soil with depth beyond 0.80m and 0.90m (TP31-TP34). Corroborating this increase in stiffness, dynamic probes generally show a progressive increase in N_{100} values with shallow refusals found in numerous probes (DP33-DP36, DP49 & DP54) at depths ranging 1.0m to 1.70m.

- Of the three open-holes carried out in the northern field (TPRO-01, 02 & 03), SPT values indicate firm to stiff soils from 1.50m. There was negligible improvement at 3.0m but some stiffening noted from 4.50m depth (See Figure 6).

Figure 6 – SPT Vs Depth plot for Open-holes TPRO-01, 02 & 03



- There are incidences of consecutive zero N_{100} values found in probes extending from ground level throughout the same area, namely DP51 to 1.40m bgl, DP52 to ca. 0.70m, DP53 to ca. 0.80m and DP55 to 0.90m (See Figure 33). It is assumed that these probes, rather than passing through very soft or soft soils, are in fact penetrating a predominantly fine sand deposit. A firm very sandy slightly gravelly silty CLAY was logged in a number of trial pits. This type of stratigraphy, occasionally becoming more sand-dominant at shallow levels, would explain the mixed probe results obtained locally.

- Plate test results in the same area suggest soft to firm soils at depths of 0.50m. A SPT N-value of 3 was recorded at 1.0m in BH14 which again highlights the presence of loose, likely sand-dominant upper soils. SPT N-values improved significantly with depth.

- The deepest probe in the area, DP50, achieved a depth of 4.10m bgl (80.95m OD) and shows a consistent N_{100} value of ≥6 from a depth of 0.80m bgl. This suggests the presence of uniformly stiff soils beyond the initial upper layer.

- Trial pit TP/RO01 indicates soft to firm grey brown very sandy very gravelly CLAY at a depth of 1.80-2.30m. However, no softening was reported in the corresponding open-hole SPT testing. The softening may be related to water softening and/or disturbance upon bucket excavation.

- Three of the additional pits (TP/RO01, TP/RO02 & BRE SA01) reported deep-seated sandy clayey GRAVEL from 2.30m (81.80m OD), from 1.20m (81.38m OD) and from 2.40m (82.33m OD). A very gravelly sand layer was also remarked in TP/RO02 from 1.80-2.20m bgl. Seepages were coincident with these lower granular strata along with instability.

- The most pronounced ("rapid") water strikes occurred in both TP/RO03 at 2.0m (79.59m OD) in a sandy very gravelly CLAY and in pit BRE SA02 at 2.60m (79.63m OD) in a slightly sandy very gravelly CLAY. It appears from pitting that water-charged granular deposits underlie the Northern Field interspersed with firm to stiff and stiff CLAY-dominant soils. This is further reinforced by the findings of rotary open-hole TPRO-01 and TPRO-02. Clay-dominant TPRO-03 did not encounter any gravel deposits to a depth of 5.20m nor was there any water strike intercepted during its construction.

Area 1 – Southern Fields

- Beneath the upper cover of topsoil, a firm grey very sandy slightly clayey SILT was noted in many trial pits. This was found to persist to ca. 1.50m bgl. In places, the silt was replaced by brownish grey gravelly clayey SAND with localised sand lenses, e.g., TP02 from 0.80–0.90m, or sand pockets, e.g., TP01 from 1.60m to 2.60m.

- Gravelly clayey SAND layers were intercepted within the first metre of pits TP02 and TP03. A brownish grey very gravelly silty SAND with cobbles and boulders was intercepted at depth in TP03 (2.20-2.90m). In the case of TP10, a greyish brown gravelly SAND was found from 0.80m to 1.60m bgl. Strata in the area were generally remarked as 'very sandy'.

- Dense brown silty sandy GRAVEL was frequently found at depth in a number of pits. Table 3 lists the frequent intervals where it was observed during pitting.

Table 3 – Occurrences of GRAVEL-dominant strata and waterstrikes in trial pits across the southern fields of ‘Area 1’

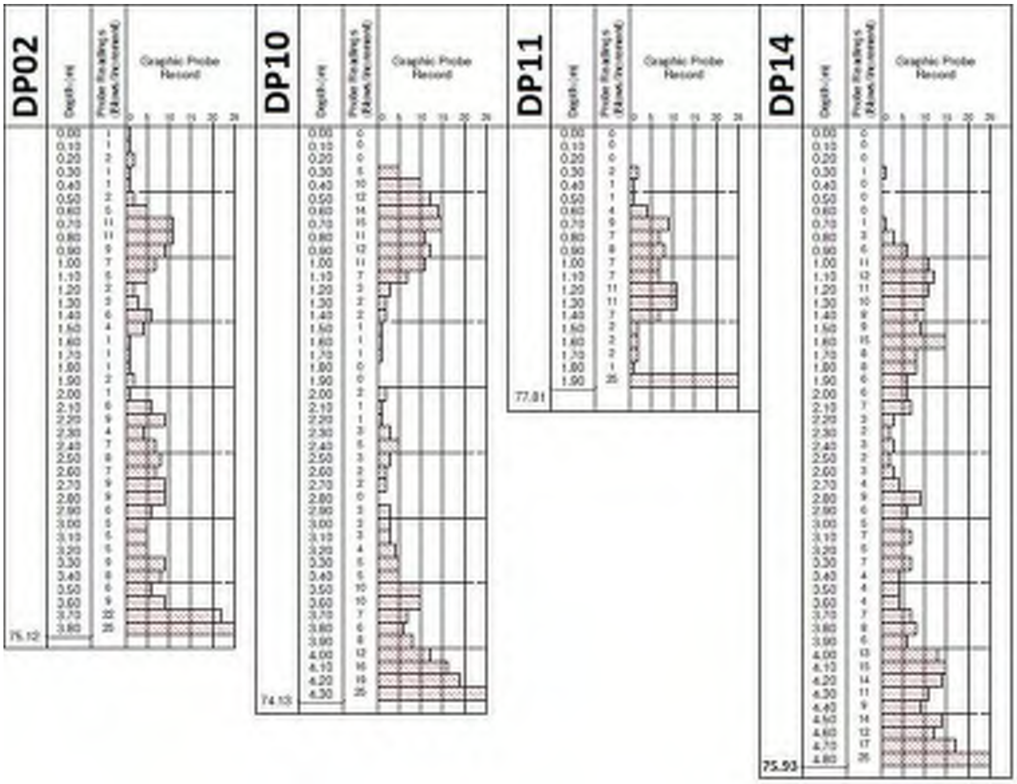
Trial Pit No.	GRAVEL STRATUM Depth m bgl (m OD)	DESCRIPTION	Waterstrike m bgl (m OD)
BRE SA03	0.30 (79.38) to 1.10 (78.58) and again from 2.0 (77.68) to base of pit (77.18)	Initially brownish grey very sand y GRAVEL with a low cobble content Secondly, a grey sandy clayey GRAVEL with a high cobble and medium boulder content	1.40 (78.28) – Seepage 2.40 (77.28) – Rapid
TP01	2.60 (77.03) to base of pit at 2.90 (76.73)	Brown silty sandy GRAVEL with a medium cobble content	2.90 (76.73) – Seepage
TP/RO04	1.70 (78.65) to base of pit at 2.30 (78.05)	Grey brown sandy very clayey GRAVEL with a high cobble content and occasional boulders	1.80 (78.55) – Rapid
TP05	2.0 (78.91) to base of pit at 2.90 (78.01)	Brown silty sandy GRAVEL with a medium cobble content	2.90 (78.01) – Seepage
TP07	2.20 (78.59) to base of pit at 2.80 (77.99)	Brown silty sandy GRAVEL with a medium cobble content	2.80 (77.99) – Seepage
TP08	2.30 (78.09) to base of pit at 3.0 (77.39)	Brown silty sandy GRAVEL with a medium cobble content	3.0 (77.39) – Seepage
TP09	1.60-2.40 (78.06 to 77.26)	Brown silty sandy GRAVEL with a medium cobble content	2.50 (77.16) – Seepage
BRE SA04	0.30 (78.01) to 1.20 (77.11)	Grey sandy slightly clayey GRAVEL with a high cobble content	Multiple seepages 0.70 (77.61) 1.20 (77.11) 1.50 (76.81)
TP/RO09	0.30 (77.01) to 1.0 (76.31) underlain by slightly gravelly silty SAND to pit base at 2.80 (74.51)	Grey very sandy silt SAND with rare cobbles	No Waterstrike

- The occurrence of sand intervals within mixed firm and stiff fines and gravelly strata can generate an inconsistent N_{100} profile. Figure 7 demonstrates the passage of high N_{100}

values passing abruptly into low values and vice versa. This is attributed to the sand pockets and lenses found in the mixed fluvio-glacial deposit.

- In proximity to DP10, TP/RO09 reports the presence of a very sandy GRAVEL overlying a grey slightly gravelly silty SAND from 1.0m (76.31m OD). It extends to the pit base at 2.80m depth (73.11m OD). This tallies well with the high blowcounts initially recorded in DP10 followed by the low blowcounts from 1.40m (77.13m OD) to ca. 2.80m (75.73m OD). However, equally, BRE SA04 shows the existence of an upper GRAVEL layer (0.30-1.20m) underlain by a soft to firm dark grey slightly sandy very gravelly CLAY. This sequencing also appears plausible when viewing the pattern of the probe blowcounts in DP10.

Figure 7 - Mixed probe results in southern fields at Area 1



- Probes extended to depths ranging 1.0m and 4.90m. They regularly highlighted the potential for intercepting both shallow and deep obstructions. For probes which penetrated deepest, N_{100} values were typically consistent showing N_{100} values of 4-6 per 100mm, often higher – the exceptions being those probes pictured in Figure 6 where it is thought sand lenses, or possibly soft to firm CLAY, entered the soil column. N_{100} values from 4-6 would suggest stiff consistency.

- Hand vanes undertaken at 0.50m showed shear values ranging 50-80kPa indicative of firm and firm to stiff soil deposits. Those completed at 0.70m were notably higher, ranging from 70-80kPa. These set of values are more indicative of a stiff deposit. A shear strength value of 120kPa was recorded at 0.70m in TP07.

- Cases of large diameter, rounded boulders occurring in pits were common, some of which were up to 1200mm (TP05 at 1.80m bgl) (Figure 8B)

- SPT's were undertaken in boreholes BH01-BH04 in the southern part of 'Area 1'. A plot showing the scatter of N values achieved versus depth is presented in Figure 9. It illustrates the presence of generally firm soils at 1.0m, passing to stiff from 2.0m depth.

- SPT N-values obtained from testing in the two southern fields of Area 1 highlight the presence of both soft and soft to firm / loose soils in the upper metre. This extends to 3m bgl in the case of TPRO-09 located in the southeastern corner. The low blowcounts are attributable to a grey silty SAND which was identified to a depth of 3.40m in TPRO-09. Where GRAVEL strata were intercepted, higher N values, typical of a more dense deposit, were recorded.

- As with the northern field in Area 1, medium dense to dense GRAVEL underlies much of the area. There is a definite heterogeneity however, with clay and sand soils intertwined. The granular deposits are often accompanied by water ingress. Shallow CLAY was remarked as 'soft to firm' in both BRE SA04 (1.20 – 3.0m) and TP/RO04 (1.0-1.70m). Elsewhere, it is found as 'firm' in BRE SA03 to the west of the site.

- Limestone bedrock was cored in RC03 from a depth of 8.80m bgl (70.57m OD). The drillhole reported initially loose (N=7 at 1.50m) becoming dense grey brown sandy silty/clayey GRAVEL.

Figure 8A & 8B – Sidewall photo of TP05 showing SILT over dense GRAVEL at 2.0m (78.91m OD). Boulder found in pit at 1.80m measuring 1200mm.

Figure 9 – SPT Vs Depth plot for BH01-BH04

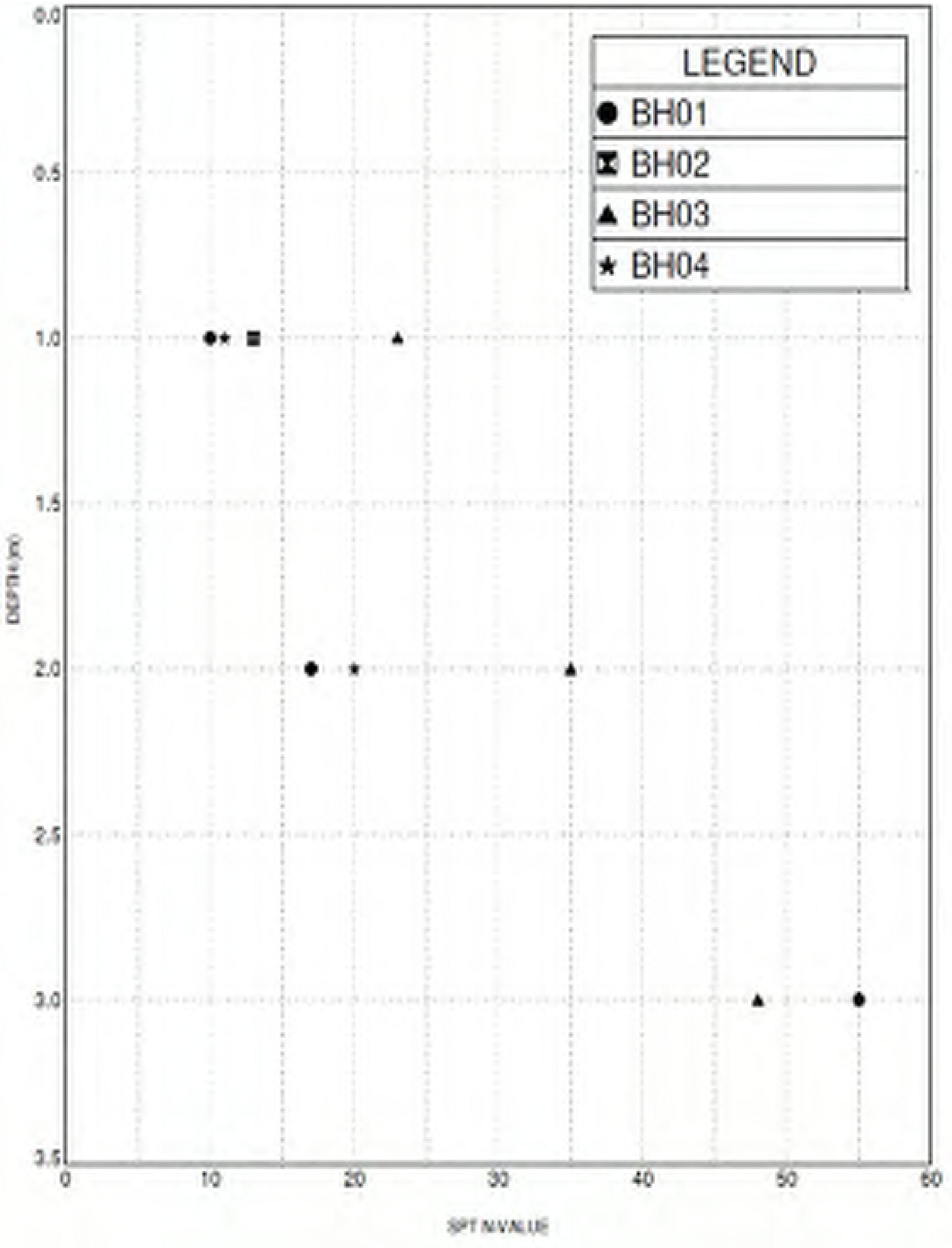
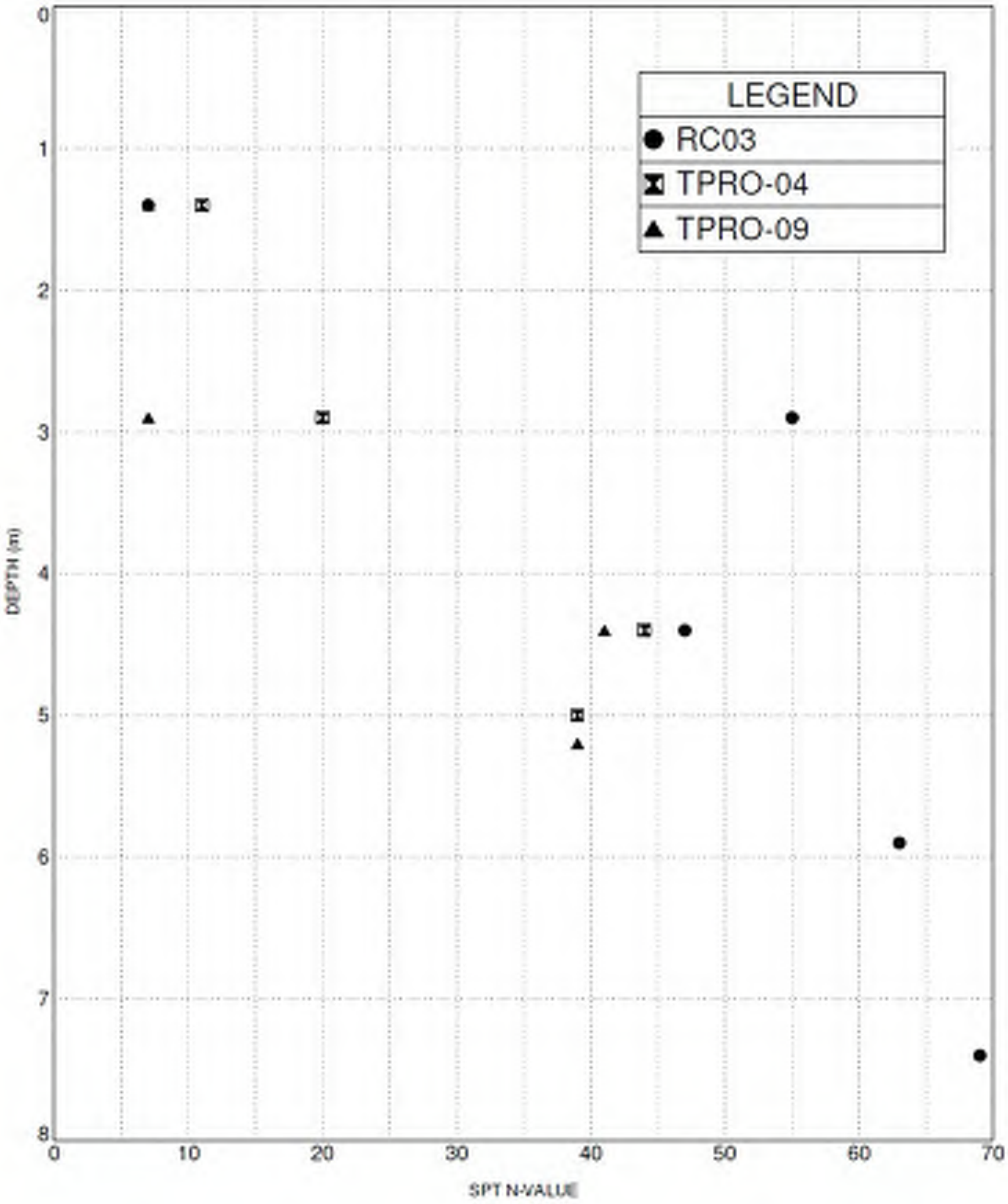


Figure 10 – SPT Vs Depth plot for TPRO-04, TPRO-09 & RC03



5.1.2 Area 2

Ground levels range from ca. 85m OD in the west (BH10) to 80.50m OD (BH12) in the east, closest to the M7 motorway. The initial 2022 suite of intrusive works completed in this area included nine trial pits and thirteen dynamic probes. The deepest probe achieved a depth of 3.80m bgl (76.80m OD) with the pits extending to depths of between 2.50m (80.61m OD) and 3.10m (78.24m OD). The three cable percussion boreholes (BH10-BH12) reached depths ranging 1.80m to 3.50m bgl (80.03m OD).

The supplementary works in April / May 2023 consisted of three rotary core drillholes and three rotary open-holes. Additionally, three trial pits were excavated at each rotary open-hole. A soakaway test (BRE SA06) was excavated with a soak test performed in the overburden soils.

TOPSOIL

- Topsoil ranges in thickness from 0.20m to 0.50m across the area, thinning towards the east in the low-lying field adjacent to the motorway (Figure 11). It was noted that up to 0.50m of topsoil was present in TP28.

Figure 11 – Tussock grasses in triangular-shaped field to east of Area 2. View SE.

GLACIAL DEPOSITS

- The pits along the western edge of 'Area 2', closest to the main farm access track, revealed the presence of generally firm and firm to stiff sandy slightly gravelly silty CLAY to ca. 1.0m, underlain by a stiff brown slightly sandy gravelly SILT. Hand vanes conducted at 0.80m in TP22 range from 75-84 suggestive of stiff material. The probes conducted across the same area (DP's 23, 37, 38, 39 & 40) each indicate progressively stiffer deposits with depth, albeit only achieving probe depths between 1.10m and 1.70m prior to refusal. Equally, the SPT plot for the tests undertaken in the drillholes in the area reflect the firm nature of the soils from 1.50m (Figure 16).

- Shallow refusal was also encountered in nearby BH10 where a depth of 1.80m (82.99m OD) was realised before termination. 1.50 hours of chiselling were used from 1.50m to 1.80m in attempting to further the depth of the borehole. The shallow refusal in BH10 at 1.80m coincides with the entry of a grey brown clayey sandy GRAVEL in TPRO-05. This may be the reasoning behind the refusal. Trial pit TP/RO05 also reported sandy clayey GRAVEL with cobbles and boulders from 1.50m (83.18m OD).

- A band of buried sand was flagged in both TP25 and in BRE06 / SATP06. From 1.20m (84.16m OD) to 2.40m (82.96m OD) in TP25, a greyish brown gravelly clayey SAND with cobbles and occasional boulders was recorded (Figure 10). In nearby SATP06, a grey brown gravelly silty SAND with cobbles was logged from 1.20m (82.25m OD) to a pit end depth of 2.0m (81.45m OD). Probes did not extend deep enough to penetrate this layer. However, given the stability viewed in sidewalls, and the reported stiffness of adjacent layers, it is likely to be dense / medium dense. The log for BRE12 / SATP12 also notes the presence of grey brown gravelly silty SAND from 1.20m (83.12m OD) to the pit base at 2.20m (82.12m OD).

- Rotary works in the western field of Area 2 show firm CLAY passing to progressively stiffer CLAY with occasional gravel bands. A deep-seated GRAVEL was encountered towards the base of TPRO-05 from 4.60m (80.04m OD) to pit base at 5.10m bgl (79.54m OD). A GRAVEL was also encountered from 3.70m (81.33m OD) to pit base (5.0m) in TPRO-06. Both GRAVEL layers were reported dry.

Figure 12 – Sandy stratum from 1.20-2.40m in TP25

- Based on SPT testing, rotary drilling at RC01 revealed the presence of firm gravelly silty sandy CLAY soil at 1.50m improving to stiff consistency at 3.0m. GRAVEL was logged at depth from 7.50m (77.83m OD) to 9.60m (75.73m OD) and again from 10.40m (74.93m OD) to 14.80m (70.53m OD). At this point the gravel changed colour from grey brown to brown. There was also a water strike at 14.50m (70.33m OD). The driller notes rockhead or 'possible weathered rock' from 16.30m bgl (69.03m OD).

- Corroborating the weathered nature of the rock at depth, a sequence of orange brown sandy gravelly CLAY was met from 17.10m (68.23m OD) to 18.70m (66.63m OD) in RC01A. This material contained highly weathered angular to subangular fine to coarse gravel, thought to be a mixture of crystalline calcite and dolomitised limestone. A water strike was observed at 16.80m (68.53m OD).

- Progressing eastwards, the next field east shows a firm and soft to firm soil extending towards 1.0m in BH11. An SPT N-value of 10 at 1.0m coupled with some low N_{100} blowcounts in adjacent probes point to a relatively lower strength upper stratum. Low shear vane values at 0.50m (47-52kPa) in trial pit TP29 indicate firm soil. Overall, however, shear vane values at 0.50m and at 0.70m in pits indicate generally firm to stiff and stiff soils. The stratigraphy in rotary open-hole TPRO-07 suggests a uniformly firm and firm to stiff becoming stiff CLAY soil extending from ca. 1.50m to 4.60m (78.26m OD).

- The most complete probe records in the area are DP41, DP43 and DP45. DP41 suggests stiff and very stiff soil from 1.0m in line with the findings of nearby trial pit TP26 and borehole BH11. DP41 ended at a depth of 2.90m (80.83m OD). DP43, from 2.10 – 2.80m, showed some localised softening with relatively lower N_{100} blowcounts. However, the soil would still be classed as firm and was visually confirmed as so in TP28. Similarly, in DP45, blowcounts from 1.30m to 1.80m are consistently recorded as 3. They are somewhat lower than N_{100} blowcounts both above and below this interval. Nearby trial pit TP27 reports stiff SILT in this same interval, becoming firm from 1.80 to 3.10m bgl.

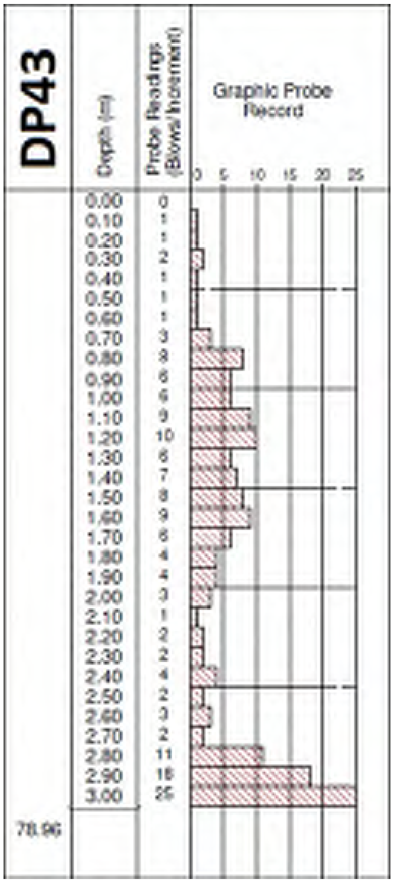


Figure 13 – Probe results for DP43

- Trial pit TP/RO07 intercepted a layer of soft to firm light brown sandy very gravelly CLAY from 1.80m (81.06m OD) to 2.50m (80.36m OD). Two seepages were encountered in this stratum. Potential water-softening may be accountable for the low blowcounts registered in nearby DP43 (Figure 13). The marked increase in blowcounts from 2.80m (79.26m OD) likely hints to a basal dense GRAVEL as found in TP/RO07 from 2.50m (80.36m OD) to the pit base at 3.30m (79.56m OD).

- Trial pit TP29 demonstrated the presence of uniformly stiff soils from 0.60m bgl to an end depth of 2.90m. In this pit, all strata are recorded as very sandy from a depth of 0.60m. Where isolated sand lenses exist, devoid of a larger granular clast component, such deposits are thought to report low N_{100} values in probe drives.

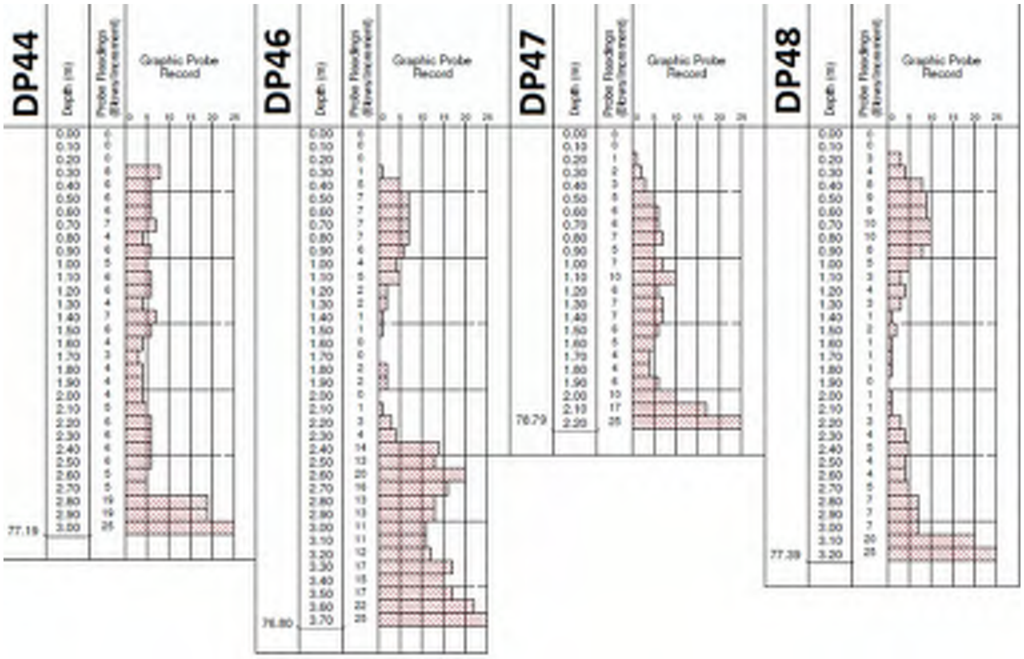
- Rotary core drillhole RC02 reported a grey brown sandy clayey GRAVEL from ground level to 13.90m (69.02m OD). Ahead of rockhead, a CLAY band was logged by the driller. At 15.10m OD, a strong to very strong, thickly to medium bedded light grey blue fine grained LIMESTONE, possibly slightly dolomitised with abundant calcite veining was cored.

- The triangular field to the northeast of the site is covered intermittently with tussock grasses, which can be an indicator of locally high water levels. Deeply cut drainage ditches also traverse the same field. The motorway, separated from the field by a mature hedgeline, is almost at grade with the level of the field (80.30 – 81.10m OD).

- Visual observation in trial pit TP30 shows initially silty SAND to 1.0m. Plate bearing tests in PB21 and PB22 performed on this silty SAND to sandy SILT revealed reasonably high values, most especially for reload cycles (6.4% & 18.9%). A stiff and firm to stiff sandy and very sandy gravelly clayey SILT completes pit TP30 at 2.50m. A water seepage was observed at 2.40m. Later recorded levels in the standpipe at BH12 were approx. 1.0m bgl.

- The resulting blowcounts from probes DP44, DP46-48 are shown in Figure 14. Both probe DP46 and probe DP48 show low (0 and 1) N_{100} values from ca. 1.50m to 2.0m. The pit nearby, BRE09 / SATP09, shows the presence of grey brown gravelly silty SAND from 0.80m to 1.80m. This stratum, it is thought, is responsible for the low to freefall drop in respective probe drives DP46 and DP48.

Figure 14 - Mixed probe results in the triangular field in Area 2



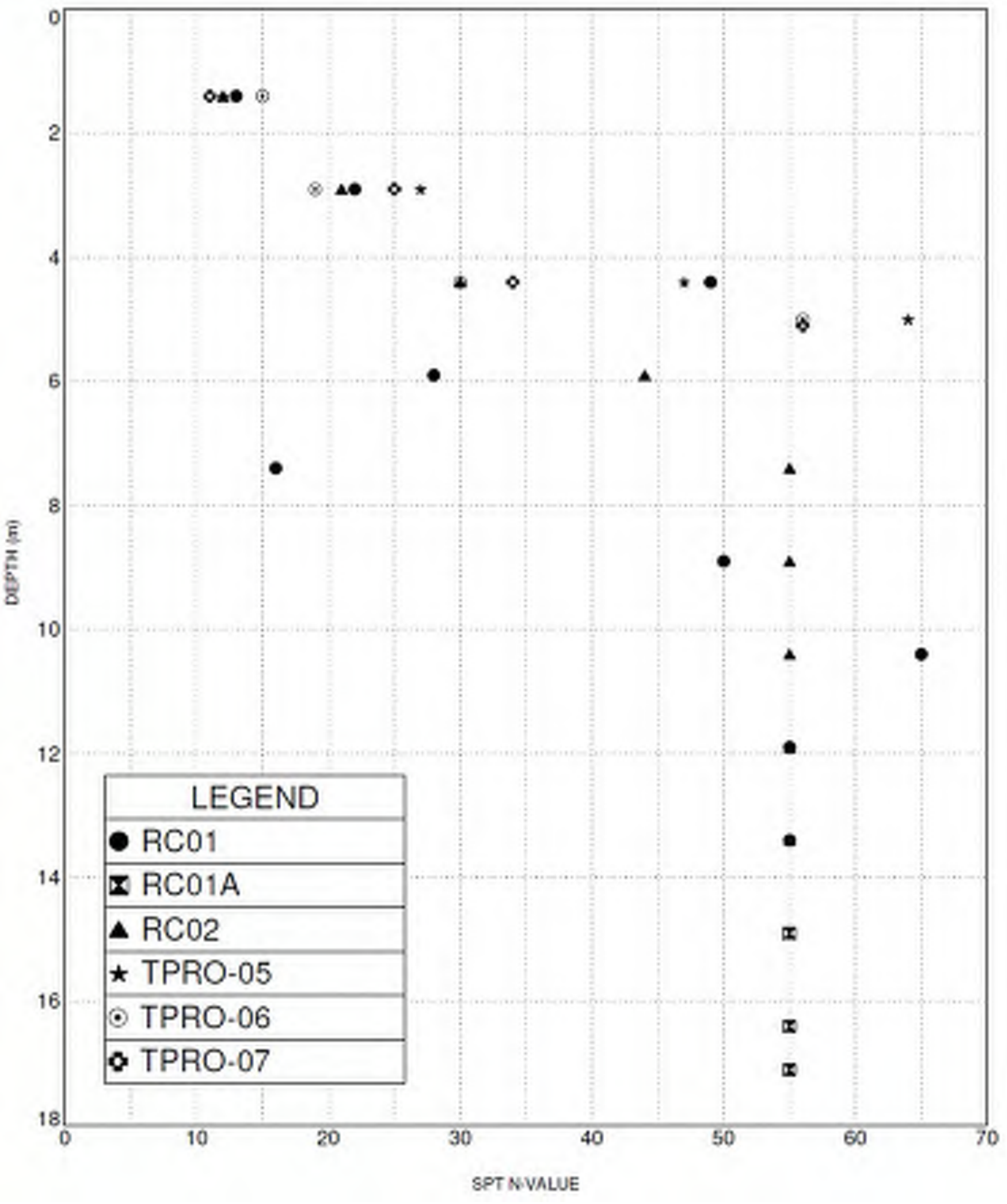
- Neither DP44 nor DP47 show any fluctuation in N_{100} blowcount to depths of 3.10m and 2.30m. The N_{100} values are remarkably consistent throughout each probe drive suggestive of an homogeneous stiff soil stratigraphy.

- BH12, sited close to an existing drainage ditch, extended to 2.40m depth (78.10m OD) before termination. A very stiff CLAY was intercepted at 1.80m (78.70m OD). A SPT test undertaken at 1.0m recorded a N value of 10. This soft to firm consistency aligns well with the findings of probe DP46 and DP48 from 1.0m to ca. 2.0m. However, no sand layers were logged during the drilling of the borehole.

- BRE SA06 (2023 phase of works) was undertaken in the same field as BRE07 (2022 phase of works). BRE SA06 demonstrates a more complete stratigraphy ranging from near surface firm brown CLAY (as found in BRE07), to a soft to firm light brown mottled golden brown and grey sandy gravelly CLAY (1.40-2.25m) to a basal stiff and very stiff dark grey CLAY (Figure 15). The pit was ended at 3.30m (79.25m OD) in the very stiff dark grey CLAY.

Figure 15 – Sidewall profile in BRE SA06. Pit walls unstable from 1.25m bgl.

Figure 16 – SPT Vs Depth plot for TPRO-05, TPRO-06, TPRO-07 & RC01 / 01A & RC02



5.1.3 Area 3

Area 3 covers the three fields to the southeast of the project. The fields are accessed via the central farmyard. Aside from BRE08 / SATP08, all of the intrusive investigation locations are positioned in the two westernmost fields.

Ground levels range from 81m OD, near the farmyard in the northwest, to 78m OD nearing the southern field boundary and stream. Termination depths in probing across the two main fields range from 1.0m to 5.60m. The trial pits conducted on site achieved depths between 1.50m to 3.20m. The cable percussion boreholes mirrored these depths, being terminated between 1.10m and 3.60m bgl.

A rotary corehole suggests rockhead lies at 10.60m (67.72m OD) with coring commencing in RC04 from 11.60m (66.72m OD). Elsewhere, rotary open-holes permitted the installation of a further two water wells in the area, namely TPRO-08 and TPRO-10. Two trial pits were also conducted adjacent to the rotary open-holes. A soak pit, BRE SA05, was also opened but no soak test was performed due to shallow water ingress.

TOPSOIL

- Topsoil ranges in thickness from 0.15m to 0.40m. The normally soft brown slightly gravelly sandy silty CLAY topsoil gives way to a darker peaty CLAY nearing the southernmost stream as evidenced in the trenches excavated for plate test PB04 (Figure 17A) and PB05 (Figure 17B). At PB05, the upper organic soil was underlain by stiff grey sandy gravelly CLAY.

Figures 17A & 17B – Upper organic soils in PB04 & PB05

Fig 17A

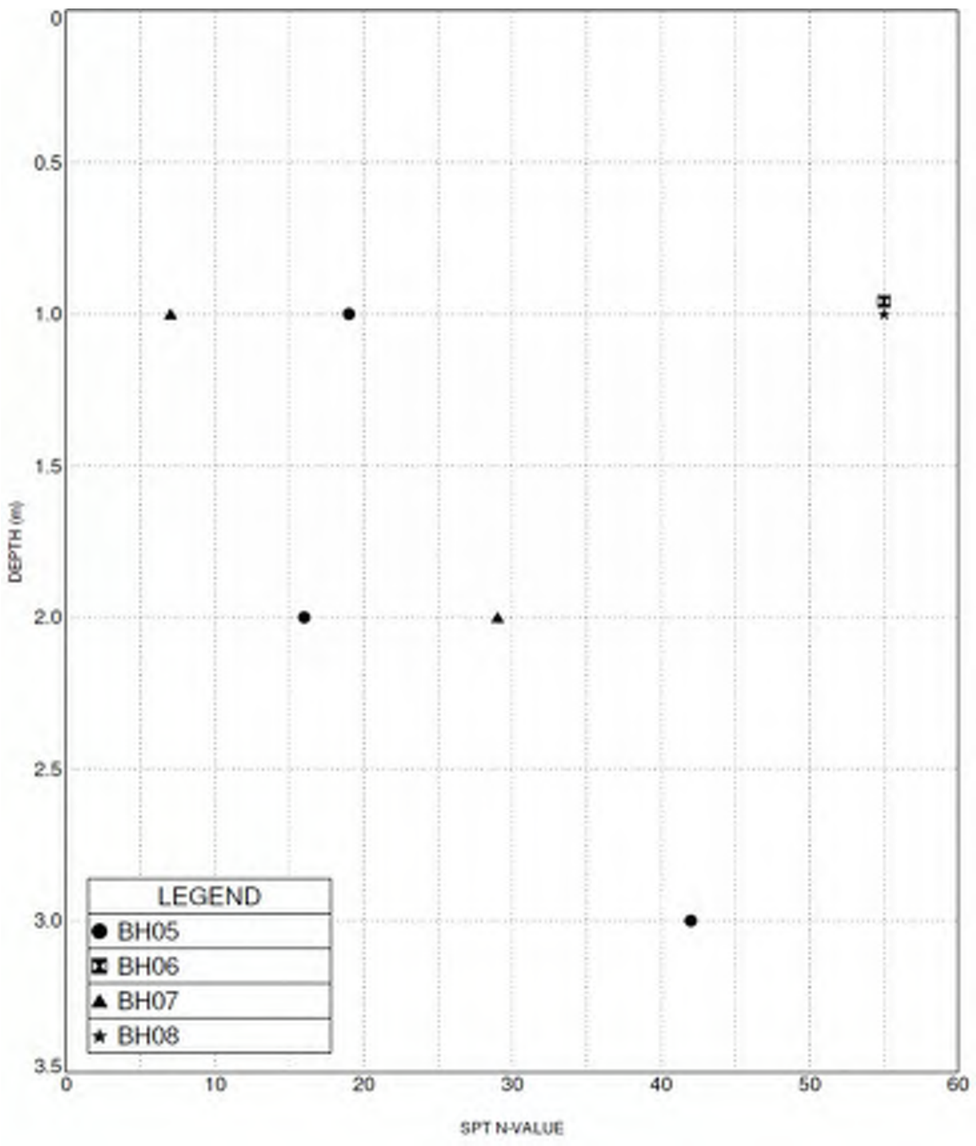
Fig 17B

GLACIAL DEPOSITS

- The westernmost fringe of ‘Area 3’ is underlain exclusively by stiff and dense deposits. Trial pit TP12 outlines a changeable stratigraphy between stiff light brown very sandy very gravelly clayey SILT and dense silty gravelly SAND. Predominantly granular soils extend to 2.40m where a firm to stiff dark brown to dark grey gravelly SILT was found. The pit was terminated at 2.70m (78.01m OD).

- Borehole BH05 reported firm to stiff and later stiff soils (based on SPT N values) to a base depth of 3.60m (74.28m OD) (See Figure 18).

Figure 18 – SPT Vs Depth plot for BH05-BH08



- Mirroring the high strength soils found in both TP12 and in BH05, dynamic probe DP20 achieved only 1.0m before refusal. DP19 also reported high N_{100} values in the upper 2.0m. However, in DP19 a notable 800mm long sequence of N_{100}=0 blowcounts was logged from 2.30m to 3.10m bgl. This is considered to be a pocket of uniform SAND or CLAY/SILT offering little in the way of resistance to the driven probe. It is not thought to be a soft to very soft soil - the assumption is based on the generally high strength, consolidated nature of the soils both above and below the same stratum in addition to the visual observation made in nearby TP13 where a 'firm slightly sandy gravelly silty CLAY' was logged from 2.40m to 2.70m (See Figure 19A & 19B).

- BH06 in the original phase of investigation refused in very stiff light brown CLAY at a depth of 1.10m bgl (80.19m OD). In the supplementary investigation, trial pit TP/RO08 was scheduled nearby. It encountered a band of GRAVEL from 1.30m to 1.50m. It is thought that this may have halted the progress of the cable percussion boring rig at BH06. The underlying soils, as evidenced in the trial pit, comprised firm grey brown CLAY from becoming stiff to very stiff dark brown CLAY to a depth of 3.30m (78.10m OD).

- The high strength lower till is also intercepted in both rotary open-hole TPRO-08 and TPRO-10 with SPT refusals from 3.0m depth. Trial pits TP/RO08 and TP/RO10 both show stiff to very stiff dark brown sandy very gravelly CLAY from 2.90m (78.50m OD) and 2.70m (74.57m OD). At 1.50m, SPT N-values suggest the presence of firm soils.

Figure 19A – 19D – Fig 19A TP13 with firm silty CLAY from 2.40m to 2.70m. **Fig 19B** Spoil with excavated silty CLAY on top of heap. **Fig 19C** TP/RO08 intercepted firm CLAY to 1.30m, GRAVEL from 1.30-1.50m underlain by firm CLAY passing to stiff to very stiff dark brown CLAY from 2.90-3.30 (pit base). **Fig 19D** TP/RO08 spoil.

Fig 19A

Fig 19B

Fig 19C

Fig 19D

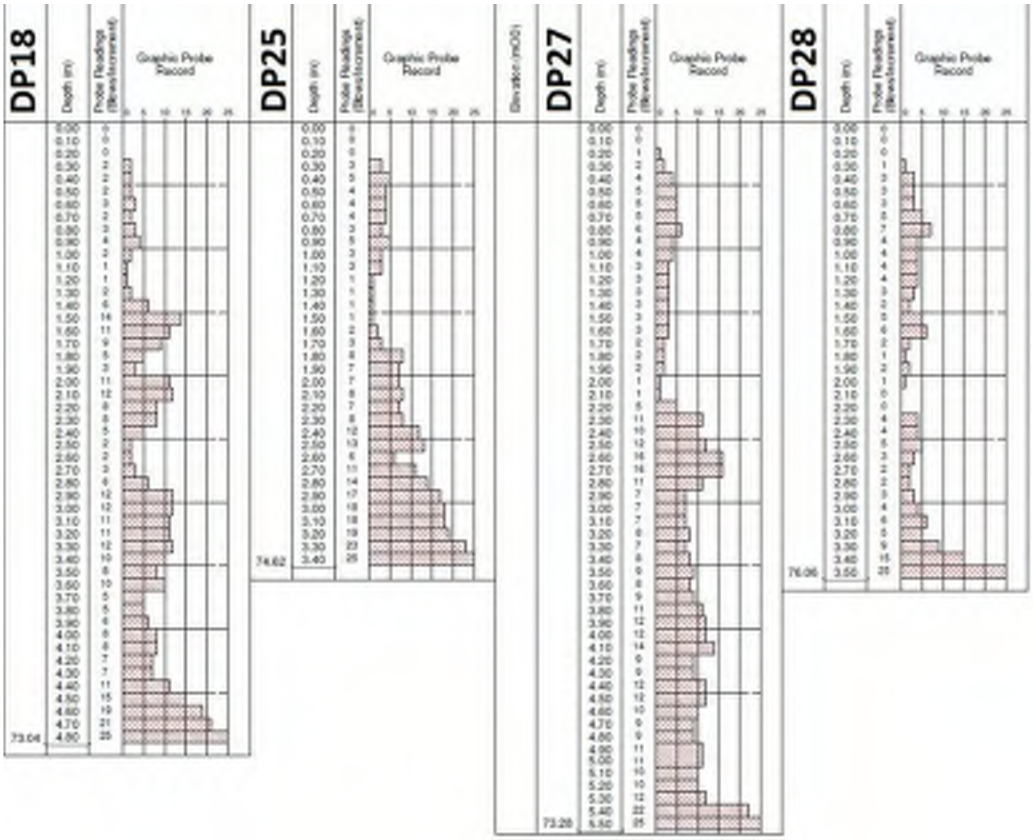
- TP14 failed to penetrate the high strength upper soils formed of very sandy silty CLAY, gravelly SILT and dense gravelly SAND. The pit was ended at 1.50m (77.80m OD).

- Towards the south of the site, in situ SPT test results show the presence of soft / loose soils in BH07 at a depth of 1.0m. Equally, in nearby RC04, SPT testing at 1.50m shows an N-value of 9 (See Figure 18). Elsewhere, SPT N-values generally indicate the progression from firm to firm to stiff and stiff soils. The shallow refusal at 1.0m in both boreholes BH06 (1.10m) and BH08 (1.30m) is also depicted in the SPT plot (Figure 18).

- Towards the central / southern part of the site, probes DP18, DP25, DP27 and DP28 combined with the findings of borehole BH07 (from 0.50m to 1.70m), signal a decrease in strength in the uppermost soil layer. Probes extended to significant depth locally (5.60m at DP27 – Figure 15) and suggest collectively that the upper 1.50m to 2.0m comprises a mix of firm and firm/stiff or medium dense soils. Based on blowcounts, there appears to be a discrete stratum of possible soft and soft to firm soil / loose fine sand from 1.10m-1.30m in DP18, 1.20-1.60m in DP25, 2.0m to 2.20m in DP27 and 2.0 to 2.30m in DP28 (See Figure 20). Lenses of fine sand were observed in nearby TP17 from 1.10 to 1.30m with very sandy SILT to 2.0m bgl. These lenses may account for the localised low blowcounts.

- Supplementary pitting at TP/RO10 (near DP28) did encounter a soft to firm grey brown sandy very gravelly CLAY with “frequent pockets of sand” from 1.0m to 1.80m (76.27-75.47m OD). This aligns well with the findings in DP28 and nearby probes where the upper strata generated often mixed N_{100} blowcounts. No other soil softening was noted in TP/RO10 in what was otherwise a pit comprising firm and stiff CLAY. No SPT results suggestive of soft soils were generated in either TPRO-08 or TPRO-10 (See Figure 22).

Figure 20 – Probe blowcounts in dynamic probes DP18, DP25, DP27 and DP28 in the southern section of ‘Area 3’



- Overall, the N_{100} values viewed in DP18 show no coherent pattern of strengthening or densifying deposits with depth in the upper three metres. This may highlight the locally changeable till composition and consistency as well as possible cobble / clast content which may cause obstructions locally.

- SATP04 / BRE04 indicates the presence of a grey silty gravelly SAND from 0.40m to 0.90m with SATP05 / BRE05 also showing very gravelly SAND and sandy GRAVEL from 0.50m to 1.70m (76.91m OD). Pit TP19 also identified a mixed silty SAND from 2.0m to pit base at 3.20m bgl (75.78m OD). Sidewalls were notably unstable in these strata. Sands and Gravels were also logged in SATP05 / BRE05 from 0.50m to pit end depth at 1.70m. Moderate water ingress was observed at 1.70m.

- Supplementary soakaway pit BRE SA05 reported a thin cover of topsoil and firm CLAY to 0.40m overlying SAND to the pit end depth at 1.70m (77.14m OD). A moderate water strike was encountered at 1.70m bgl (77.14m OD) (See Figure 21B).

- Probes to the northeastern extent of 'Area 3' show a marked consistency in blowcounts from ground level to, in the case of DP29, 5.20m. Soils are clearly stiff and dense in probes DP29 and DP30 and do not show any loose / soft intervals. Both probes DP31 and DP32 terminated on shallow, apparently progressively stiff to very stiff / dense soils. In the base of nearby pit TP20, the soils were remarked as 'firm, occasionally soft to firm'. In any case, the vertical pit sidewalls appear stable to 3.0m (76.78m OD) depth (Figure 16A).

- Plate bearing tests undertaken on the upper soils (PB04, PB05 & PB09 & PB10) at depths of 0.40m and 0.50m report equivalent CBR values of between 2.0% and 3.5% (discounting the low result from PB04 of 0.1%). These are indicative of a firm subgrade.

Figure 21A & 21B – Sidewalls in trial pits located in Area 3. Fig 21A Sidewall in TP20 showing firm and firm to stiff clayey SILT and silty CLAY to 2.60m. A firm occasionally soft to firm blackish grey clayey SILT was logged from 2.60m to 3.0m (76.78m OD) **Fig 21B** Sidewall collapse in BRE SA05. Water sitting at 1.70m bgl.

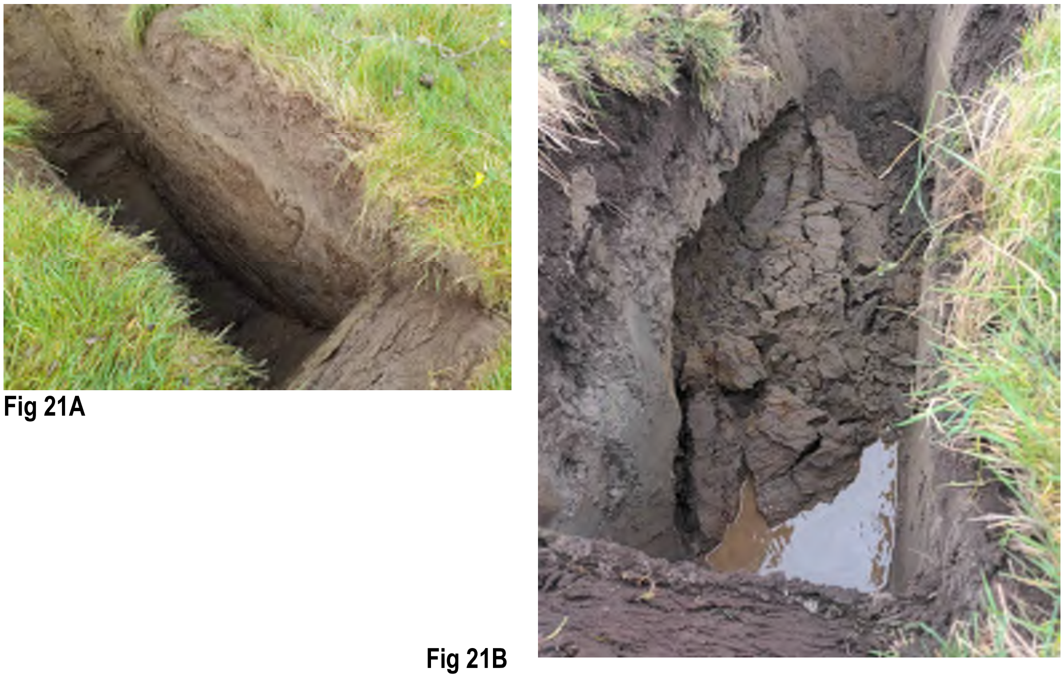
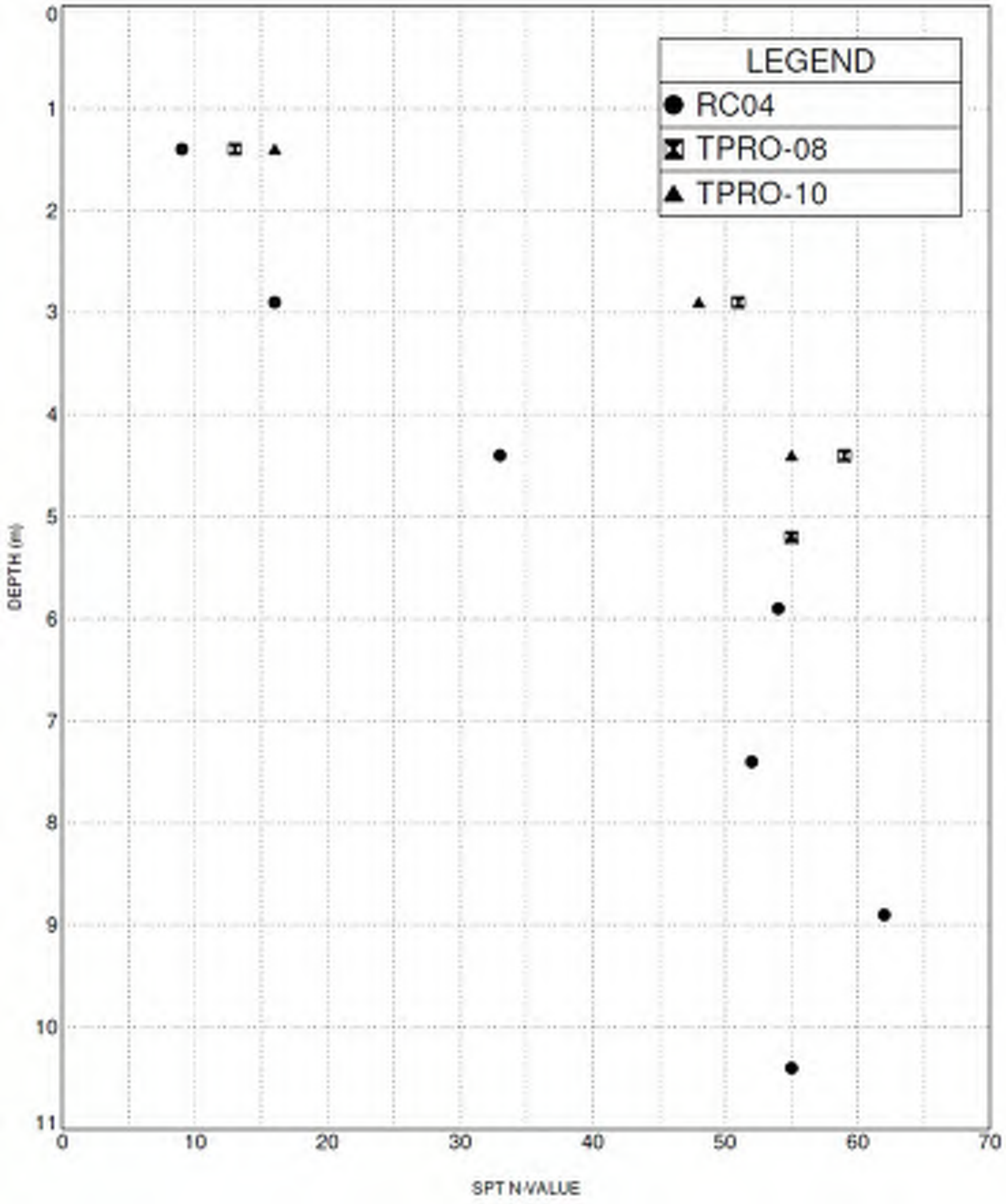


Fig 21A

Fig 21B

Figure 22 – SPT Vs Depth plot for TPRO-08, TPRO-10 & RC04



5.2 Bedrock

Reference to the GSI map for the area (Figure 23, 1:100,000 Solid Geology series) shows that the site is underlain by the Carboniferous, Viséan-aged Rickardstown Formation. The rock formation consists of cherty often dolomitised limestone. No outcrops were found on site.

Figure 23 - Bedrock Geological Map for the Halverstown Site (retrieved from GSI website)

Key: **RK** = Rickardstown Formation
BA = Ballysteen Limestone

Bedrock was not intercepted at either the base of machine excavated trial pits or cable percussion boreholes. However, rotary core drilling, undertaken as part of the supplementary investigation, did prove rock at each of the five locations. Of the five locations, one rotary corehole was undertaken in Area 1 (western fields), three in Area 2 (eastern fields) and one in Area 3 (southeastern fields).

Recovered cores in RC02, RC03 and RC04 were logged as slightly weathered, thickly to thinly bedded, light blue grey, fine-grained LIMESTONE with localised dolomitization. A stromatactic structure was evident in the cores as well as abundant calcite veining (Figure 24). RC04 displayed more visibly interbedded calcisiltite and argillaceous layers. In the case of RC01 and RC01A, no competent bedrock was met. Instead, the recovered cores (RC01A) returned a clay / calcite crystal mix from 17.30 – 18.70m. Given the unlithified, brittle crystalline structure of the calcite, open-hole techniques were deployed in both RC01 and RC01A. SPT testing was undertaken to provide further detail on density of the calcite veinfill. Arisings from the drilling at RC01 were photographed on the ground following drilling (Figure 25).

Discontinuity spacings in the limestone rotary cores ranged from widely (600 to 2000mm) to closely (60 to 200mm) spaced, medium (200 to 600mm) to closely spaced in the case of RC02. The rock encountered in RC01 and RC01A comprised crystalline calcite, presumed localised veinfill hosted in the limestone bedrock. Given the dolomitised nature of the limestone in the area, the development of fissures / fractures in the rock and subsequent infill by calcite is not surprising. However, in the case of RC01 and RC01A (performed approximately 5m apart), the calcite is extensive and not restricted to thin veinfill in dolomitised bedrock (as observed in RC02 & RC03 and to a lesser extent in RC04).

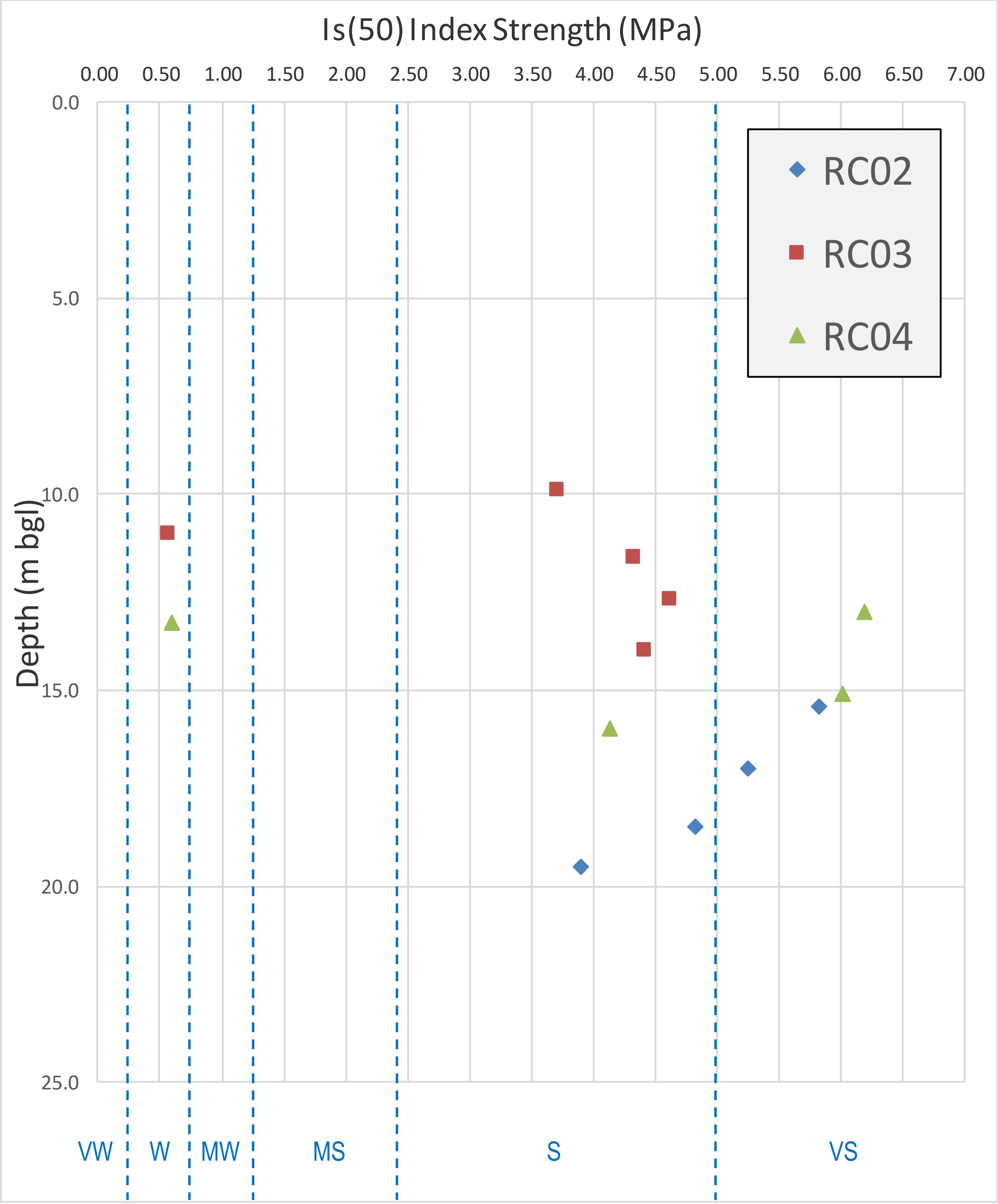
The discontinuity surfaces in the limestone are typically smooth to very locally rough, planar. Apertures are tight to locally moderately open, occasionally exhibiting clay smearing. Calcite veins (1-10mm thick) and slight iron oxide staining were often noted. Dips are subhorizontal and locally 30° and 40°.

Figure 24 – Bedrock cores from RC02

Figure 25 – Pulverised returns at the surface following open-hole drilling through crystalline calcite at RC01

The point load strength index (PLSI) test data produced $I_s(50)$ values ranging from 0.57 to 6.20 MPa, with a mean value of 4.19 MPa. The strengths when plotted show a broad scatter but are chiefly placed in the centre of the PLSI chart (Figure 26), corroborating the largely medium strong strengths recorded in core logging.

Figure 26 – $I_s(50)$ strengths obtained from diametrial Point Load Strength Index testing



VW = Very Weak, W = Weak, MW = Moderately Weak, MS = Medium Strong, S = Strong, VS = Very Strong (ISO 14689:2017 (E))

Using a correlation factor (K) of 20 to assess compressive strength, this suggests a characteristic strength envelope in the order of 11 to 124 MPa and categorizes the bedrock as weak (5 to 12.5 MPa) to very strong (100 to 250MPa). The visual strength descriptors determined during engineering geological logging marry well with the overall plot scatter in Figure 26.

ISO 14689:2017 (E) rock strength parameters are drawn on Figure 26 to allow correlation between UCS and Point Load Strength tests. A correlation factor (K) of 20 was used to plot the ISO 14689:2017 (E) MPa strength divisions on the Point Load strength ($I_s(50)$) plot.

5.3 Groundwater

Water strikes (seepage, slow and moderate inflows) were intercepted during shallow trial pit excavation, with groundwater also struck during borehole construction at BH01, BH02, BH04 and BH12. A well installed in BH13 later reported water only to be dipped dry in July 2023. With the exception of TP30 and BH12 in the northeast, during the 2022 phase of investigation, shallow groundwater was found exclusively towards the south of the site, near the stream boundary (See holes identified on Figure 27 & Table 4).

Figure 27 – Trial pits and boreholes where groundwater entry was recorded (initial 2022 phase of investigation)

During the supplementary investigation in April / May 2023, of the ten rotary open-holes drilled across the site, six remained dry to their bases on the date of construction. These were TPRO-03, 05, 06, 07, 08 and 10. Standpipes were installed in each well to permit future monitoring. In July 2023, groundwater was found in all standpipes. In the case of the trial pits excavated near each corresponding open-hole, with the exception of TP/RO09 and 10, water strikes in various forms, ranging from seepages to rapid inflows, were encountered. Occasionally, multiple strikes were recorded in a single trial pit. In the case of the six soakaway pits, water strikes were again prolific, being encountered in each of the six pits. This may account for the erroneous results in both tests run in BRE SA06, namely SA06_A and SA06_A1, where the water levels rose during the respective soak tests. No soak tests were performed in pits BRE SA02 – BRE SA05 due to water ingress accompanied by poor pit sidewall stability.

Finally, of the five rotary coreholes constructed on the site, where rock was found at appreciable depths, strikes were encountered at depth. Where rock was met at higher levels, noted in both RC03 and RC04, water strikes were generally intercepted at higher levels. It should be added that both RC03 and RC04 were conducted in the topographically lower (southern) portion of the site where groundwater was typically found at higher levels. As with the rotary open-holes, each cored drillhole had a standpipe installed to permit later groundwater monitoring. The holes were dipped in early July 2023.

During the 2022 investigation, for the most part the groundwater entries were reported as seepages in trial pits, frequently in gravel horizons at the base of trial pits at ca. 3.0m. Instability and sidewall collapse generally accompanied the entry of water into open pits. Figure 27 shows the individual exploratory hole locations where water strikes were encountered (2022). There is a pattern across the site which follows, for the most part, the occurrence of buried Gravel and Sand at depth (at ca. 2.50-3.0m).

In 'Area 1', groundwater was met between elevation 76m OD and 79.50m OD, related to the occurrence of granular water-bearing soils or potentially isolated lenses in more extensive clays. Charged groundwater strikes were intercepted in each of BH1, BH03 and BH04 where, at each bore, groundwater was found to rise considerably during the 20minute observation period. This may be suggestive of a significant piezometric pressure at depth.

During the April / May 2023 investigation, in the northern field of 'Area 1', gravel and sand strata hosted seepages in TP/RO01, TP/RO02, TP/RO03 as well as BRE SA01 at depths ranging 1.50-2.80m. At depth, in both TP/RO03 and BRE SA02, rapid ingress was observed at 2.0m (79.59m OD) and 2.60m (79.63m OD), strikes clearly linked in elevation despite being located ca. 160m apart.

Within the fields to the south of 'Area 1', trial pits again encountered water strikes, save for TP/RO09 which remained dry to its base at 2.80m (74.51m OD). It may be the case that the pit did not remain open for a period long enough to allow groundwater equilibrate. Nearby, rotary open-hole TPRO-09 reported 'blowing sands' from 1.20-4.20m with a water strike encountered at 4.0m bgl. For sands to 'blow' in the casing, there must be water present to allow for sand solifluction to occur. It is deemed therefore that the sands observed were likely water saturated. Collapse during trial pit excavation suggests water-laden silty sands were present (Figure 28).

Figure 28 – Sidewall collapse in grey silty SAND upon completion of TP/RO09 excavation.

Strikes in the southern field in 'Area 1' were observed as seepages to rapid flow, sometimes occurring in the same pit, eg., BRE SA03 where a seepage was recorded at 1.40m followed by a rapid strike at 2.40m. Once again, water strikes were generally found in clayey GRAVEL and very gravelly CLAY layers and ranged in depth from 0.70m (seepage) to 2.40m (rapid). The water strike intercepted at 5.90m in RC03 was later found to have risen (by drillhole completion) to a depth of 1.70m bgl. It was later dipped at 3.33m (July 2023).

The strikes in 'Area 2' were restricted to the lower elevation locations of BH12 and TP30, both positioned beside a deep drainage ditch. Strike levels were remarkably consistent at 78.20 and 78.30m OD with the strike in the borehole noted to rise inside the drill casing from 2.20m to 0.70m bgl (over the twenty-minute monitoring period).

The additional phase of works in 'Area 2' reported water strikes in trial pits TP/RO05, TP/RO06 and TP/RO07. A moderate strike was intercepted in TP/RO05 at 2.30m (82.38m OD) with only seepages in TP/RO06. A seepage and rapid strike were both observed in TP/RO07, the rapid strike at 2.40m bgl (80.46m OD) immediately above a very clayey GRAVEL layer at 2.50m bgl. Some softening appears to be present in what was described on site as a "soft to firm light brown CLAY" coincident with the appearance of the seepage and rapid ingress in TP/RO-07. Likewise, in TP/RO06, a soft to firm layer was encountered from 1.50-2.50m with a seepage recorded at 2.0m. Rotary open-holes 05, 06 and 07 remained dry during their construction but were later found to have water levels between 2.43 to 3.79m bgl (between 80.43-81.27m OD) when dipped in July 2023.

Coreholes intercepted bedrock at significant depth (between 14.80-17.10m bgl), in the case of RC01 and RC01A, encountering what is thought to be an extensive calcite veinfill rather than limestone bedrock. Across the five holes, water strikes were encountered at depths ranging 11.80m to 16.80m bgl. By completion of drilling at each of the five cored locations, water in the respective coreholes had risen to levels ranging 3.40m to 6.0m bgl.

Finally, in 'Area 3', during the initial phase on investigation, strikes were measured between 75m OD and 77m OD, the deepest being the water strike observed in BH05 at 2.80m bgl (75.08m OD). Strikes in trial pits were, as with other areas, observed between 2.50m and 3.0m bgl. The shallowest ingress was reserved for both BH07 (1.30m) and SATP05 / BRE05 (1.70m), both of which were located in closest proximity to the stream / southern boundary.

In the case of the two boreholes, BH02 and BH03, water strikes were recorded at greater depths than in nearby trial pits. The depths are noted in Table 4. Once encountered, groundwater rose inside the drill casings suggestive of a buildup of piezometric pressure at depth. Water levels were documented to rise by 1.0m and 3.20m respectively from initial strike levels of 4.0m (104.01m OD) and 5.20m (100.86m OD). As with trial pits, the two strikes were seated in clayey/silty sandy Gravel layers.

In relation to the additional 2023 works, a moderate water strike was encountered in BRE SA05 at 1.70m (77.14m OD) marrying exactly with the findings in SATP05 / BRE05. Elsewhere, the two nearby TP/RO pits remained largely dry with only a seepage recorded in TP/RO08 at 2.30m (79.10m OD). No strikes were noted in either rotary open-hole, TPRO-08 or TPRO-10. Rotary corehole RC04 intercepted groundwater at 5.40m with water dipped inside the casing at the end of drilling at 3.50m bgl (74.82m OD). It was dipped in July 2023 at 1.12m bgl (77.20m OD).

The potential does exist for there to be seasonal changes in groundwater level. The limited groundwater monitoring information collected over the course of the project suggests there is such a variation present.

Table 4 – Water measurements in on-site exploratory holes (TP-, SA-, BH-, TP/RO, TPRO-, RC- and BRE SA-)

Exploratory Hole No.		Water Struck **m bgl** (m OD)	Stratum Description	Rate of Flow	Remarks / Stratum of water ingress (m OD)
AREA 1 (WEST)					
2022 Works	BH01	**2.80** (77.24)	Firm to stiff dark brown sandy gravelly silty CLAY	Moderate	Rose to 1.30m (78.74) after 20minutes
	BH03	**2.70** (75.92)	Stiff light brown very sandy gravelly CLAY	Moderate	Rose to 0.60m (78.02) after 20minutes. Installation dipped at 1.30m (77.32) & 1.80m (76.82) & 2.05m (76.57)
	BH04	**1.60** (79.46)	Firm to stiff and stiff dark and light brown sandy gravelly silty CLAY	Slow	Rose to 0.60m (80.46) after 20minutes
	BH13	**-**	-	-	Installation dipped at 2.20m (80.60m) & 2.38m (80.42). Dry on 10-07-23
	TP01	**2.90** (76.73)	Brown silty sandy GRAVEL	Seepage	Slightly unstable from 1.60m – seepage at base of pit
	TP05	**2.90** (78.01)	Silty sandy GRAVEL	Seepage	Unstable w/ sidewall collapse from 2.80m – seepage at base of pit
	TP07	**2.80** (77.99)	Brown silty sandy GRAVEL	Seepage	Unstable from 2.0m – seepage at base of pit
	TP08	**3.0** (77.39)	Brown silty sandy GRAVEL	Seepage	Unstable from 2.30m – seepage at base of pit
	TP09	**2.50** (77.16)	Dark grey very sandy gravelly clayey SILT	Seepage	Unstable w/ sidewall collapse from 1.60m
2023 Works	TP/RO01	**2.40** (81.70)	Grey brown sandy very clayey GRAVEL	Seepage	Slightly unstable from 1.90m
	TP/RO02	**2.10** (80.48)	Brown slightly clayey very gravelly SAND	Seepage	Unstable from 0.40m
	TP/RO03	**1.50** (80.09)	Firm light brown sandy very gravelly CLAY	Seepage	Unstable from 1.0m
		2.0 (79.59)		Rapid	
	TP/RO04	**1.80** (78.55)	Grey brown sandy very clayey GRAVEL	Rapid	Unstable from 1.50m
	TPRO-01	**3.50** (80.56)	Grey brown slightly clayey sandy GRAVEL	Seepage	Depth to water at end of drilling = 4.90m (79.16) Installation dipped at 3.63m (80.43m)
	TPRO-02	**4.40** (78.12)	Grey brown clayey sandy GRAVEL	Seepage	Depth to water at end of drilling = 4.80m (77.72) Installation dipped at 3.16m (79.36m)
	TPRO-03	Dry	-	Dry	Installation dipped at 1.49m (80.14m)
	TPRO-04	**4.50** (75.78)	Dark grey slightly clayey sandy GRAVEL	Seepage	Depth to water at end of drilling = 4.70m (75.58) Installation dipped at 2.27m (78.01m)

Cont.

2023 Works	TPRO-09	**4.0** (73.31)	Grey silty gravelly SAND ("blowing sands")	Seepage	Depth to water at end of drilling = 4.80m (72.51) Installation dipped at 0.64m (76.67m)
	BRE SA01	**2.80** (81.93)	Brownish grey sandy clayey GRAVEL	Seepage	Unstable from 2.0m
	BRE SA02	**2.60** (79.63)	Firm to stiff light brown slightly sandy very gravelly CLAY	Rapid	Strike rising 150mm in 14minutes
	BRE SA03	**1.40** (78.28)	Firm yellowish grey sandy very gravelly CLAY	Seepage	Sidewall collapse from 0.40m – Rapid ingress rising 150mm in 4minutes
		2.40 (77.28)	Grey sandy clayey GRAVEL	Rapid	
	BRE SA04	**0.70** (77.61)	Grey sandy slightly gravelly CLAY	Seepage	Sidewall collapse from 0.70m
		1.20 (77.11)	Soft to firm dark grey slightly sandy very gravelly CLAY	Seepage	
		1.50 (76.81)	Soft to firm dark grey slightly sandy very gravelly CLAY	Seepage	
	RC03	**5.90** (73.47)	Grey brown sandy silty/clayey GRAVEL	Seepage	Depth to water at end of drilling = 1.70m (77.67) Installation dipped at 3.33m (76.04m)
AREA 2 (NORTHEAST)					
2022 Works	BH12	**2.20** (78.30)	Light brown sandy silty gravelly CLAY	Moderate	Rose to 0.70m (79.80) after 20minutes. Installation dipped at 0.98m (79.52) & 1.0m (79.50) & 1.54 (78.96)
	TP30	**2.40** (78.21)	Grey very sandy gravelly clayey SILT	Seepage	Unstable w/ sidewall collapse from 0.20m
2023 Works	TP/RO05	**2.30** (82.38)	Brownish grey sandy clayey GRAVEL	Moderate	Slightly unstable from 1.50m
	TP/RO06	**2.0** (82.92)	Soft to firm light brown sandy very gravelly CLAY	Seepage	Slightly unstable from 1.50m
		3.0 (81.92)	Grey brown sandy very clayey GRAVEL	Seepage	
	TP/RO07	**1.80** (81.06)	Soft to firm light brown sandy very gravelly CLAY	Seepage	Slightly unstable from 1.10m
		2.40 (80.46)		Rapid	
	TPRO-05	Dry	-	Dry	Installation dipped at 3.79m (80.85m)
	TPRO-06	Dry	-	Dry	Installation dipped at 3.76m (81.27m)
	TPRO-07	Dry	-	Dry	Installation dipped at 2.43m (80.43m)
	BRE SA06	**2.50** (80.05)	Stiff occasionally very stiff grey slightly sandy very gravelly CLAY	Seepage	Slightly unstable from 1.25m

2023 Works	RC01	**14.50** (70.83)	Grey brown clayey sandy coarse GRAVEL	Seepage	Depth to water at end of drilling = 3.50m (81.83)
	RC01A	**16.80** (68.53)	Grey brown slightly clayey sandy GRAVEL	Seepage	Depth to water at end of drilling = 6.0m (79.33) Installation noted Dry on 10-07-23
	RC02	**11.80** (71.12)	Grey brown sandy clayey GRAVEL	Seepage	Depth to water at end of drilling = 3.40m (79.52). Installation dipped at 2.85m (80.07m)
AREA 3 (SOUTH & SOUTHEAST)					
2022 Works	BH05	**2.80** (75.08)	Dark brown sandy silty gravelly CLAY	Moderate	Rose to 1.50m (76.38) after 20minutes. Installation dipped at 0.87m (77.01m)
	BH07	**1.30** (76.64)	Dark brown sandy SILT/CLAY	Slow	Rose to 0.90m (77.04) after 20minutes
	TP13	**2.70** (77.13)	Slightly sandy gravelly silty CLAY	Seepage	Seepage at base of pit
	TP16	**2.80** (76.27)	Brownish grey sandy very silty GRAVEL	Moderate	Slightly unstable, sidewall collapse at 2.0m
	TP18	**3.0** (76.37)	Dark grey sandy gravelly SILT	Seepage	Slightly unstable, sidewall collapse at 2.50m - Seepage at base of pit
	TP19	**2.50** (76.48)	Slightly gravelly silty SAND	Moderate	Slightly unstable, sidewall collapse at 2.50m
	SATP05 / BRE05	**1.70** (76.91)	Grey sandy GRAVEL	Moderate	Unstable – sidewall collapse from 0.70m
2023 Works	TP/RO08	**2.30** (79.10)	Firm grey brown sandy very gravelly CLAY	Seepage	Slightly unstable from 2.0m
	TPRO-08	Dry	-	Dry	Installation dipped at 1.22m (80.18m)
	TPRO-10	Dry	-	Dry	Installation dipped at 1.40m (78.20m)
	BRE SA05	**1.70** (77.14)	Greyish brown SAND	Moderate	Unstable from 0.60m
	RC04	**5.40** (72.92)	Grey brown sandy silty/clayey GRAVEL	Seepage	Depth to water at end of drilling = 3.50m (74.82). Installation dipped at 1.12m (77.20m)

5.4 Ground Gases

Gas monitoring was undertaken in the borehole standpipes to measure concentrations of methane, carbon dioxide, oxygen and hydrogen sulphide. A Geotech GA5000 apparatus was used and the readings were conducted by an IGSL engineering geologist. Summary details of the gas concentrations are presented in Table 5. The monitoring works determined carbon dioxide concentrations (peak readings) of 0.6 to 2.3%. No methane (CH_4) or hydrogen sulphide (H_2S) ppm concentration was detected in any of the four wells.

Table 5 - Summary of Ground Gas (Peak) Measurements

BH	Reading Date	CH_4 (%)	CO_2 (%)	O_2 (%)	CO (ppm)	H_2S (ppm)	Flow Rate (l/hr)
BH10	19-Dec-22	0	2.3	15.9	0	0	0.1
BH12	19-Dec-22	0	1.1	15.9	0	0	0.1
BH03	19-Dec-22	0	0.6	20.6	0	0	0.1
BH13	19-Dec-22	0	0.8	18.9	0	0	0.1

6. GROUND ASSESSMENT & ENGINEERING RECOMMENDATIONS

6.1 General

In light of the ground investigation findings, the following geotechnical issues are developed and discussed for engineering design:

- Foundation Solutions
- Earthworks & Ground Improvement
- Groundwater / Infiltration
- Slopes / Batters
- Pavement Construction
- Buried Concrete
- Ground Gas
- Environmental Testing - Water
- Waste Acceptance Criteria [WAC] & Environmental Testing

Figure 29 – DC Building Layout and ESB GiS Substation with 2023 investigation point overlay

Taken from RKD Drawing No. 22217-RKD-ZZ-ZZ-DR-A-1100

6.2 Foundation Solutions

6.2.1 DC Bld 1

DC Building 1 is located on glacial soils, typically firm to stiff and stiff in consistency. The dynamic probes did not extend beyond a depth of 1.70m (82.62m OD), each terminating or refusing in stiff soils. SPT N-values in BH09 and BH10 indicate firm soils to c3.0m. Visual observations during trial pitting show the upper soils are generally firm and firm to locally stiff. Shear vane tests at 0.50m in TP25 range from 80b to 90kPa and are suggestive of stiff deposits. The stiff fine grained soils (clay matrix) should be capable of offering a safe or allowable beating capacity of 125 to 150kPa and appear mostly at a depth of 1.0m bgl. This depth and bearing capacity could be used to size conventional strip footings and pads at Building 1 (and to limit long term settlements to <15 to 20mm).

Levels range widely across the footprint of Building 1 from 83.0 to 85.30m OD, hence excavations to construct conventional strip footings and/or pads will subsequently vary. It is expected that considerable cut / fill earthworks will be required over the building footprint. For this reason, if significant mass excavation is planned, in order to re-use the material and reduce stockpiling or 'soil waste' removal from site, a programme of soil stabilisation could be undertaken. Laboratory testing on samples acquired from site was conducted using varying percentages of lime and lime/cement binders. The modification trial testing established an incremental increase in soil performance in terms of strength / stiffness (refer to Section 6.3). Given the greenfield site currently extends over a large unobstructed expanse, soil stabilisation is seen as a practical solution. In our experience, such soils treated with lime or lime / cement should offer bearing capacities in the order of 250 to 300kPa.

If the design makes provision for ground improvement / soil stabilisation methods, then a field demonstration trial (footprint of c. 10 x 10m) is advised to assess the performance of the modified soils with lime or lime / cement binders. This would allow for in-situ testing (plate load, nuclear gauge, sand replacement and CBR mould samples) to measure CBR / stiffness, relative compaction (percentage degree of compaction) and air voids.

A greyish brown gravelly clayey SAND with a medium cobble content and occasional boulders was intercepted at 1.20m (84.16m OD) in TP25. This is the only occurrence of a granular-type stratum found at the proposed building during the 2022 investigation. Plate bearing testing on exposed sand will offer some degree of assistance in determining the settlement regime within the sand / fine gravel layers. A series of plate bearing tests will allow for determination of dig depth upon which treated soils can be placed. A nominal CBR percentage of 3% for untreated soils should be sought ahead of placement.

No water was found in the shallow installation constructed at well BH10 to a base depth of 1.80m (82.99m OD) and so the shallow dig area should remain free of groundwater inundation. A drainage plan should be developed for surface water drainage however so as not to inadvertently cause softening of the freshly exposed soils through water ponding. There is also the potential to intercept water in isolated, perched sand/gravel lenses.

Additional investigation in 2023 at 'Building 1' involved the construction of two rotary coreholes, a rotary open-hole and a trial pit. The rotary holes each unearthed a sequence of initially firm soil passing to progressively stiff to very stiff / dense soils from 3.0m (based on SPT data – see Figure 16). TP/RO05, excavated in the central area of proposed 'Building 1' reported firm CLAY to 3.60m with an intervening water-bearing gravel horizon from 1.50-2.90m bgl. The gravel layer, deemed dense on the basis of probe blowcounts, is thought to be the reason for shallow termination in nearby probes DP37, 38 & 39. Rotary open-hole drilling also highlighted the presence of the gravel layer (from 1.60-2.0m) and showed (by SPT blowcounts) the underlying CLAY to be stiff, becoming very stiff. Gravel was again intercepted at depth (from 4.60m to 5.0m). The rotary coreholes both suggest stiff and very stiff soils extend to depth with some medium dense gravel interbeds (ca. 7.50 – 9.0m bgl). Rock was reported at depths ranging ca. 14.80m to 17.10m bgl. Should larger loadings be required, the use of bored piling methods would be recommended. As the bedrock was not identified as limestone but rather crystalline calcite veinfill, and as the spatial extent of the calcite in unknown in the area around RC01 / RC01A, pile design should not be over reliant on end bearing but achieve its strength from skin friction in both the stiff clay overburden and intervening gravel. Given the uncemented, extremely closely fractured nature of the rock in the area, it should be treated from a geotechnical view as a dense gravel. The bearing capacities offered by the crystalline calcite would therefore be in the order of 300kPa.

6.2.2 DC Bld 2

This building straddles an existing field boundary. Currently, the topographically lower eastern field has the appearance of regular waterlogging due to its thick cover of tussocked grass. Deep drainage ditches traverse the same field to assist with drainage.

For the purposes of designing shallow foundations, safe or allowable bearing capacities will depend on soil type / composition and stiffness. Across the Building 2 area, the soils consist of initially firm becoming stiff Silt and Clay matrix till and should offer a similar capacity as that noted for Building 1, i.e., 125 to 150kPa at 1.0m bgl. Many strength indicators, from shear vanes, probes and SPT N-values, as well as visual strength descriptions made during pitting, point to the presence of firm and stiff soils generally. However, there are also outliers where probe values and SPT N values from 1.0m to 2.0m flag the potential for low strength soils to be present in the stratigraphy. Consecutive N_{100} values of 0 and 1 were recorded in DP46 and DP48 and SPT N values of 10 were returned for tests from 1.0-1.45m (indicative of soft to firm soil) in both BH11 and BH12. The possibility of there being fine sand and clast-free Silt and Clay may offer an explanation for the lower blowcounts in the driven dynamic tests. Such fine-grained coarse soils present little resistance to probing and often appear as successive zero blow counts.

Trial pit TP/RO07, excavated during the 2023 phase of works, intercepted a 'soft to firm' sandy very gravelly CLAY layer from 1.80m to 2.50m bgl. Its position aligns well with the lower blowcounts registered in nearby probe DP43 from 2.10m to 2.70m. Entry of gravel at depth in TP/RO07 (from 2.50m) is marked by an immediate rise in blowcounts in DP43, suggestive of a dense nature.

In light of the lower strength shallow horizons, it is recommended (if choosing conventional foundation design) to size pads and strip footings with a safe bearing capacity of 100kPa at c1.0m. Locally, if softened soils are intercepted, these can be excavated and replaced with low-grade C20 leanmix concrete to underside of foundation.

As with Building 1, the option to modfify and stabilise soils should be considered thereby offering a significantly higher bearing capacity (250 to 300 kPa). It would also 'build out' the risk of foundations bearing on to or traversing zones of low strength (soft) soils.

Given the occurrence of possible lower strength soils from 1.50m to 2.50m, soil stabilisation would need to incorporate this layer. This would bring soil stripping and soil re-working close to the water-bearing gravel stratum on site. This makes modification of soils somewhat more impractical without first initiating water drawdown (water level in wells RC02 and TPRO-07 was found between 2.43-2.85 / 80.43-80.07m OD). As an alternative design solution, to homogenise the strength of the ground without extensive soil stabilisation, given consistently stiff / dense ground lies at ca. 5.0m bgl, it is recommended installing a network of controlled modulus columns to stiffen the ground. A load distribution mattress (comprised of SR21 compliant hardcore) should be installed to allow for construction of this network of columns. This cover will offer a foundation from which to develop the building floor / ground floor slab.

Water levels in well BH12 were dipped at ca. 1.0m / 79.50m OD in December 2022 which, although possibly generated from a deeper-seated water strike (at 2.20m), do present concerns for open excavations in the area. Any shallow excavations should be formed and backfilled once blinded to prevent water entry. A dig plan should aspire to immediate blinding on the same day. Inundation of excavations will see a subsequent softening and associated lowering of shear strengths. This could lead to unnecessary over-excavation.

Bedrock cores were recovered from 15.10m comprising strong to very strong LIMESTONE. The cover of overburden soils was reported (based on SPT N values) as being as being dense from 4.50m. Extension of bored piles to depth is another potential foundation solution which would deliver larger loadings via skin friction and ultimately, end bearing (at ca. 15.0m). A piling contractor should be consulted with regard to depth of pile embedment based on loadings required.

6.2.3 DC Bld 3

Geotechnical inconsistencies are once again present when the findings of the intrusive holes over the 'Building 3' footprint are considered. These are illustrated most succinctly in the blowcount pattern recovered from probes DP06, DP07 and DP08. Shallow obstructions were recorded in both DP07 and DP08 but low N_{100} blowcounts were obtained in DP06 to a depth of ca. 1.50m (Figure 30). Nearby TP02 reported firm sandy gravelly cobbly SILT to ca. 3.0m. The only deviation from this was the occurrence of a brownish grey gravelly clayey SAND from 0.80m to 1.0m. This may be the cause of the low blowcounts in DP06 to ca. 1.50m.

In light of this uncertainty, the additional SI undertaken in April / May 2023 saw trial pit TP/RO04 conducted a matter of metres away from DP06. This uncovered a 'soft to firm' stratum from 1.0m to 1.70m before encountering a sandy very clayey gravel at depth. This explains the blowcount pattern registered in DP06 where low N_{100} values were found in the clay, gradually increasing, and ultimately terminating in the underlying gravel. Nearby, rotary open-hole TPRO-04 did not intercept shallow dense gravels but rather firm becoming firm to stiff clay soils extending to ca. 3.50m (based on SPT N values). This suggests the gravel is variable in its spatial extent.

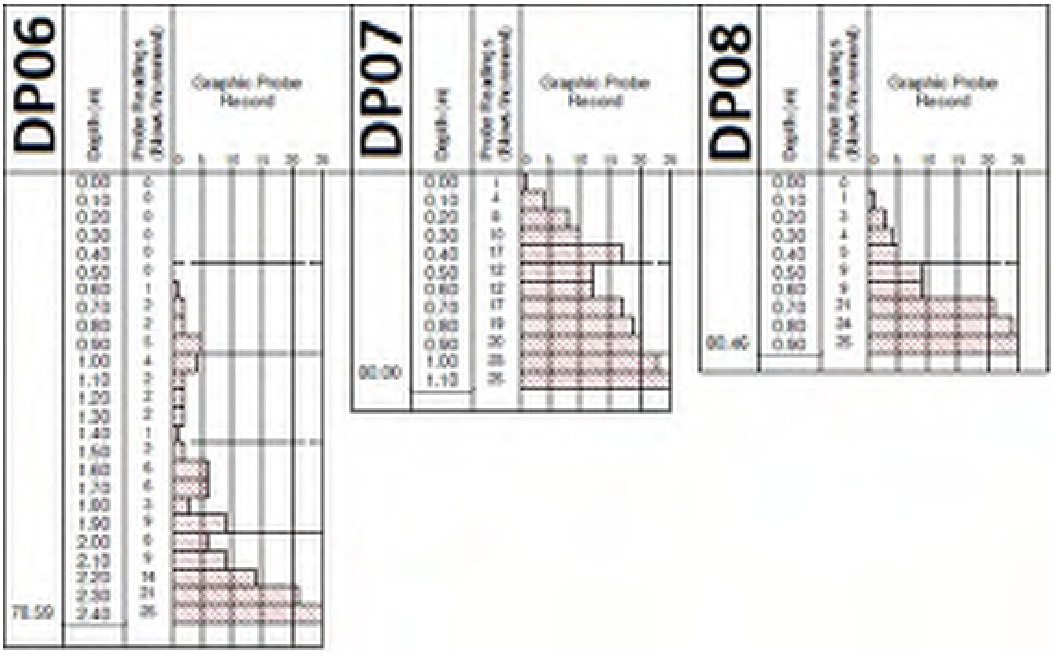
Elsewhere, BH01 and BH02 recorded SPT N-values at 1.0m indicative of lowerbound firm soils, with a slight improvement from 1.50-2.0m (See Figure 9). As with the other buildings, placing conventional footings on the upper soils could be considered. Given the disparity locally in stiffnesses, it is recommended that footings placed at depths of ca. 1.0m are assessed and approved by a competent engineering geologist / geotechnical engineer. Where deemed appropriate, plate load testing should be conducted to evaluate settlement under loading and stiffness (not ignoring the limited stress distribution by a plate load test). Positioning the pads at depths of ca. 1.0m should offer a safe or allowable bearing capacity of 100kPa bearing at best. Excavating to ca. 1.50m should see an increase in safe bearing pressure (up to 150Pa) but there will in all likelihood be areas of marked changes in soil type and these should be examined ahead of blinding.

The alternative to placing pads and strip footings in the upper soils would be to modify / stabilise the areal extent of the building thereby creating a uniform working platform in which to site pads and strip footings. Pads and trenches formed in stabilised fill should offer a bearing capacity of 250 to 300kPa.

As with Building 2, the operation of soil stripping and later modification with lime / lime-cement binder may see groundwater ingress during excavation / treated soil placement. The water levels dipped in July 2023 show elevations ranging by two metres, from 78m OD to 76m OD. The standpipe installed in TPRO-04 is likely to represent the local level (2.27m / 78.01m OD) given the pipework extends to 5.0m bgl. It equates approximately with a rapid ingress of water in gravels in nearby trial pit TP/RO04, intercepted at 1.80m bgl / 78.55m OD.

The use of piles to achieve greater bearing pressures would see bored piles extend to ca. 9.0m with limestone having been encountered at 8.80m (70.57m OD). Overlying bedrock in the area, a grey brown sandy silty clayey GRAVEL was reported which appears very dense from 3.0m bgl. A low SPT N value obtained at 1.50m (N=7) corroborates the presence of shallow soft soils in the area.

Figure 30 – Probes positioned in NW corner of DC Building 3



6.2.4 DC Bld 4

The 2023 investigation sited a trial pit TP/RO03 in the central area of proposed ‘Building 4’. The pit proved a firm CLAY to 2.30m at which point the dig was terminated due to instability. A seepage at 1.50m (80.09m OD) was followed by a rapid inflow of water at 2.0m. Both strikes were recorded in a ‘very gravelly CLAY’. Nearby rotary open-hole TPRO-03 suggested firm CLAY extends to at least 3.0m (SPT N values of 16 at both 1.50m and 3.0m bgl). CLAY was found to persist to the finish depth of 5.0m bgl. On the day of construction (02-05-23), the drillhole was reported dry. When dipped on 10-07-23, the well reported a water level of 1.49m (80.14m OD) equating to the seepage first registered in TP/RO03 at 1.50m bgl.

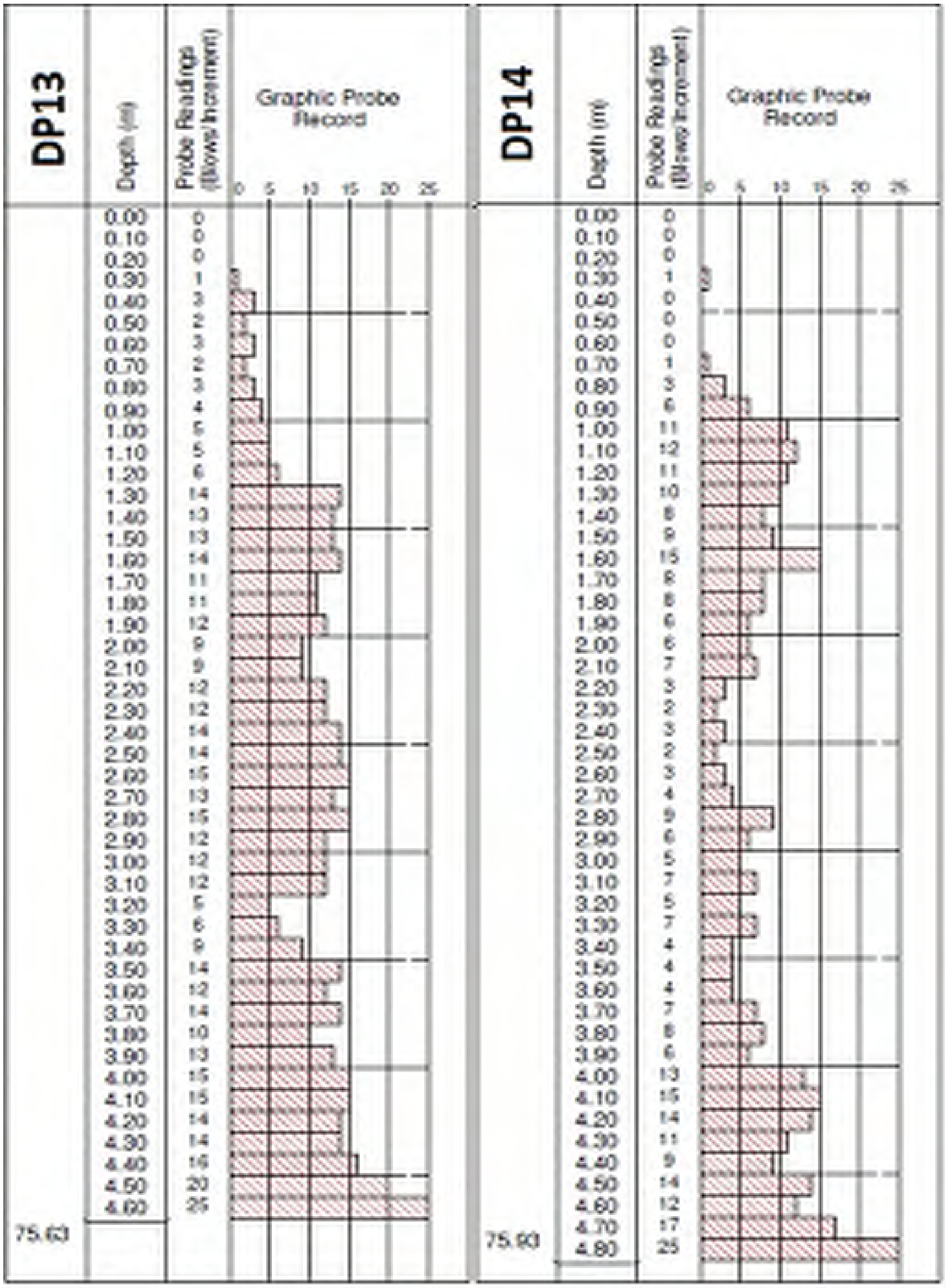
The original phase of investigation reported a firm to stiff and stiff dark and light brown CLAY from 1.20m to 2.80m in BH04. A slow water strike was recorded at 1.60m (79.46m OD). As with other boreholes in the area, BH09 registered firm soils to ca. 2.0 / 3.0m depth.

Aside from probes DP13 and DP14 located to the southeast of the proposed footprint, all other probes terminated at shallow levels generally shy of 1.60m bgl. These shallow refusals are thought attributable to increasing clast / gravel content in the till. The two probes which extended to depth (4.70m and 4.90m respectively) do not show an overly similar pattern in blowcounts (Figure 31). Given that locally pits reported the entry of gravel at depths between 2.0 to 2.30m bgl, the inconsistencies between probe N_{100} values are thought due to the heterogeneity of the gravel at depth interspersed occasionally with finer sand lenses. In contrast to SPT N values, probes DP13 and DP14 suggest dense / stiff soils from ca. 1.20m.

Given the variability in the area, allied with low SPT N values in boreholes indicative of firm / medium dense soils, a bearing capacity of 100kPa is recommended at c1.0m at Building 4. As with other buildings on the site, if greater load bearing capacities are required the use of excavate and replace and re-engineer the upper soils by stabilisation techniques could be used to produce a high strength engineered fill.

Alternatively, rotary open-hole drilling proved stiff soils from 4.0m (to 5.0m end depth). The use of CMC (controlled modulus columns) methods across the footprint to found into this stratum could be considered. The installation of piles (rockhead levels unproven in the area of Building 4) to support the column loads should be considered with capacity derived from skin friction and end bearing (rockhead at 8.80m in RC03 / ca. 15m in RC01A). It is not known what the spatial extent of calcite veinfill as found in RC01 / RC01A is and further rotary holes should be considered if piling is selected.

Figure 31 – DP13 & DP14 profiles - both located towards the southeast of Building 4



6.2.5 DC Bld 5

Borehole BH05, to the south of the newly positioned ‘Building 5’, reported initially firm soils to ca. 2.0m. Stiffer soils, based on SPT N-values, extended to end depths of 3.60m. BH06 achieved only 1.10m before termination and so it does not provide much information on local stratigraphy. Likewise, a number of probes (DP20, 24, 31) achieved only shallow depths terminating at 1.0m.

A number of probes extended to depths ranging ca. 3.50 – 5.20m bgl at this area. In these probes, an array of N_{100} patterns exist. Some show steady increase in blowcounts with depth, ie., DP21, whilst others suggest the presence of deeply buried, potential soft / low strength zones, ie., DP19 & DP28 (Figure 32).

In the more recent 2023 investigation, rotary open-hole ROTP-08 was conducted along with trial pit TP/RO08. The rotary open-hole, based on SPT N-values recorded firm soils to ca. 2.0m with stiff soils from 2.40m, becoming very stiff from 3.20m to a base depth of 5.0m. The pit, TP/RO08, also registered a firm CLAY to 2.90m, being stiff to very stiff from 2.90m to pit base at 3.30m. A gravel was identified in TP/RO08 from 1.30m to 1.50m and this may be relevant when considering the shallow termination depths in nearby probes. The water level in standpipe TPRO-08 was read at 1.22m bgl (July 2023). This relatively elevated level may be linked to the shallow buried gravel layer.

The low blowcounts in DP19 and DP28 may reflect potential soft or low strength zones where water softening may be a factor. Alternatively, the probes may infer the presence of fine sands and gravels which offer little point load resistance compared to more gravelly Silt and Clay soils above and below.

Both DP19 and DP28 are placed spatially in a linear trend where waterstrikes were encountered in both trial pits and boreholes (See Figure 27). If this were the case, this would imply the presence of water saturated, likely granular soils at depth and this may correspond to the low N_{100} interval.

The use of conventional strip and pad footings should see a bearing capacity of 125kPa achievable at c 1.0m depth. Where it is deemed that unsuitable / low strength soils are in place at this depth, the use of excavate and replace methods (i.e. lean mix concrete to underside of footings) is advised to deepen excavations locally.

As with other proposed buildings, soil stabilisation offers a technique to homogenise the strength of the upper soils. A stiff dark grey brown CLAY appears in

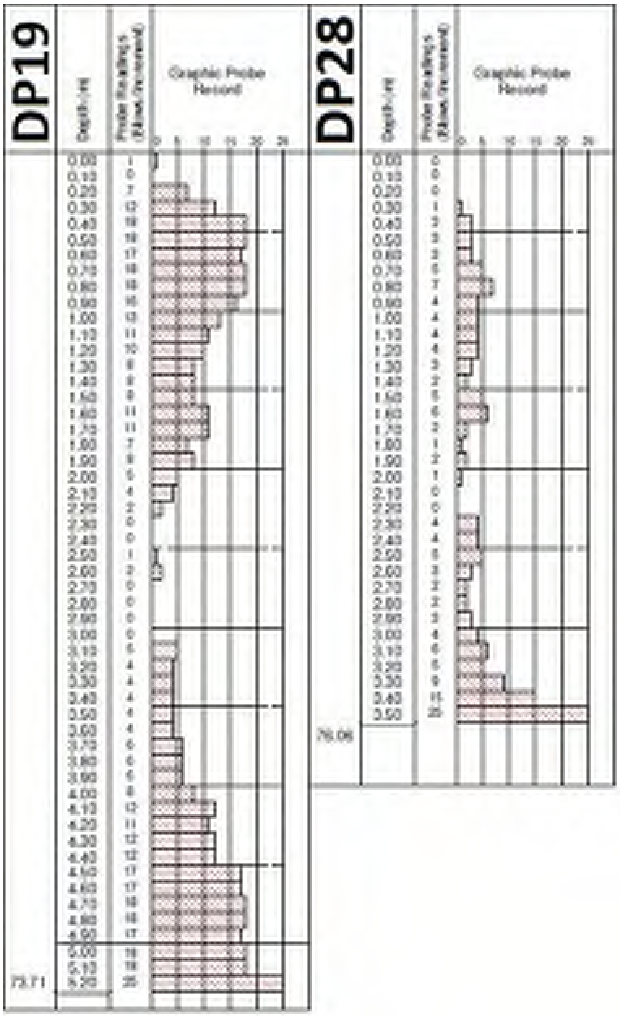


Figure 32 – DP19 and DP28 profiles

the deeper holes and pits (at ca. 3.0m) and this over-consolidated glacial till should provide a founding layer capable of offering ca. 200-250kPa. However, practical ways of founding on this layer would suggest use of shallow piles or CMC techniques to avoid excavation through water-saturated granular or low strength zones.

6.2.6 DC Bld 6

The disparity in soil stiffness observed between BH07 in the south and BH08 (2022 investigation) in the north underlines the variability in the soils underlying Building 6. Towards the south (the lowest topographical point on the site), soft soils were reported in BH07 to 1.70m (76.24m OD). Nearby probe DP25 reaffirms the possible soft nature of the upper stratum to a similar depth. However, DP26 shows no such softening. Instead, stiff / dense soils are reported from immediately below the topsoil. The potential softening in BH07 and DP25 is also reported at depth in both DP27 and DP28 where both probes registered their lowest probe N_{100} values in an interval from ca. 2.0m to 2.20m. Since this is roughly coincident with the water table, water softening or possible sand lenses may account for the low N_{100} values obtained. In any case, it would be advised to investigate further the soil type and strength at each of DP25, 27 and 28.

The presence of potentially soft / low strength soils to c 1.70m (BH07), coupled with the reported softening at 2.0m in some probe logs, implies shallow footings may not be suitable across the entire footprint without extensive excavation and replacement. Additionally, the higher water table could undermine shallow excavations where formed.

There is a 3m difference in levels between BH07 and BH08, from south to north. Ground Improvement (soil stabilization) could be adopted to produce a high strength engineered fill upon which the building could be sited. As outlined previously, this is a well proven method in achieving a significant improvement in strength and hence bearing capacity and would largely eliminate off-site disposal of low strength / unsuitable deposits. Utilising soil stabilisation would permit re-use of the site-won materials when forming an enhanced strength subgrade. A soil stabilised layer built off the underlying stiff soils should offer bearing capacities in the order of 250 to 300 kPa.

The alternative to employing soil stabilisation techniques would be to excavate and replace *en masse* the low strength soil and bring up with layers of imported granular fill (T0 to SR21 Annex E). The introduction of compacted gravel would provide a medium in which to found pads and strip footings at bearing capacities of ca.200kPa. This may not be practical on a large-scale basis given the likely excavation depths and volume of soil arisings generated and subsequent fill required.

6.2.7 GiS Sub

Trial pitting across the GiS Sub area reported firm onto stiff soils at 1.0m bgl. The stratum was logged as very sandy throughout. Probes constructed through the upper layer revealed negligible resistance with successive 0 and 1 blowcounts per 100mm (Figure 33). It is thought this is related to the sandy nature of the soil rather than highlighting a soft zone. Equally, boreholes BH13 and BH14 reported low SPT N-values indicative of loosened soils. A bearing capacity of 125kPa should be possible on the sandy clay soils at 1.0m based on visual observations in trial pits. Use of large diameter plate bearing tests at formation level will allow for better assessment of the density of the soils at 1.0m. Should larger capacities be required, it is likely the use of soil stabilisation measures would see an increase in the bearing pressures of 250 to 300 kPa.

Figure 33 – Probes positioned W to E across GiS Sub showing low N_{100} values for 1m bgl

6.3 Earthworks & Ground Improvement

To evaluate the re-use properties of the upper soils, a programme of earthworks laboratory testing was conducted. This comprised CBR, Moisture Condition Value (MCV) and Dry Density / Moisture Content relationship. Bulk samples were acquired from a selection of trial pits excavated across the site with testing initially conducted on the material at their natural or 'as-received' moisture contents. Earthworks testing was undertaken on those samples listed in Table 6. Their respective depth intervals and soil descriptions are shown in the aforementioned table.

Table 6 – Sample description of soils used in Earthworks testing – soil strength taken from TP logs

Exploratory Hole No.	Sample Depth	Sample Description
TP04*	0.60	('Firm') Brown slightly sandy slightly gravelly CLAY
TP12*	0.50	('Stiff') Brown slightly sandy slightly gravelly CLAY
TP13	1.0	("Firm") Grey/brown sandy gravelly SILT/CLAY
TP13	1.50	('Firm') Brown slightly sandy, slightly gravelly, CLAY
TP16	1.0	('Stiff') Mottled brown slightly sandy, slightly gravelly, CLAY
TP18	0.50	('Firm to stiff') Mottled brown sandy gravelly SILT/CLAY
TP19*	0.50	('Firm to stiff') Brown sandy gravelly SILT/CLAY
TP20	0.60	('Firm') Grey/brown sandy gravelly SILT/CLAY
TP21	0.50	('Firm') Brown sandy gravelly SILT/CLAY
TP22	0.60	('Firm') Brown sandy gravelly SILT/CLAY
TP24	0.60	('Firm to stiff') Brown sandy gravelly SILT/CLAY
TP26*	0.50	('Firm') Brown slightly sandy, slightly gravelly, CLAY
TP28	0.70	('Firm') Mottled brown slightly sandy, slightly gravelly, CLAY
TP29	0.50	('Firm') Brown sandy gravelly SILT/CLAY
TP31*	0.50	('Firm') Brown slightly sandy slightly gravelly CLAY
TP33	0.60	('Firm') Brown slightly sandy, slightly gravelly, CLAY
TP34	0.60	('Firm') Brown sandy gravelly CLAY

*Soil samples subject to1% Lime addition, 1% lime / 2% cement addition & 3% lime addition

The samples, ahead of being subject to reusability testing, each have their >20mm fraction removed. This, in the case of the CLAY and SILT/CLAY soils, removed 2.7 to 14% of the 'as received' soil sample.

The resultant earthworks testing (on natural 'as-received' samples) produced laboratory CBR results in the range 0.5 to 48% with MCV's of 0.2 to 12.7. Moisture contents ranged from 9.2 to 26%. Maximum dry densities were proven to range between 1.76 and 2.01mg/m^3 at optimum moisture contents of 8% to 14% (refer to Table 7).

Table 7 - Summary Details of Laboratory Testing samples

Hole No.	**Depth**	**Lab CBR Value %** (Moisture Content %)	**MCV at Natural Moisture Content** (Moisture Content %)	**Dry Density / Moisture Content Relationship**
TP04*	0.60	1.9 (15)	4.6 (13)	Max Dry Density = 1.93mg/m^3 at 9% OMC
TP12*	0.50	2.1 (17)	6.0 (13)	Max Dry Density = 1.87mg/m^3 at 11% OMC
TP13	1.0	1.6 (13)	8.8 (12)	-
TP15	1.50	1.5 (13)	7.1 (13)	Max Dry Density = 1.99mg/m^3 at 10% OMC
TP16	1.0	0.5 (14)	0.2 (14)	Max Dry Density = 2.01mg/m^3 at 8% OMC
TP18	0.50	48 (10)	12.3 (9.2)	-
TP19*	0.50	8 (13)	8.2 (13)	Max Dry Density = 1.94mg/m^3 at 11% OMC
TP20	0.60	-	2.4 (18)	-
TP20	1.0	0.6 (19)	-	-
TP21	0.50	1.6 (20)	7.6 (20)	-
TP22	0.60	1.1 (20)	5.7 (20)	Max Dry Density = 1.80mg/m^3 at 14% OMC
TP24	0.60	47 (13)	11.2 (14)	-
TP26*	0.50	1.0 (13)	6.4 (14)	Max Dry Density = 1.96mg/m^3 at 10% OMC
TP28	0.70	0.5 (26)	2.8 (25)	Max Dry Density = 1.76mg/m^3 at 14% OMC
TP29	0.50	42 (9.2)	16 (9.9)	-
TP31*	0.50	7.4 (13)	12.7 (11)	Max Dry Density = 1.96mg/m^3 at 9% OMC

Following this initial classification, trial mixes were carried out to evaluate the performance of the soils following the addition of lime and lime / cement binders. Once mixed with the binder, the samples were then subjected to further Moisture Condition Value (MCV) and soaked CBR tests at designated time intervals. The MCV tests were conducted after mixing and air curing for one hour with soaked CBR tests following curing for 3, 5 and 7 days respectively. Tables 8 and 9 provide a summary of the laboratory test results on samples which, for comparative purposes, are presented with and without the lime and lime / cement addition.

Table 8 – Moisture Condition Value [MCV] at natural moisture content for overburden soil samples and MCV at varying % lime and % lime / cement content

Exploratory Hole No.	**Sample Depth Range**	**MCV** (Moisture Content %)			
		Initial MCV (MC %)	**1% Lime MCV** (MC %)	**1% Lime / 2% Cement MCV** (MC %)	**3% Lime MCV (MC %)**
TP04	0.60m	4.6 (13)	7.2 (10)	8.6 (14)	13.6 (11)
TP12	0.50m	6.0 (13)	8.0 (13)	8.9 (14)	11.7 (12)
TP19	0.50m	8.2 (13)	11.2 (13)	11.5 (12)	12.9 (12)
TP26	0.50m	6.4 (14)	8.4 (11)	9.8 (12)	11.9 (12)
TP31	0.50m	12.7 (11)	15.4 (9.5)	15.4 (10)	16.1 (9.2)

In classification testing, moisture contents for the natural soils examined were found to range from 6.5 to 19% (aside from some outliers) with those samples selected for reusability testing ranging from 12 to 18%. Optimum MCV and dry density values were obtained over a similar range of moisture contents (between 8 and 14%). The addition of lime / cement binder is seen to raise the MCV value since hydration further reduces moisture content. MCV testing shows effective improvement with lime addition. However, there are samples where the MCV value becomes dry of optimum suggesting optimum MCV results are achieved with a 1% lime admixture.

Table 9 – Summary of CBR Tests at NMC and with addition of Lime / Lime-Cement Binders

Exploratory Hole No.	**Sample Depth**	**CBR % Value**												
		Initial Unsoaked (Natural state)	1% Lime			2% Lime			3% Lime			1% Lime / 2% Cement		
			3-Day Soaked	5-Day Soaked	7-Day Soaked	3-Day Soaked	5-Day Soaked	7-Day Soaked	3-Day Soaked	5-Day Soaked	7-Day Soaked	3-Day Soaked	5-Day Soaked	7-Day Soaked
TP04	0.60m	1.9	11	34	49	34	41	42	31	52	61	41	67	90
TP12	0.50m	2.1	7.4	14.6	20.4	12	24	36	29	40	48	39	40	53
TP19	0.50m	8	14	24	37	39	55	60	39	77	86	74	82	122
TP26	0.50m	1.0	13	21	32	35	46	53	58	69	63	58	83	95
TP31	0.50m	7.4	7.6	19	37	41	41	63	35	50	62	46	74	95

There trial testing shows an incremental increase in strength over the CBR test duration. Clearly there is a distinct improvement with treatment using higher percentage lime and with the combined lime and cement binder. Values appear to level off with little divide noted in CBR values for treated soils by the 7-day period whether there was a 2% or 3% lime admixture added. A marked increase in CBR results was noted where cement (2%) was combined with lime (1%) being even more pronounced when allowed cure for 7 days compared with 5 days.

There is a marked heterogeneity in the uppermost soils on site. There are instances in the same pit where the CLAY subsoils are remarked as firm to stiff (BRE SA06 0.65-1.40m) with deeper soils logged as 'soft to firm' (1.40-2.25m). The use of binder will obviously improve those areas where lower strength compressible soils are encountered and will serve to elevate the already positive performance of the more firm / stiff soils. The investigation did not indicate a consistent pattern of soil strengths across the site. The various SPT plots drafted for the site (See Figures 6, 9, 10, 16, 18, 22) do suggest that the upper 2m to 3m of soil could be classed as generally firm, occasionally soft to firm as well as variably firm to stiff.

Therefore, in certain localised areas, without reworking / drying or modification with lime (calcium oxide), the natural, uppermost, surficial fine-grained soft to firm and occasionally soft soil would be unsuitable for re-use as a sub-structure formation. However, it is clear that the addition of binders, in its varying concentrations, will produce an acceptable sub-formation layer (high strength Class 2 engineered fill with an MCV 8 to 15). Soil stabilisation may also be relevant to the overall development of this gently sloping site, particularly if cut and fill operations are envisaged.

It is vital that during the soil stabilization process if chosen, that any stockpiles are graded and shaped so that surface water cannot collect or pond. Similarly, careful control of excavation, transporting, stockpiling, placing and compaction is advised to ensure that degradation of the shallow soil deposits does not occur. This is extremely important as poor earthworks management would render the fine soils as unsuitable for re-use.

Chemical analysis tests to measure sulphate and sulphur contents to BRESD1 were scheduled on the lime treated CBR samples (after 7 days curing). The results on the samples tested from TP04, TP26, TP19, TP12 & TP31 show negligible concentrations of water soluble sulphate, acid soluble sulphate and total sulphur (See Appendix 12) demonstrating no adverse reaction with lime.

If the design makes provision for ground improvement or soil stabilization methods, then a field demonstration trial (footprint of c. 10 x 10m) is advised to assess the performance of the modified soils with lime or lime / cement binders. This would allow for in-situ testing (plate load, nuclear gauge, sand replacement and CBR mould samples) to measure CBR / stiffness, relative compaction (percentage degree of compaction) and air voids.

6.4 Groundwater / Infiltration

As noted in Section 5.3, during the 2022 investigation, groundwater strikes were generally restricted to areas towards the southern half of the site (south of the existing farmyard). The construction of shallow monitoring wells throughout the site, augmented by the completion of further pits in April / May 2023, highlighted the occurrence of water in gravelly CLAY and GRAVEL layers in the northern half of the site between 1.50-2.80m bgl. Possible softened layers ('Soft to firm') were also documented in pits TP/RO06 and TP/RO07 coincident with water seepages and rapid ingress. Rotary open-holes 05, 06 and 07, which remained dry during their construction, were later found to have water levels between 2.43 to 3.79m bgl (between 80.43-81.27m OD) when dipped in July 2023.

A plan of the pits and boreholes where water strikes were encountered during the 2022 investigation is shown in Figure 27. The influence local topography has on the occurrence of groundwater strikes is clearly demonstrated in 'Area 3'. Strikes were intercepted generally in buried sandy GRAVEL soils at depths in the region 2.0m bgl in the trial pits and from 2.0m to 3.0m in boreholes. In boreholes, it was frequently noted that after a twenty-minute observation period, the strikes rose appreciably.

In 'Area 1', a water seepage, the shallowest noted on the project, was noted in BRE SA04 at 0.70m towards the southernmost field boundary. Rotary open hole TPRO-09 identified peat to 1.20m in this relatively low-lying area. The standpipe in TPRO-09 was dipped at 0.64m bgl (76.67m OD) in July 2023.

Given the depths where groundwater strikes were reported, ingress in shallow foundation excavation should be anticipated in certain areas of the site. However, it is generally regarded as unlikely, with the water sitting in deeper-seated Gravel. Should localised seepages occur, they should be readily controlled by sump pumping. Should water-bearing sandy deposits be encountered, pumping in these deposits will serve to remove sand-sized grains and may de-stabilise areas where wash-out occurs. This should be noted in any risk assessment developed for dewatering deep digs / service trenches.

As mentioned in Section 5.3 and evidenced in water monitoring, the potential exists for seasonal changes in groundwater levels. The works were mainly carried out during October 2022. It may be the case that the various waterbodies at depth are subject to seasonal variations. Further monitoring will assist in this matter.

Discounting the potentially erroneous results obtained from the April / May 2023 tests, fourteen soakaway tests were conducted on the site (See Table 10). A second shallow soakaway test (SA05B) was conducted at location SA05 following interception of water in SA05A at 1.70m bgl. The remaining soak pits were found to be devoid of groundwater. A test failure (no or negligible infiltration) was recorded in tests conducted in soak pits SA01, SA03 and SA08. These results are thought typical of largely impermeable fine glacial till material. Such soils would not be suitable for conventional soakaways offering only low or very limited natural infiltration.

Similarly, the infiltration rates where water did permeate through sidewalls were generally measured at -06E and -07E m/sec typical of sandy silts, very silty fine sands and laminated or mixed strata of silts/sand/clay. Permeability classification would be low to very low in these cases.

Table 10 – Measured infiltration rates (f) expressed as exposed area (metre) per unit time (minute)

Soakaway Test No.	**Depth of Test (m bgl)**	**Infiltration Rate *f*** (m/min)	**Infiltration Rate *f*** (m/sec)
SA01	1.60	0 m/min	0 m/sec
SA02	1.50	0.00015 m/min	2.441E-06 m/sec
SA03	1.80	0 m/min	0 m/sec
SA04	2.10	5.2E-05 m/min	8.591E-07 m/sec
SA05A	1.70	0.0005 m/min	8.333E-06 m/sec
SA05B	1.20 (Cycle 1)	0.00057 m/min	9.47E-06 m/sec
	1.20 (Cycle 2)	0.00041 m/min	6.887E-06 m/sec
SA06	2.0 (Cycle 1)	0.00029 m/min	4.851E-06 m/sec
	2.0 (Cycle 2)	0.00021 m/min	3.467E-06 m/sec
SA07	2.20	9.6E-05 m/min	1.603E-06 m/sec
SA08	2.10	0 m/min	0 m/sec
SA09	2.0 (Cycle 1)	0.00025 m/min	4.212E-06 m/sec
	2.0 (Cycle 2)	0.00016 m/min	2.718E-06 m/sec
SA10	1.60	0.000207039 m/min	3.451E-06 m/sec
SA11	1.80	8.46561E-05 m/min	1.411E-06 m/sec
SA12	2.20	0.0003 m/min	5.002E-06 m/sec
	2.20	0.00024 m/min	3.961E-06 m/sec
SA13	1.60	0.00022 m/min	3.59E-06 m/sec

6.5 Slopes / Batters

A maximum slope angle of 1V to 1.5H (33°) is recommended for temporary batters constructed within the upper medium to low strength fine grained soils. A long-term slope angle of 1V to 2H (26°) should be appropriate for batters in the same soils. Where deep excavation works are required in the superficial deposits, the use of trench box support is advised especially given the instability noted at depth in some of the trial pits, moreso upon encountering groundwater. In addition, the uppermost fine subsoils will be susceptible to softening and degradation and surface water or groundwater ingress can lead to a significant reduction in shear strength. Perched water can exist locally in isolated sand lenses and this should be considered in risk assessments for excavations.

Site operatives or personnel should not enter unsupported excavations and should be informed of potential risks. Where site operatives or engineering staff work in close proximity to temporary slopes or batters, these should be inspected and approved by a suitably experienced civil engineer, preferably with geotechnical experience. Where there is a risk of spalling of battered slopes, the use of a geogrid is recommended. The geogrid should be anchored at the top and bottom of the ridge face to contain particles such as gravel, cobbles and / or boulders that may become dislodged.

6.6 Pavement Construction

Twenty-three plate load tests were conducted on the shallow subsoil at depths ranging 0.40m bgl to 0.60m bgl. The plate load test permits an assessment of the in-situ stiffness of the upper soil. The test results are reported in Appendix 4 and summarised below in Table 11. The equivalent CBR values range from 0.1 to 3.5% on the initial load cycle (Cycle 1) and 0.2 to 18.9% on the reload cycle (Cycle 2).

Table 11 – Equivalent CBR % Values obtained in Plate Bearing Testing

Test No.	Depth	CBR at Load Cycle (%)	CBR at Re-Load (%)
PB 01	0.60	0.3	4.7
PB 02	0.60	0.3	0.8
PB 03	0.50	0.6	3.2
PB 04	0.40	0.1	2.2
PB 05	0.40	3.5	15.9
PB 06	0.40	0.3	3.8
PB 07	0.60	0.5	1.5
PB 08	0.50	0.2	0.8
PB 09	0.40	2.0	7.1
PB 10	0.50	2.7	3.0
PB 11	0.50	0.2	1.1
PB 12	0.50	0.2	0.7
PB 13	0.50	0.3	0.3
PB 14	0.40	0.2	0.3
PB 15	0.50	0.6	0.6
PB 16	0.60	0.2	0.6
PB 17	0.40	0.7	2.4
PB 18	0.50	0.2	0.7
PB 19	0.60	0.3	0.8
PB 20	0.40	1.5	8.3
PB 21	0.40	0.7	6.4
PB 22	0.50	2.4	18.9
PB 23	0.50	0.9	1.9

The majority of plate test results indicate extremely low CBR values (0.1 – 1.0%). For the most part, the plate tests were conducted on a sub-topsoil layer which was described as very sandy, potentially loose. There were areas where topsoil was reported as 0.50m thick (TP28) but generally 0.40m thick and so some plate tests may have been performed on a contact between lowerbound topsoil and upperbound loose subsoil. Often no appreciable increase is noted between load and reload cycle implying no effectual increase in density with compaction. Where such a combination of results was obtained, the installation of a thickened sub-formation layer will be required.

There were instances of higher load and reload values, namely at PB05, PB09 and PB22. It is thought that these soils may have been stiffer and more gravelly in composition. In such cases, significant increases were observed between the initial load cycle and the following reload cycle. This infers room for gain with static pre-rolling.

Overall, a CBR design value of 1% should be adopted for the near surface soils in their current state. Ahead of road construction, and following compaction of the soils, a further set of plate testing (450 or 600mm diameter) could be undertaken to assess the improvement in stiffness of the formation. Given the negligible improvement seen in many tests (from load to reload), if the same test levels are again adopted it is unlikely that a significant improvement will be achieved.

In their current state, either geogrid reinforcement or the use of starter material (Class 6A / 6B) should be considered to provide a suitable foundation layer especially for access or haul / spine roads. Such a mechanically stabilized layer would be expected to consist of at least 1 layer of geogrid with 500 to 600mm of granular fill (well graded aggregate, possibly T1). Where geogrid is not utilized then approximately 500mm build-up of Class 6A / 6B starter layer material could be considered in conjunction with c300mm thick capping layer (Class 6F capping in line with Series 600 of TII SRW). This should provide a satisfactory foundation layer to adequately support the pavement.

During construction, it is important that the subgrade is not allowed to deteriorate if exposed to surface water. Locally the capping layer thickness may need to be increased if pockets or zones of lower strength formation areas are encountered. The time of year will play a role in subgrade strength especially during winter or early Spring where heavy rainfall would cause degradation of the formation. If there are particular concerns regarding the condition of the formation soils, then additional plate bearing tests should be considered during construction to verify or validate the stiffness / density of the formation soils and adequate capping thickness.

In addition, the durability of the capping material should be confirmed as capping will be exposed to the elements (especially if the works are undertaken during the winter / spring period). It is important that argillaceous sedimentary rocks (i.e. muddy limestone, calcareous mudstone, shale, etc.) are not used as capping or as a starter layer. These have high potential to give rise to degradation (i.e. poor durability and soundness) and slaking and therefore would not be suitable. All granular fills used in pavement construction should be tested and approved in advance of being used in the pavement construction.

Should soil stabilisation methods be used on site, significantly increased CBR values should be achievable on near surface soils upon the addition of lime and lime-cement binders. This may prove to be a useful method in re-using the soils on site without importation of granular material. If soil stabilisation with lime/cement is envisaged, additional plate load tests (450 or 600mm diameter) would be prudent during construction operations to verify or validate the improvement in stiffness of the formation prior to construction of the base course layer.

6.7 Buried Concrete

The chemical analysis tests on natural soil samples show pH (2.5:1) values range from 8.2 to 8.7. The sulphate aqueous extract (SO_4) results from shallow trial pit soil samples and from borehole samples produced values of <10mg/l. This would suggest the 'as-received' soil samples tested could be categorised as BRE Class DS-1. Table C1 ACEC for greenfield sites in BRE SD 1 (2005) can be used in the selection and design of concrete. If mobile groundwater conditions prevail at the site and given the pH values obtained from the testing, then ACEC class AC-1^d would be expected to be appropriate for buried concrete in the soils. In line with I.S. EN 206-1:2013, concrete could be manufactured to Class XA1 where founded or positioned in the upper soils (Class XA1 being ≥ 2000 and ≤ 3000 SO_4^{2-} mg/kg).

6.8 Ground Gas

Peak Carbon dioxide gas levels recorded on site were found to measure 0.6% to 2.3%. No detectable methane gas, carbon monoxide nor hydrogen sulphide were found in any of the four wells. Peak flow rates measured 0.1l/hr implying negligible generation within the individual wells. The gas measurements are presented in Appendix 8.

An RSK Group report commissioned by the National House-Building Council (NHBC) entitled 'Guidance on Evaluation of Development Proposals on Sites Where Methane and Carbon Dioxide are Present' (2007) offers some explanation for the derivation of carbon dioxide. Carbon dioxide gas is known to have both anthropogenic and natural sources. In relation to generation from anthropogenic sources, the decomposition of organic material results in the production of methane and carbon dioxide in approximately equal proportions. As equivalent methane levels were not recorded on site, it is unlikely that the CO_2 levels were generated from the decomposition of organic-containing waste materials – in any case, none were found on site during pitting or boring. Likewise, the potential for carbon dioxide to be generated naturally from the underlying limestone bedrock can be discounted since the wells are all shallow.

Offering a potential reason for the carbon dioxide levels, the report (NHBC, 2007) states that;

> *'the drilling and installation of monitoring wells will introduce artificially high concentrations of oxygen into the ground, which will cause aerobic conditions to develop. Biological micro-organisms in the ground that thrive in such conditions will not generate methane, although they will generate carbon dioxide. Any trace amounts of methane generated would typically be expected to be readily oxidised. As the microorganisms consume the oxygen, the ground conditions will revert back from aerobic to anaerobic (oxygen deficient) '*

This would suggest that the increased carbon dioxide levels measured in December 2022 are likely the result of temporary fluctuations in the overall background concentration rates. It would also imply that further monitoring would eventually see a return to original background levels once the anaerobic conditions became re-established.

6.9 Environmental Testing - Water

Environmental analysis was conducted on five water samples. Three samples were bailed from installed monitoring wells, BH03, BH12 and BH13. Well samples were acquired only after having first developing each installation. Two additional samples were acquired from the stream at its eastern entry point ('Stream Start') and at the point where its course leaves the site, towards the western end ('Stream End'). Results from analysis have been compared to standards outlined in the EPA publication *Towards Setting Guideline Values for the Protection of Groundwater in Ireland Interim Report*, EPA 2003 (EPA IGV) and to the *European Communities Environmental Objectives (Groundwater) Regulations, 2010* (S.I. No. 9 of 2010) (See Table 14). Lastly, where trigger values were not available, results have been compared to standards outlined in the fourth edition of the World Health Organization's (WHO) *Guidelines for drinking-water quality* (GDWQ) (2017).

No hydrocarbon contamination was detected in the samples. Table 12 shows the instances where exceedances were recorded. The universal Total Hardness exceedances may be reflective of the calcium carbonate limestone bedrock upon which the soils overlie.

Table 12 – Elevated values (Water Analysis compared to EPA Interim Guideline Values & S.I. No.9 of 2010)

Parameter	Stream Start (East)	Stream End (West)	BH03	BH12	BH13	Environmental Guideline Source [EPA IGV]
Total Hardness as $CaCo_3$	360	360	230	360	270	200 mg/l
Manganese (Dissolved)	0.57	0.58	450	170	1.3	50 µg/l

6.10 Waste Acceptance Criteria [WAC] & Environmental Testing

Environmental soil samples were taken across a range of depths from trial pits. Samples were analysed for their compliance to the criteria set out in the 2002 European Council Decision (2003/33/EC). O'Callaghan Moran & Associates have conducted a waste characterisation assessment of the samples in accordance with the Environmental Protection Agency (EPA) Guidelines on the Classification of Waste (2015). This report, together with conclusions and recommendations, is presented in Appendix 13.

REFERENCES

1.0 BS 5930 (2015+A1:2020) Code of Practice for Site Investigation, British Standards Institution (BSI).

2.0 BS 1377 (1990) Methods of Testing of Soils for Civil Engineering Purposes, BSI.

3.0 Eurocode 7, Part 2: Ground Investigation & Testing (EN 1997-2:2007)

4.0 Irish Standard IS 888:2016, NSAI (Published in March 2016)

5.0 National House-Building Council [NHBC] (2007). Guidance on Evaluation of Development Proposals on Sites Where Methane and Carbon Dioxide are Present. Report No. 10627-R01(04). NHBC and RSK Group.

6.0 Site Investigation Practice: Assessing BS 5930 (1986), Geological Society Special Publication, No. 2.

7.0 Sowers, G.F. (1962) Shallow Foundations, Foundation Engineering, McGraw Hill

8.0 SR21:2014+A1:2016 Guidance on the use of IS EN 13242+A1:2007

9.0 Terzaghi, K., Peck, R.B., & Mesri, G. (1996). Soil Mechanics in Engineering, 3rd Edition. New York, Wiley.

10.0 Tomlinson, M.J. Pile Design & Construction Practice, 4th Edition

11.0 Site Investigation Practice: Assessing BS 5930 (1986), Geological Society Special Publication, No. 2.

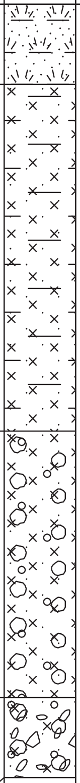
Appendix 1

Trial Pit Logs and Photographs

TRIAL PIT RECORD

REPORT NUMBER 24330

CONTRACT	Halverstown	**TRIAL PIT NO.**	**TP01**
		SHEET	Sheet 1 of 1
LOGGED BY	MB	**DATE STARTED**	18/10/2022
CO-ORDINATES	686,064.74 E 719,680.12 N	**DATE COMPLETED**	18/10/2022
GROUND LEVEL (m)	79.63	**EXCAVATION METHOD**	7t Hitachi
CLIENT			
ENGINEER	DOBA		



	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples: Sample Ref	Samples: Type	Samples: Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0	TOPSOIL: Soft brown slightly gravelly sandy CLAY. Sand is fine to coarse. Gravel is fine to medium subrounded.									
1.0	Firm grey very sandy slightly clayey SILT. Sand is fine to medium		0.30	79.33		AA186957	B	0.50-0.60	38 42 34 45 56 59	
2.0	Firm brown very sandy very gravelly SILT with pockets of yellow fine sand and medium cobbles. Sand is fine to coarse. Gravel is fine to coarse subrounded.Cobbles are subrounded to rounded of limestone.		1.60	78.03		AA186958	B	1.60-1.70		
	Brown silty sandy GRAVEL with a medium cobble content. Sand is fine to coarse. Gravel is fine to coarse subrounded.Cobbles are subrounded to rounded of limestone.		2.60	77.03		AA186959	B	2.60-2.70		
3.0	End of Trial Pit at 2.90m		2.90	76.73	1 (Seepage)					

Groundwater Conditions
Seepage at 2.90m

Stability
Slightly unstable from 1.60m

General Remarks
Pit footprint scanned using cable avoidance tool [CAT]. Shear vanes (set of three) carried out at both 0.30m & 0.50m bgl. Vane attempted at 0.70m - too gravelly. Pit backfilled with arisings.

TRIAL PIT RECORD

REPORT NUMBER 24330

CONTRACT Halverstown

TRIAL PIT NO. TP02

SHEET Sheet 1 of 1

LOGGED BY MB

CO-ORDINATES 686,127.58 E
719,725.08 N

DATE STARTED 18/10/2022

DATE COMPLETED 18/10/2022

GROUND LEVEL (m) 81.08

CLIENT

ENGINEER DOBA

EXCAVATION METHOD 7t Hitachi

	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples			Vane Test (KPa)	Hand Penetrometer (KPa)
						Sample Ref	Type	Depth		
0.0	TOPSOIL: Soft brown slightly gravelly sandy CLAY. Sand is fine to coarse. Gravel is fine to medium subrounded.		0.20	80.88						
	Firm brown sandy gravelly CLAY with a low cobble content. Sand is fine to coarse. Gravel is fine to coarse subrounded.Cobbles are subrounded to rounded of limestone.		0.80	80.28		AA181997 AA181998	B B	0.50-0.50 0.70-0.70	38 42 32	
1.0	Brownish grey gravelly clayey SAND. Sand is fine to medium. Gravel is fine to coarse subangular to subrounded. 0.80-0.90m Fine to medium sand lens		1.00	80.08						
2.0	Firm brown sandy gravelly SILT with a medium cobble content. Sand is fine to coarse. Gravel is fine to coarse subrounded.Cobbles are subrounded to rounded of limestone.		3.00	78.08		AA181999 AA181200	B B	1.70-1.70 2.60-2.60		
3.0	End of Trial Pit at 3.00m									

Groundwater Conditions
Dry

Stability
Good

General Remarks
Pit footprint scanned using cable avoidance tool [CAT]. Shear vane (set of three) carried out at 0.30m bgl. Vane attempted at 0.50m - too gravelly. Pit backfilled with arisings.

TRIAL PIT RECORD

REPORT NUMBER 24330

CONTRACT	Halverstown	**TRIAL PIT NO.**	**TP03**
		SHEET	Sheet 1 of 1
LOGGED BY	MB	**DATE STARTED**	18/10/2022
CO-ORDINATES	686,128.56 E 719,683.63 N	**DATE COMPLETED**	18/10/2022
GROUND LEVEL (m)	80.45	**EXCAVATION METHOD**	7t Hitachi
CLIENT			
ENGINEER	DOBA		

	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples			Vane Test (KPa)	Hand Penetrometer (KPa)
						Sample Ref	Type	Depth		
0.0	TOPSOIL: Soft brown slightly gravelly sandy CLAY. Sand is fine to coarse. Gravel is fine to medium subrounded.		0.30	80.15						
	Brownish grey slightly gravelly silty SAND. Sand is fine to medium. Gravel is fine to coarse subangular to subrounded.		0.80	79.65		AA186953	B	0.50-0.60	39 31 34	
1.0	Stiff grey mottled orange sandy gravelly SILT. Sand is fine to medium. Gravel is fine to coarse subangular to subrounded.		1.80	78.65		AA186954	B	1.20-1.20		
2.0	Firm to stiff brown sandy gravelly clayey SILT with a medium cobble content. Sand is fine to coarse. Gravel is fine to coarse subrounded.Cobbles are subrounded to rounded of limestone.		2.20	78.25		AA186955	B	1.80-1.80		
	Brownish grey very gravelly silty SAND with medium cobbles and ocassional boulders. Sand is fine to medium. Gravel is fine to coarse subangular to subrounded.Cobbles and boulders are subrounded to rounded of limestone.		2.90	77.55		AA186956	B	2.50-2.60		
3.0	End of Trial Pit at 2.90m									

Groundwater Conditions
Dry

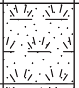
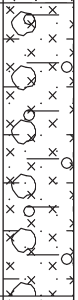
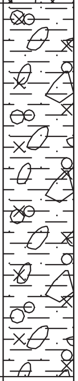
Stability
Slightly unstable from 2.20m

General Remarks
Pit footprint scanned using cable avoidance tool [CAT]. Shear vane (set of three) carried out at 0.30m bgl. Pit backfilled with arisings.

TRIAL PIT RECORD

REPORT NUMBER 24330

CONTRACT	Halverstown	**TRIAL PIT NO.**	**TP04**
		SHEET	Sheet 1 of 1
LOGGED BY	MB	**DATE STARTED**	19/10/2022
CO-ORDINATES	686,151.77 E 719,626.13 N	**DATE COMPLETED**	19/10/2022
GROUND LEVEL (m)	79.83	**EXCAVATION METHOD**	7t Hitachi
CLIENT			
ENGINEER	DOBA		

	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples: Sample Ref	Samples: Type	Samples: Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0	TOPSOIL: Soft brown slightly gravelly sandy CLAY. Sand is fine to coarse. Gravel is fine to medium subrounded.		0.30	79.53						
1.0	Firm brown sandy gravelly SILT with a low cobble content. Sand is fine to coarse. Gravel is fine to coarse subrounded.Cobbles are subrounded to rounded of limestone.		1.40	78.43		AA186982	B	0.60-0.60	45 50 43 67 68 71 78 82 84	
2.0	Firm brown sandy gravelly silty CLAY with a medium cobble content and occassional boulders. Sand is fine to coarse. Gravel is fine to coarse subrounded.Cobbles and boulders are subrounded to rounded of limestone.		2.80	77.03		AA186983 AA186984	B B	1.50-1.60 2.60-2.70		
3.0	End of Trial Pit at 2.80m									

Groundwater Conditions
Dry

Stability
Good

General Remarks
Pit footprint scanned using cable avoidance tool [CAT]. Shear vanes (set of three) carried out at 0.30m, 0.50m and 0.70m bgl. Pit backfilled with arisings.

TRIAL PIT RECORD

REPORT NUMBER 24330

CONTRACT Halverstown

TRIAL PIT NO. **TP05**

SHEET Sheet 1 of 1

LOGGED BY MB

CO-ORDINATES 686,195.58 E
719,693.69 N

GROUND LEVEL (m) 80.91

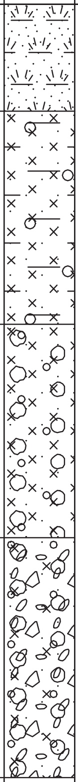
DATE STARTED 18/10/2022

DATE COMPLETED 18/10/2022

CLIENT

ENGINEER DOBA

EXCAVATION METHOD 7t Hitachi



	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples: Sample Ref	Samples: Type	Samples: Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0	TOPSOIL: Soft brown slightly gravelly sandy CLAY. Sand is fine to coarse. Gravel is fine to medium subrounded.		0.40	80.51						
1.0	Firm brownish grey slightly clayey sandy gravelly SILT. Sand is fine to coarse. Gravel is fine to coarse subrounded		1.20	79.71		AA186960	B	0.50-0.60	32 38 35 65 72 76	
	Firm brown sandy gravelly SILT with a medium cobble content and occassional boulders. Sand is fine to coarse. Gravel is fine to coarse subrounded.Cobbles and boulders are subrounded to rounded of limestone. Boulder at 1.80m (up to 1200mm)		2.00	78.91		AA186961	B	1.50-1.60		
2.0	Brown silty sandy GRAVEL with a medium cobble content. Sand is fine to coarse. Gravel is fine to coarse subrounded.Cobbles are subrounded to rounded of limestone. Sidewall collapse at 2.0m		2.90	78.01	1 (Seepage)	AA186962	B	2.50-2.60		
3.0	End of Trial Pit at 2.90m									

Groundwater Conditions
Seepage at 2.90m

Stability
Unstable, side wall collapse from 2.80m

General Remarks
Pit footprint scanned using cable avoidance tool [CAT]. Shear vanes (set of three) carried out at both 0.30m & 0.50m bgl. Vane attempted at 0.70m - too gravelly. Pit backfilled with arisings.

TRIAL PIT RECORD

REPORT NUMBER 24330

CONTRACT	Halverstown	**TRIAL PIT NO.**	**TP06**
		SHEET	Sheet 1 of 1
LOGGED BY	MB	**DATE STARTED**	19/10/2022
CO-ORDINATES	686,189.63 E 719,600.91 N	**DATE COMPLETED**	19/10/2022
GROUND LEVEL (m)	79.75	**EXCAVATION METHOD**	7t Hitachi
CLIENT			
ENGINEER	DOBA		

	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples			Vane Test (KPa)	Hand Penetrometer (KPa)
						Sample Ref	Type	Depth		
0.0	TOPSOIL: Soft brown slightly gravelly sandy CLAY. Sand is fine to coarse. Gravel is fine to medium subrounded.		0.30	79.45						
1.0	Firm grey mottled orange very gravelly sandy SILT. Sand is fine to coarse. Gravel is fine to coarse subrounded.		1.20	78.55		AA186979	B	0.50-0.60	45 56 42 58 67 74	
2.0	Firm brown very sandy very gravelly SILT with a medium cobble content and occassional boulders. Sand is fine to coarse. Gravel is fine to coarse subrounded. Cobbles and boulders are subrounded to rounded of limestone. Sidewall collapse at 1.20m		2.70	77.05		AA186980 AA186981	B B	1.50-1.60 2.50-2.60		
3.0	End of Trial Pit at 2.70m									

Groundwater Conditions
Dry

Stability
Unstable, side wall collapse at 1.20m

General Remarks
Pit footprint scanned using cable avoidance tool [CAT]. Shear vanes (set of three) carried out at both 0.30m & 0.50m bgl. Pit backfilled with arisings.

TRIAL PIT RECORD

REPORT NUMBER 24330

CONTRACT	Halverstown	**TRIAL PIT NO.**	TP07
		SHEET	Sheet 1 of 1
LOGGED BY	MB	**DATE STARTED**	18/10/2022
CO-ORDINATES	686,233.75 E 719,669.34 N	**DATE COMPLETED**	18/10/2022
GROUND LEVEL (m)	80.79	**EXCAVATION METHOD**	7t Hitachi
CLIENT			
ENGINEER	DOBA		

	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples: Sample Ref	Samples: Type	Samples: Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0	TOPSOIL: Soft brown slightly gravelly sandy CLAY. Sand is fine to coarse. Gravel is fine to medium subrounded.		0.30	80.49						
1.0	Firm brownish grey sandy gravelly silty CLAY with pockets of silty SAND. Sand is fine to medium. Gravel is fine to coarse subangular to subrounded.		1.10	79.69		AA186963	B	0.50-0.60	24 27 38 70 76 77 120	
2.0	Firm to stiff brownish grey sandy gravelly SILT with a medium cobble content. Sand is fine to coarse. Gravel is fine to coarse subrounded. Cobbles are subrounded to rounded of limestone.		2.20	78.59		AA186964	B	1.50-1.60		
	Brown silty sandy GRAVEL with a medium cobble content. Sand is fine to coarse. Gravel is fine to coarse subrounded. Cobbles are subrounded to rounded of limestone.		2.80	77.99	1 (Seepage)	AA186965	B	2.50-2.60		
3.0	End of Trial Pit at 2.80m									

Groundwater Conditions
Seepage at 2.80m

Stability
Unstable from 2.0m

General Remarks
Pit footprint scanned using cable avoidance tool [CAT]. Shear vanes (set of three) carried out at both 0.30m & 0.50m bgl. Single vane attempted at 0.70m bgl. Vane attempted at 0.70m - too gravelly. Pit backfilled with arisings.

TRIAL PIT RECORD

REPORT NUMBER 24330

CONTRACT	Halverstown	**TRIAL PIT NO.**	**TP08**
		SHEET	Sheet 1 of 1
LOGGED BY	MB	**DATE STARTED**	19/10/2022
CO-ORDINATES	686,254.83 E 719,606.17 N	**DATE COMPLETED**	19/10/2022
GROUND LEVEL (m)	80.39	**EXCAVATION METHOD**	7t Hitachi
CLIENT			
ENGINEER	DOBA		

	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples Sample Ref	Samples Type	Samples Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0	TOPSOIL: Soft brown slightly gravelly sandy CLAY. Sand is fine to coarse. Gravel is fine to medium subrounded.		0.20	80.19						
	Firm brownish grey sandy gravelly SILT. Sand is fine to medium. Gravel is fine to coarse subangular to subrounded.		0.90	79.49		AA186966	B	0.50-0.60	38 42 36 71 60 65	
1.0 2.0	Firm brown slightly clayey sandy gravelly SILT with a medium cobble content. Sand is fine to coarse. Gravel is fine to coarse subrounded.Cobbles are subrounded to rounded of limestone.		2.30	78.09		AA186967	B	1.50-1.60		
	Brown silty sandy GRAVEL with a medium cobble content. Sand is fine to coarse. Gravel is fine to coarse subrounded.Cobbles are subrounded to rounded of limestone.		3.00	77.39	1 (Seepage)	AA186968	B	2.50-2.60		
3.0	End of Trial Pit at 3.00m									

Groundwater Conditions
Seepage at 3.0m

Stability
Unstable from 2.3m

General Remarks
Pit footprint scanned using cable avoidance tool [CAT]. Shear vanes (set of three) carried out at both 0.30m & 0.50m bgl. Vane attempted at 0.70m - too stiff. Pit backfilled with arisings.

TRIAL PIT RECORD

REPORT NUMBER	24330		
CONTRACT	Halverstown	**TRIAL PIT NO.**	**TP09**
		SHEET	Sheet 1 of 1
LOGGED BY	MB	**DATE STARTED**	19/10/2022
CO-ORDINATES	686,274.81 E 719,546.61 N	**DATE COMPLETED**	19/10/2022
GROUND LEVEL (m)	79.66	**EXCAVATION METHOD**	7t Hitachi
CLIENT			
ENGINEER	DOBA		

	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples			Vane Test (KPa)	Hand Penetrometer (KPa)
						Sample Ref	Type	Depth		
0.0	TOPSOIL: Soft brown slightly gravelly sandy CLAY. Sand is fine to coarse. Gravel is fine to medium subrounded.									
	Firm grey mottled orange sandy gravelly SILT with silty sand lenses. Sand is fine to coarse. Gravel is fine to coarse subrounded.		0.30	79.36		AA186975	B	0.50-0.60	40 38 46 60 63 67	
1.0	Firm greyish brown sandy gravelly clayey SILT with a low cobble content. Sand is fine to coarse. Gravel is fine to coarse subrounded.Cobbles are subrounded to rounded of limestone.		0.80	78.86		AA186976	B	1.20-1.30		
2.0	Brown silty sandy GRAVEL with a medium cobble content. Sand is fine to coarse. Gravel is fine to coarse subrounded.Cobbles are subrounded to rounded of limestone. Side wall collapse at 1.60m		1.60	78.06		AA186977	B	1.90-2.00		
	Firm dark grey very sandy gravelly clayey SILT with a medium cobble content. Sand is fine to coarse. Gravel is fine to coarse subrounded.Cobbles are subrounded to rounded of limestone. (Recovered wet)		2.40	77.26	1 (Seepage)	AA186978	B	2.50-2.60		
3.0	End of Trial Pit at 3.00m		3.00	76.66						

Groundwater Conditions
Seepage at 2.50m

Stability
Unstable, side wall collapse from 1.60m

General Remarks
Pit footprint scanned using cable avoidance tool [CAT]. Shear vanes (set of three) carried out at both 0.30m & 0.50m bgl. Vane attempted at 0.70m - too gravelly. Pit backfilled with arisings.

TRIAL PIT RECORD

REPORT NUMBER 24330

CONTRACT	Halverstown	**TRIAL PIT NO.**	**TP10**
		SHEET	Sheet 1 of 1
LOGGED BY	MB	**DATE STARTED**	19/10/2022
CO-ORDINATES	686,322.16 E 719,619.95 N	**DATE COMPLETED**	19/10/2022
GROUND LEVEL (m)	80.87	**EXCAVATION METHOD**	7t Hitachi
CLIENT			
ENGINEER	DOBA		

	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples Sample Ref	 Type	 Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0	TOPSOIL: Soft brown sandy CLAY with rootlets. Sand is fine to coarse.		0.30	80.57						
	Firm to stiff grey mottled orange sandy gravelly clayey SILT. Sand is fine to coarse. Gravel is fine to coarse subrounded.		0.80	80.07		AA186969	B	0.50-0.60	38 42 35 63 65 71	
1.0	Greyish brown gravelly SAND with a low cobble content. Sand is fine to coarse. Gravel is fine to coarse subrounded.		1.60	79.27		AA186970	B	1.20-1.30		
2.0	Firm brown slightly silty sandy gravelly CLAY with a medium cobble content. Sand is fine to coarse. Gravel is fine to coarse subrounded.Cobbles are subrounded to rounded of limestone.		2.80	78.07		AA186971	B	2.60-2.70		
3.0	End of Trial Pit at 2.80m									

Groundwater Conditions
Dry

Stability
Good

General Remarks
Pit footprint scanned using cable avoidance tool [CAT]. Shear vanes (set of three) carried out at both 0.30m & 0.50m bgl. Vane attempted at 0.70m - too gravelly. Pit backfilled with arisings.

TRIAL PIT RECORD

REPORT NUMBER 24330

CONTRACT Halverstown

TRIAL PIT NO. **TP11**

SHEET Sheet 1 of 1

LOGGED BY MB

CO-ORDINATES 686,313.08 E
719,522.07 N

GROUND LEVEL (m) 79.52

DATE STARTED 19/10/2022

DATE COMPLETED 19/10/2022

CLIENT

ENGINEER DOBA

EXCAVATION METHOD 7t Hitachi

	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples			Vane Test (KPa)	Hand Penetrometer (KPa)
						Sample Ref	Type	Depth		
0.0	TOPSOIL: Soft brown sandy CLAY with rootlets. Sand is fine to coarse.		0.20	79.32						
1.0	Firm grey mottled orange sandy gravelly clayey SILT. Sand is fine to coarse. Gravel is fine to coarse subrounded. 0.70-0.80m Fine to medium sand lens		1.10	78.42		AA186972	B	0.50-0.60	49 45 48 56 52 61	
2.0	Stiff grey brown sandy gravelly SILT with a low cobble content. Sand is fine to coarse. Gravel is fine to coarse subrounded.Cobbles are subrounded to rounded of limestone.		2.20	77.32		AA186973	B	1.50-1.60		
	Firm to stiff dark grey slightly clayey sandy gravelly SILT with a medium cobble content. Sand is fine to coarse. Gravel is fine to coarse subrounded.Cobbles are subrounded to rounded of limestone.		2.90	76.62		AA186974	B	2.50-2.60		
3.0	End of Trial Pit at 2.90m									

Groundwater Conditions
Dry

Stability
Good

General Remarks
Pit footprint scanned using cable avoidance tool [CAT]. Shear vanes (set of three) carried out at both 0.30m & 0.50m bgl. Vane attempted at 0.70m - too gravelly. Pit backfilled with arisings.

TRIAL PIT RECORD

REPORT NUMBER	24330
CONTRACT	Halverstown
TRIAL PIT NO.	TP12
SHEET	Sheet 1 of 1
LOGGED BY	MB
CO-ORDINATES	686,361.01 E 719,589.72 N
GROUND LEVEL (m)	80.71
DATE STARTED	06/10/2022
DATE COMPLETED	06/10/2022
CLIENT	
ENGINEER	DOBA
EXCAVATION METHOD	7t Hitachi

	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples			Vane Test (KPa)	Hand Penetrometer (KPa)
						Sample Ref	Type	Depth		
0.0	TOPSOIL: Soft brown slightly gravelly sandy silty CLAY. Sand is fine to coarse. Gravel is fine to medium subrounded.		0.30	80.41					20 25 22	
	Stiff light brown very sandy very gravelly clayey SILT. Sand is fine to coarse. Gravel is fine to coarse subrounded. Cobbles are subrounded to rounded of limestone.		0.70	80.01		AA185481	B	0.50-0.60		
1.0	(Dense) Silty gravelly SAND with a low cobble content. Sand is fine to medium. Gravel is fine to coarse subrounded. Cobbles are subrounded to rounded of limestone.		1.60	79.11		AA185482	B	0.80-0.90		
2.0	(Medium dense) Brown silty gravelly SAND with a medium cobble content. Sand is fine to medium. Gravel is fine to coarse subrounded. Cobbles are subrounded to rounded of limestone.		2.40	78.31		AA185483	B	1.80-1.90		
	Firm to stiff dark brown to dark grey slightly clayey sandy gravelly SILT with a low cobble content. Sand is fine to coarse. Gravel is fine to coarse subangular to subrounded. Cobbles are subrounded to rounded of limestone		2.70	78.01		AA185484	B	2.50-2.60		
3.0	End of Trial Pit at 2.70m									

Groundwater Conditions
Dry

Stability
Good

General Remarks
Pit footprint scanned using cable avoidance tool [CAT]. Shear vane (set of three) carried out at 0.20m bgl. Vane attempted at 0.50m - too gravelly. Pit backfilled with arisings.

TRIAL PIT RECORD

REPORT NUMBER 24330

CONTRACT	Halverstown	**TRIAL PIT NO.**	**TP13**
		SHEET	Sheet 1 of 1
LOGGED BY	MB	**DATE STARTED**	04/10/2022
CO-ORDINATES	686,381.27 E 719,525.82 N	**DATE COMPLETED**	04/10/2022
GROUND LEVEL (m)	79.83	**EXCAVATION METHOD**	7t Hitachi
CLIENT			
ENGINEER	DOBA		

	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples			Vane Test (KPa)	Hand Penetrometer (KPa)
						Sample Ref	Type	Depth		
0.0	TOPSOIL: Soft brown slightly silty gravelly sandy CLAY with a low cobble content and rootlets. Sand is fine to coarse. Gravel is fine to medium subrounded. Cobbles are subrounded of limestone		0.40	79.43					45	
	Firm to stiff brown mottled grey slightly sandy gravelly silty CLAY. Sand is fine to coarse. Gravel is fine to coarse subrounded.		0.90	78.93		AA185474	B	0.50-0.50	55	
1.0	Firm greyish brown slightly sandy gravelly clayey SILT with a low coblle content. Sand is fine to coarse. Gravel is fine to coarse subrounded. Cobbles are subrounded to rounded of limestone		1.40	78.43		AA185475	B	1.00-1.00		
2.0	Firm brownish grey sandy gravelly silty CLAY with a low cobble content. Gravel is fine to coarse subrounded. Cobbles are subrounded to rounded of limestone.		2.40	77.43		AA185476	B	1.50-1.50		
	Firm slightly sandy gravelly silty CLAY. Gravel is fine to medium subrounded.		2.70	77.13	1 (Seepage)	AA185477	B	2.50-2.50		
3.0	End of Trial Pit at 2.70m									

Groundwater Conditions
Seepage at 2.70m

Stability
Good

General Remarks
Pit footprint scanned using cable avoidance tool [CAT]. Shear vanes carried out at both 0.30m & 0.50m bgl. Vane attempted at 0.60m - too gravelly. Pit backfilled with arisings.

TRIAL PIT RECORD

REPORT NUMBER 24330

CONTRACT Halverstown

TRIAL PIT NO. TP14
SHEET Sheet 1 of 1

LOGGED BY MB

CO-ORDINATES 686,397.36 E
719,469.29 N

GROUND LEVEL (m) 79.30

DATE STARTED 03/10/2022
DATE COMPLETED 03/10/2022

CLIENT
ENGINEER DOBA

EXCAVATION METHOD 7t Hitachi

	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples			Vane Test (KPa)	Hand Penetrometer (KPa)
						Sample Ref	Type	Depth		
0.0	TOPSOIL: Soft brown sandy CLAY with timber rootlets. Sand is fine to coarse.		0.15	79.15						
	(Loose) Light brown fine silty SAND with rootlets. Sand is fine to coarse.		0.25	79.05						
	Firm to stiff light grey mottled yellow very sandy silty CLAY. Sand is fine to coarse.		0.60	78.70		AA185457	B	0.50-0.50	100	
	Very stiff light brown mottled orange and grey sandy very gravelly SILT. Sand is fine to coarse. Gravel is fine to coarse subrounded. Slow progress from 0.80m to 1.50m due to cobbles and boulders.		0.90	78.40		AA185458	B	0.80-0.90		
1.0	(Dense) Light grey slightly silty slightly clayey gravelly SAND with a medium to high cobble content. Sand is fine to coarse. Gravel is fine to coarse subrounded. Cobbles are subrounded to rounded of limestone		1.50	77.80		AA185459	B	1.20-1.20		
	Obstruction at 1.50m - possible boulders End of Trial Pit at 1.50m									
2.0										
3.0										

Groundwater Conditions
Dry

Stability
Good

General Remarks
Pit footprint scanned using cable avoidance tool [CAT]. Shear vane carried out at 0.35m bgl. Vane attempted at 0.75m - too stiff. Pit backfilled with arisings.

TRIAL PIT RECORD

REPORT NUMBER 24330

CONTRACT	Halverstown	**TRIAL PIT NO.**	**TP15**
		SHEET	Sheet 1 of 1
LOGGED BY	MB	**CO-ORDINATES**	686,444.04 E 719,538.61 N
DATE STARTED	04/10/2022	**DATE COMPLETED**	04/10/2022
CLIENT		**GROUND LEVEL (m)**	80.39
ENGINEER	DOBA	**EXCAVATION METHOD**	7t Hitachi

	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples: Sample Ref	Samples: Type	Samples: Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0	TOPSOIL: Soft brown gravelly sandy CLAY with rootlets. Sand is fine to coarse. Gravel is fine to medium subrounded.		0.30	80.09						
	Firm greyish brown sandy gravelly slightly clayey SILT with a low coblle content. Sand is fine to coarse. Gravel is fine to coarse subrounded. Cobbles are subrounded to rounded of limestone		1.00	79.39		AA185478	B	0.50-0.50		
1.0	Firm greyish brown sandy gravelly SILT. Sand is fine to coarse. Gravel is fine to coarse subrounded. Cobbles are subrounded to rounded of limestone		1.70	78.69		AA185479	B	1.50-1.50		
2.0	Firm rarely soft to firm brown slightly sandy gravelly silty CLAY with a low cobble content with pockets of coarse yellow sand from 2.50m. Gravel is fine to coarse subrounded. Cobbles are subrounded to rounded of limestone Side wall collapse from 2.0m to 2.50m		2.80	77.59		AA185480	B	2.30-2.30		
3.0	End of Trial Pit at 2.80m									

Groundwater Conditions
Dry

Stability
Slightly unstable, side wall collapse at 2.0m

General Remarks
Pit footprint scanned using cable avoidance tool [CAT]. Pit backfilled with arisings.

TRIAL PIT RECORD

REPORT NUMBER 24330

CONTRACT	Halverstown	**TRIAL PIT NO.**	**TP16**
		SHEET	Sheet 1 of 1
LOGGED BY	MB	**DATE STARTED**	03/10/2022
CO-ORDINATES	686,437.15 E 719,442.70 N	**DATE COMPLETED**	03/10/2022
CLIENT		**GROUND LEVEL (m)**	79.07
ENGINEER	DOBA	**EXCAVATION METHOD**	7t Hitachi

	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples			Vane Test (KPa)	Hand Penetrometer (KPa)
						Sample Ref	Type	Depth		
0.0	TOPSOIL: Soft brown gravelly sandy CLAY with rootlets. Sand is fine to coarse. Gravel is fine to medium subrounded.									
	Firm to stiff brown mottled orange very sandy silty gravelly CLAY with a low cobble content. Gravel is fine to coarse subrounded. Cobbles are subrounded to rounded of limestone		0.30	78.77					45	
						AA185460	B	0.50-0.50		
	Stiff light grey sightly clayey sandy gravelly SILT with a low cobble content. Sand is fine to coarse. Sand is fine to coarse. Gravel is fine to coarse subrounded. Cobbles are subrounded to rounded of limestone		0.70	78.37					60	
1.0						AA185461	B	1.00-1.00		
						AA185462	B	1.50-1.50		
	(Medium dense) Brownish grey sandy very silty GRAVEL with a low cobble content and occasional boulders. Sand is fine to coarse. Gravel is fine to coarse subrounded. Cobbles and boulders are subrounded to rounded of limestone Side wall collapse from 2.0m to 3.0m		1.80	77.27						
2.0										
						AA185463	B	2.20-2.20		
					1 (Moderate)					
3.0	End of Trial Pit at 3.00m		3.00	76.07						

Groundwater Conditions
Moderate flow at 2.80m

Stability
Slightly unstable, side wall collapse at 2.0m

General Remarks
Pit footprint scanned using cable avoidance tool [CAT]. Shear vanes carried out at both 0.30m & 0.70m bgl. Pit backfilled with arisings.

TRIAL PIT RECORD

REPORT NUMBER 24330

CONTRACT	Halverstown	**TRIAL PIT NO.**	**TP17**
		SHEET	Sheet 1 of 1
LOGGED BY	MB	**CO-ORDINATES**	686,475.64 E 719,507.57 N
DATE STARTED	06/10/2022	**DATE COMPLETED**	06/10/2022
CLIENT		**GROUND LEVEL (m)**	80.15
ENGINEER	DOBA	**EXCAVATION METHOD**	7t Hitachi

	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples: Sample Ref	Samples: Type	Samples: Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0	TOPSOIL: Soft brown slightly silty gravelly sandy CLAY with a low cobble content and rootlets. Sand is fine to coarse. Gravel is fine to medium subrounded. Cobbles are subrounded of limestone Localised sidewall collapse from 0.20m to 2.0m		0.30	79.85						
	Stiff greyish brown slightly sandy gravelly clayey SILT. Sand is fine to coarse. Gravel is fine to coarse subrounded.		1.10	79.05		AA185485	B	0.60-0.60	57 39 42 80 72 66	
1.0	(Loose) Light brown to grey silty SAND. Sand is fine to medium. Sand tapers to the north. 1.10-1.30m Fine to medium sand lens		1.30	78.85						
	Firm grey very sandy gravelly SILT. Sand is fine to medium. Gravel is fine to coarse subrounded.		2.00	78.15		AA185486	B	1.40-1.40		
2.0	Firm brown to dark grey gravelly sandy silty CLAY with a low cobble content. Sand is fine to medium. Gravel is fine to coarse subrounded. Cobbles are subrounded to rounded of limestone.		2.90	77.25		AA185487	B	2.20-2.20		
3.0	End of Trial Pit at 2.90m									

Groundwater Conditions
Dry

Stability
Unstable - wall collapse from 0.20m with renewed collapse in unstable sandy horizon at 2.50m

General Remarks
Pit footprint scanned using cable avoidance tool [CAT]. Shear vanes (set of three) carried out at both 0.30m & 0.50m bgl. Vane attempted at 0.70m - too gravelly. Pit backfilled with arisings.

TRIAL PIT RECORD

REPORT NUMBER 24330

CONTRACT Halverstown

TRIAL PIT NO. TP18
SHEET Sheet 1 of 1

LOGGED BY MB

CO-ORDINATES 686,500.35 E
719,443.56 N

GROUND LEVEL (m) 79.37

DATE STARTED 03/10/2022
DATE COMPLETED 03/10/2022

CLIENT
ENGINEER DOBA

EXCAVATION METHOD 7t Hitachi

	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples			Vane Test (KPa)	Hand Penetrometer (KPa)
						Sample Ref	Type	Depth		
0.0	TOPSOIL: Soft brown sandy CLAY with rootlets. Sand is fine to coarse.								30	
	Firm to stiff brown mottled grey slightly sandy gravelly silty CLAY with a low cobble content. Sand is fine to coarse. Gravel is fine to coarse subrounded. Cobbles are subrounded to rounded of limestone.		0.40	78.97		AA185464	B	0.50-0.50	54	
1.0	Stiff greyish brown slightly sandy gravelly SILT with a low cobble content. Sand is fine to coarse. Gravel is fine to coarse subrounded. Cobbles are subrounded to rounded of limestone.		0.80	78.57		AA185465	B	1.50-1.50		
2.0	Firm brownish grey sandy slightly gravelly SILT. Sand is fine to coarse. Gravel is fine to medium subrounded		1.60	77.77						
	Firm and soft dark grey sandy gravelly SILT with a low cobble content. Sand is fine to coarse. Gravel is fine to coarse subrounded. Cobbles are subrounded to rounded of limestone (Recovered wet) Side wall collapse from 2.50m to 3.0m		2.50	76.87		AA185466	B	2.50-2.50		
3.0	End of Trial Pit at 3.00m		3.00	76.37	1 (Seepage)	AA185467	B	3.00-3.00		

Groundwater Conditions
Seepage at 3.0m

Stability
Slightly unstable, side wall collapse at 2.50m

General Remarks
Pit footprint scanned using cable avoidance tool [CAT]. Shear vanes carried out at both 0.20m & 0.50m bgl. Vane attempted at 0.70m - too stiff. Pit backfilled with arisings.

TRIAL PIT RECORD

REPORT NUMBER 24330

CONTRACT	Halverstown	**TRIAL PIT NO.**	**TP19**
		SHEET	Sheet 1 of 1
LOGGED BY	MB	**DATE STARTED**	03/10/2022
CO-ORDINATES	686,519.89 E 719,387.48 N	**DATE COMPLETED**	03/10/2022
GROUND LEVEL (m)	78.98	**EXCAVATION METHOD**	7t Hitachi
CLIENT			
ENGINEER	DOBA		

	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples Sample Ref	Samples Type	Samples Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0	TOPSOIL: Soft brown sandy CLAY with rootlets. Sand is fine to coarse.		0.30	78.68						
	Firm to stiff grey mottled orange sandy gravelly silty CLAY with a low cobble content. Sand is fine to coarse. Gravel is fine to coarse subrounded. Cobbles are subrounded to rounded of limestone.		0.90	78.08		AA185468	B	0.50-0.50	50	
1.0	Firm grey gravelly sandy SILT with a low cobble content. Sand is fine to coarse. Gravel is fine to coarse subrounded. Cobbles are subrounded to rounded of limestone.		2.00	76.98		AA185469	B	1.00-1.00		
2.0	(Medium dense) Slightly gravelly silty SAND with a low cobble content. Sand is fine. Gravel is fine to coarse subrounded. Cobbles are subrounded to rounded of limestone.		2.50	76.48	1 (Moderate)	AA185470	B	2.20-2.20		
3.0	(Dense) Slightly gravelly silty SAND with a medium cobble content and occasional boulders. Sand is fine. Gravel is fine to coarse subrounded. Cobbles and boulders are subrounded to rounded of limestone. Side wall collapse from 2.50m to 3.20m		3.20	75.78		AA185471	B	2.90-2.90		
	End of Trial Pit at 3.20m									

Groundwater Conditions
Moderate flow at 2.50m

Stability
Slightly unstable, side wall collapse at 2.50m

General Remarks
Pit footprint scanned using cable avoidance tool [CAT]. Shear vane carried out at 0.30m bgl. Vane attempted at 0.50m - too stiff. Pit backfilled with arisings.

TRIAL PIT RECORD

REPORT NUMBER 24330

CONTRACT Halverstown

TRIAL PIT NO. TP20
SHEET Sheet 1 of 1

LOGGED BY MB

CO-ORDINATES 686,566.81 E
719,458.67 N

GROUND LEVEL (m) 79.78

DATE STARTED 06/10/2022
DATE COMPLETED 06/10/2022

CLIENT
ENGINEER DOBA

EXCAVATION METHOD 7t Hitachi

	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples			Vane Test (KPa)	Hand Penetrometer (KPa)
						Sample Ref	Type	Depth		
0.0	TOPSOIL: Soft brown slightly gravelly sandy silty CLAY. Sand is fine to coarse. Gravel is fine to medium subrounded.									
1.0	Firm grey slightly sandy gravelly clayey SILT. Sand is fine to coarse. Gravel is fine to coarse subrounded. Slow progress from 0.80m onwards due to cobbles and boulders.		0.40	79.38		AA185488	B	0.60-0.60	45 40 65 70 60	
2.0	Firm to stiff brown mottled grey very silty slightly sandy gravelly CLAY with silt pockets. Sand is fine to coarse. Gravel is fine to coarse subrounded.		1.40	78.38		AA185489	B	1.60-1.70		
	Firm slightly clayey slightly gravelly sandy SILT. Sand is fine to coarse. Gravel is fine to medium subrounded.		2.40	77.38		AA185490	B	2.40-2.50		
	Firm occasionally soft to firm blackish grey slightly sandy gravelly clayey SILT with a low cobble content. Sand is fine to coarse. Gravel is fine to medium subrounded.		2.60	77.18		AA185491	B	2.90-2.90		
3.0	End of Trial Pit at 3.00m		3.00	76.78						

Groundwater Conditions
Dry

Stability
Good

General Remarks
Pit footprint scanned using cable avoidance tool [CAT]. Shear vanes (set of three) carried out at both 0.40m & 0.60m bgl. Vane attempted at 0.70m - too gravelly. Pit backfilled with arisings.

TRIAL PIT RECORD

REPORT NUMBER 24330

CONTRACT Halverstown

TRIAL PIT NO. **TP21**

SHEET Sheet 1 of 1

LOGGED BY MB

CO-ORDINATES 686,295.25 E
719,774.44 N

GROUND LEVEL (m) 82.96

DATE STARTED 14/10/2022

DATE COMPLETED 14/10/2022

CLIENT

ENGINEER DOBA

EXCAVATION METHOD 7t Hitachi

	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples			Vane Test (KPa)	Hand Penetrometer (KPa)
						Sample Ref	Type	Depth		
0.0	TOPSOIL: Soft brown gravelly sandy CLAY. Sand is fine to coarse. Gravel is fine to medium subrounded.								34 38 43	
	Firm brownish orange slightly gravelly silty sandy CLAY . Sand is fine to medium. Gravel is fine to coarse subangular to subrounded.		0.40	82.56		AA181983	B	0.50-0.60	77 81 83	
1.0	Firm to stiff brown very gravelly sandy silty CLAY with a medium cobble content. Sand is fine to coarse. Gravel is fine to coarse subrounded. Cobbles are subrounded to rounded of limestone.		0.90	82.06		AA181984	B	1.50-1.60		
2.0	Firm to stiff brownish grey slightly sandy gravelly clayey SILT with a medium cobble content and occassional boulders. Sand is fine to coarse. Gravel is fine to coarse subrounded. Cobbles and boulders are subrounded to rounded of limestone.		2.20	80.76		AA181985	B	2.50-2.60		
3.0	End of Trial Pit at 2.90m		2.90	80.06						

Groundwater Conditions
Dry

Stability
Good

General Remarks
Pit footprint scanned using cable avoidance tool [CAT]. Shear vanes (set of three) carried out at both 0.20m & 0.50m bgl. Vane attempted at 0.70m - too gravelly. Pit backfilled with arisings.

TRIAL PIT RECORD

REPORT NUMBER 24330

CONTRACT	Halverstown	**TRIAL PIT NO.**	**TP22**
		SHEET	Sheet 1 of 1
LOGGED BY	MB	**DATE STARTED**	11/10/2022
CO-ORDINATES	686,367.54 E 719,727.88 N	**DATE COMPLETED**	11/10/2022
GROUND LEVEL (m)	83.38	**EXCAVATION METHOD**	7t Hitachi
CLIENT			
ENGINEER	DOBA		

	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples			Vane Test (KPa)	Hand Penetrometer (KPa)
						Sample Ref	Type	Depth		
0.0	TOPSOIL: Soft brown slightly gravelly sandy CLAY. Sand is fine to coarse. Gravel is fine to medium subrounded.		0.30	83.08						
	Firm brown sandy slightly gravelly silty CLAY.Sand is fine to coarse. Gravel is fine to coarse subrounded.		0.90	82.48		AA185497	B	0.60-0.60	50 48 52 60 68 70 75 84 81	
1.0	Stiff brown slightly sandy gravelly SILT with a low cobble content. Sand is fine to coarse. Gravel is fine to coarse subrounded. Cobbles are subrounded to rounded of limestone.		1.80	81.58		AA185498	B	1.40-1.40		
2.0	Stiff brownish grey sandy gravelly silty CLAY with a low cobble content. Sand is fine to coarse. Gravel is fine to coarse subrounded. Cobbles are subrounded to rounded of limestone.		2.20	81.18		AA185499	B	1.90-1.90		
	Brownish grey slightly silty gravelly SAND with a medium cobble content. Sand is fine to coarse. Gravel is fine to coarse subrounded. Cobbles are subrounded to rounded of limestone.		2.90	80.48		AA185500	B	2.40-2.40		
3.0	End of Trial Pit at 2.90m									

Groundwater Conditions
Dry

Stability
Good

General Remarks
Pit footprint scanned using cable avoidance tool [CAT]. Shear vanes (set of three) carried out at 0.30m, 0.50m & 0.70m bgl. Vane attempted at 0.90m - too gravelly. Pit backfilled with arisings.

TRIAL PIT RECORD

REPORT NUMBER	24330		
CONTRACT	Halverstown	**TRIAL PIT NO.**	**TP23**
		SHEET	Sheet 1 of 1
LOGGED BY	MB	**DATE STARTED**	11/10/2022
CO-ORDINATES	686,365.66 E 719,792.47 N	**DATE COMPLETED**	11/10/2022
GROUND LEVEL (m)	84.33	**EXCAVATION METHOD**	7t Hitachi
CLIENT			
ENGINEER	DOBA		

	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples			Vane Test (KPa)	Hand Penetrometer (KPa)
						Sample Ref	Type	Depth		
0.0	TOPSOIL: Soft brown slightly gravelly sandy CLAY. Sand is fine to coarse. Gravel is fine to medium subrounded.		0.30	84.03						
1.0	Firm brown sandy slightly gravelly silty CLAY.Sand is fine to coarse. Gravel is fine to coarse subrounded.		1.30	83.03		AA181957	B	0.50-0.60	45 50 55 55 62 63 63 65 67	
2.0	Stiff brown sandy gravelly SILT with a low cobble content. Sand is fine to coarse. Gravel is fine to coarse subrounded. Cobbles are subrounded to rounded of limestone.		2.30	82.03		AA181958	B	1.50-1.50		
	Very stiff sandy gravelly clayey SILT. Sand is fine to coarse. Gravel is fine to coarse subrounded.		2.80	81.53		AA181959	B	2.50-2.60		
3.0	End of Trial Pit at 2.80m									

Groundwater Conditions
Dry

Stability
Good

General Remarks
Pit footprint scanned using cable avoidance tool [CAT]. Shear vanes (set of three) carried out at 0.30m, 0.50m & 0.70m bgl. Vane attempted at 0.80m - too gravelly. Pit backfilled with arisings.

TRIAL PIT RECORD

REPORT NUMBER	24330
CONTRACT	Halverstown
TRIAL PIT NO.	**TP24**
SHEET	Sheet 1 of 1
LOGGED BY	MB
CO-ORDINATES	686,354.34 E 719,849.15 N
GROUND LEVEL (m)	85.19
DATE STARTED	12/10/2022
DATE COMPLETED	12/10/2022
CLIENT	
ENGINEER	DOBA
EXCAVATION METHOD	7t Hitachi

	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples: Sample Ref	Samples: Type	Samples: Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0	TOPSOIL: Soft brown gravelly sandy CLAY. Sand is fine to coarse. Gravel is fine to medium subrounded.		0.40	84.79					30 35 32	
1.0	Firm to stiff brown mottled orange very sandy gravelly CLAY. Sand is fine to coarse. Gravel is fine to coarse subangular to subrounded.		1.20	83.99		AA181960	B	0.60-0.70	76 81 89	
	Firm brown very sandy slightly gravelly CLAY with a low cobble content. Sand is fine to coarse. Gravel is fine to coarse subrounded.Cobbles are subrounded to rounded of limestone.		1.60	83.59		AA181961	B	1.50-1.60		
2.0 3.0	End of Trial Pit at 2.60m					AA181962	B	2.60-2.70		

Groundwater Conditions
Dry

Stability
Good

General Remarks
Pit footprint scanned using cable avoidance tool [CAT]. Shear vanes (set of three) carried out at both 0.20m & 0.30m bgl. Vane attempted at 0.70m - too gravelly. Pit backfilled with arisings.

TRIAL PIT RECORD

REPORT NUMBER 24330

CONTRACT	Halverstown	**TRIAL PIT NO.**	**TP25**
		SHEET	Sheet 1 of 1
LOGGED BY	MB	**DATE STARTED**	12/10/2022
CO-ORDINATES	686,425.96 E 719,809.88 N	**DATE COMPLETED**	12/10/2022
GROUND LEVEL (m)	85.36	**EXCAVATION METHOD**	7t Hitachi
CLIENT			
ENGINEER	DOBA		

	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples Sample Ref	Samples Type	Samples Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0	TOPSOIL: Soft brown gravelly sandy CLAY. Sand is fine to coarse. Gravel is fine to medium subrounded.									
1.0	Firm brown mottled orange very sandy gravelly CLAY. Sand is fine to coarse. Gravel is fine to coarse subangular to subrounded.		0.40	84.96		AA181963	B	0.50-0.60	50 52 47 80 95 83	
2.0	Greyish brown gravelly clayey SAND with a medium cobble content and occasional boulders. Sand is fine to coarse. Gravel is fine to coarse subrounded.Cobbles and boulders are subrounded to rounded of limestone.		1.20	84.16		AA181964	B	1.50-1.60		
	Firm brownish grey very sandy gravelly SILT with a low cobble content. Sand is fine to coarse. Gravel is fine to coarse subrounded.Cobbles are subrounded to rounded of limestone.		2.40	82.96		AA181965	B	2.50-2.60		
3.0	End of Trial Pit at 3.00m		3.00	82.36						

Groundwater Conditions
Dry

Stability
Good

General Remarks
Pit footprint scanned using cable avoidance tool [CAT]. Shear vanes (set of three) carried out at both 0.30m & 0.50m bgl. Vane attempted at 0.80m - too gravelly. Pit backfilled with arisings.

TRIAL PIT RECORD

REPORT NUMBER	24330		
CONTRACT	Halverstown	**TRIAL PIT NO.**	TP26
		SHEET	Sheet 1 of 1
LOGGED BY	MB	**DATE STARTED**	13/10/2022
CO-ORDINATES	686,611.58 E 719,726.52 N	**DATE COMPLETED**	13/10/2022
GROUND LEVEL (m)	83.00	**EXCAVATION METHOD**	7t Hitachi
CLIENT			
ENGINEER	DOBA		

	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples: Sample Ref	Samples: Type	Samples: Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0	TOPSOIL: Soft brown gravelly sandy silty CLAY. Sand is fine to coarse. Gravel is fine to medium subrounded.		0.30	82.70					38 46 42	
	Firm brown sandy gravelly silty CLAY with root hairs. Sand is fine to coarse. Gravel is fine to coarse subangular to subrounded.		0.90	82.10		AA181975	B	0.50-0.60	66 73 68	
1.0	Stiff brown very sandy very gravelly silty CLAY with a medium cobble content and ocassional boulders. Sand is fine to coarse. Gravel is fine to coarse subrounded.Cobbles and boulders are subrounded to rounded of limestone. Boulder at 1.80m (up to 400mm)		2.10	80.90		AA181976	B	1.30-1.40		
2.0	Firm to stiff brown sandy very gravelly silty CLAY with a low cobble content. Sand is fine to coarse. Gravel is fine to coarse subrounded.Cobbles are subrounded to rounded of limestone.		2.70	80.30		AA181978	B	2.40-2.50		
3.0	End of Trial Pit at 2.70m									

Groundwater Conditions
Dry

Stability
Good

General Remarks
Pit footprint scanned using cable avoidance tool [CAT]. Shear vanes (set of three) carried out at both 0.20m & 0.50m bgl. Vane attempted at 0.70m - too gravelly. Pit backfilled with arisings.

TRIAL PIT RECORD

REPORT NUMBER	24330		
CONTRACT	Halverstown	**TRIAL PIT NO.**	**TP27**
		SHEET	Sheet 1 of 1
LOGGED BY	MB	**DATE STARTED**	13/10/2022
CO-ORDINATES	686,682.52 E 719,695.28 N	**DATE COMPLETED**	13/10/2022
GROUND LEVEL (m)	81.34	**EXCAVATION METHOD**	7t Hitachi
CLIENT			
ENGINEER	DOBA		

	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples			Vane Test (KPa)	Hand Penetrometer (KPa)
						Sample Ref	Type	Depth		
0.0	TOPSOIL: Soft brown gravelly sandy silty CLAY. Sand is fine to coarse. Gravel is fine to medium subrounded.		0.30	81.04						
1.0	Firm grey mottled orange sandy gravelly SILT. Sand is fine to coarse. Gravel is fine to coarse subrounded.		1.10	80.24		AA181972	B	0.50-0.60	45 48 49 78 85 82 120 118	
	Stiff grey sandy gravelly SILT with a low cobble content. Sand is fine to coarse. Gravel is fine to coarse subrounded.Cobbles are subrounded to rounded of limestone.		1.80	79.54		AA181973	B	1.50-1.60		
2.0 3.0	Firm brown sandy gravelly clayey SILT with a low cobble content. Sand is fine to coarse. Gravel is fine to coarse subrounded.Cobbles are subrounded to rounded of limestone.		3.10	78.24		AA181974	B	2.20-2.30		
	End of Trial Pit at 3.10m									

Groundwater Conditions
Dry

Stability
Good

General Remarks
Pit footprint scanned using cable avoidance tool [CAT]. Shear vanes (set of three) carried out at 0.30m, 0.50m & 0.70m bgl. Pit backfilled with arisings.

TRIAL PIT RECORD

REPORT NUMBER 24330

CONTRACT	Halverstown	**TRIAL PIT NO.**	**TP28**
		SHEET	Sheet 1 of 1
LOGGED BY	MB	**DATE STARTED**	13/10/2022
CO-ORDINATES	686,668.41 E 719,756.26 N	**DATE COMPLETED**	13/10/2022
GROUND LEVEL (m)	81.28	**EXCAVATION METHOD**	7t Hitachi
CLIENT			
ENGINEER	DOBA		

	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples Sample Ref	Type	Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0	TOPSOIL: Soft brown gravelly sandy silty CLAY with roolets and timber roots. Sand is fine to coarse. Gravel is fine to medium subrounded.		0.50	80.78					38 35 41	
1.0	Firm grey mottled orange sandy gravelly SILT. Sand is fine to coarse. Gravel is fine to coarse subrounded.		1.30	79.98		AA181969	B	0.60-0.70	80 95 98	
2.0	Firm grey mottled orange sandy gravelly SILT. Sand is fine to coarse. Gravel is fine to coarse subrounded.		2.20	79.08		AA181970	B	1.60-1.70		
	Firm brown sandy gravelly clayey SILT with a low cobble content. Sand is fine to coarse. Gravel is fine to coarse subrounded.Cobbles are subrounded to rounded of limestone.		2.70	78.58		AA181971	B	2.50-2.60		
3.0	End of Trial Pit at 2.70m									

Groundwater Conditions
Dry

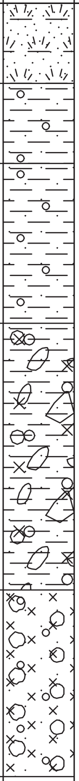
Stability
Good

General Remarks
Pit footprint scanned using cable avoidance tool [CAT]. Shear vanes (set of three) carried out at both 0.20m & 0.50m bgl. Vane attempted at 0.70m - too gravelly. Pit backfilled with arisings.

TRIAL PIT RECORD

REPORT NUMBER
24330

CONTRACT	Halverstown	**TRIAL PIT NO.**	**TP29**
		SHEET	Sheet 1 of 1
LOGGED BY	MB	**DATE STARTED**	13/10/2022
CO-ORDINATES	686,647.26 E 719,817.71 N	**DATE COMPLETED**	13/10/2022
GROUND LEVEL (m)	81.66	**EXCAVATION METHOD**	7t Hitachi
CLIENT			
ENGINEER	DOBA		



	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples			Vane Test (KPa)	Hand Penetrometer (KPa)
						Sample Ref	Type	Depth		
0.0	TOPSOIL: Soft brown gravelly sandy silty CLAY with roolets. Sand is fine to coarse. Gravel is fine to medium subrounded.		0.30	81.36					28 31 34	
	Firm brown sandy gravelly CLAY. Sand is fine to coarse. Gravel is fine to coarse subrounded.		0.60	81.06		AA181966	B	0.50-0.60	47 52 48	
1.0	Stiff grey very sandy gravelly CLAY. Sand is fine to coarse. Gravel is fine to coarse subrounded.		1.20	80.46						
2.0	Stiff brown very sandy very gravelly silty CLAY with a medium cobble content. Sand is fine to coarse. Gravel is fine to coarse subrounded.Cobbles and boulders are subrounded to rounded of limestone.		2.20	79.46		AA181967	B	1.50-1.60		
	Stiff greyish brown very sandy gravelly SILT with a low cobble content. Sand is fine to coarse. Gravel is fine to coarse subrounded.Cobbles and boulders are subrounded to rounded of limestone.		2.90	78.76		AA181968	B	2.50-2.60		
3.0	End of Trial Pit at 2.90m									

Groundwater Conditions
Dry

Stability
Good

General Remarks
Pit footprint scanned using cable avoidance tool [CAT]. Shear vanes (set of three) carried out at both 0.20m & 0.50m bgl. Vane attempted at 0.70m - too gravelly. Pit backfilled with arisings.

TRIAL PIT RECORD

REPORT NUMBER 24330

CONTRACT	Halverstown	**TRIAL PIT NO.**	**TP30**
		SHEET	Sheet 1 of 1
LOGGED BY	MB	**DATE STARTED**	13/10/2022
CO-ORDINATES	686,733.51 E 719,786.79 N	**DATE COMPLETED**	13/10/2022
GROUND LEVEL (m)	80.61	**EXCAVATION METHOD**	7t Hitachi
CLIENT			
ENGINEER	DOBA		

	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples			Vane Test (KPa)	Hand Penetrometer (KPa)
						Sample Ref	Type	Depth		
0.0	TOPSOIL: Soft dark brown sandy silty CLAY with roolets. Sand is fine to coarse. Gravel is fine to medium subrounded.		0.20	80.41						
	Firm grey mottled orange gravelly silty SAND. Sand is fine to medium. Gravel is fine to coarse subangular to subrounded. Sidewall collapse from 0.20m		1.00	79.61		AA181978	B	0.50-0.60	32 35 39	
1.0	Stiff greyish brown sandy gravelly clayey SILT with a medium cobble content. Sand is fine to coarse. Gravel is fine to coarse subrounded. Cobbles are subrounded to rounded of limestone.		1.70	78.91		AA181979	B	1.50-1.60	>120	
2.0	Firm to stiff grey very sandy gravelly clayey SILT with a low cobble content and bands of silty sand. Sand is fine to coarse. Gravel is fine to coarse subrounded. Cobbles are subrounded to rounded of limestone. Recovered wet from 2.0-2.5. 1.70m-1.80m Fine to medium sandy silt lens		2.50	78.11	1 ▼ (Seepage)	AA181980	B	2.30-2.40		
3.0	End of Trial Pit at 2.50m									

Groundwater Conditions
Seepage at 2.40m

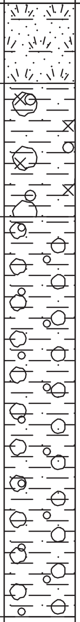
Stability
Unstable, sidewall collapse from 0.20m

General Remarks
Pit footprint scanned using cable avoidance tool [CAT]. Shear vane (set of three) carried out at 0.30m bgl. Single vane undertaken at 1.0m bgl. Pit ended at 2.50m due to instability. Pit backfilled with arisings.

TRIAL PIT RECORD

REPORT NUMBER 24330

CONTRACT	Halverstown	**TRIAL PIT NO.**	**TP31**
		SHEET	Sheet 1 of 1
LOGGED BY	MB	**DATE STARTED**	17/10/2022
CO-ORDINATES	686,101.19 E 719,955.04 N	**DATE COMPLETED**	17/10/2022
GROUND LEVEL (m)	83.80	**EXCAVATION METHOD**	7t Hitachi
CLIENT			
ENGINEER	DOBA		

	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples			Vane Test (KPa)	Hand Penetrometer (KPa)
						Sample Ref	Type	Depth		
0.0	TOPSOIL: Soft brown gravelly sandy CLAY with roolets. Sand is fine to coarse. Gravel is fine to medium subrounded.		0.30	83.50					30 34 38	
	Firm brown very sandy slightly silty gravellly CLAY. Sand is fine to medium. Gravel is fine to coarse subangular to subrounded.		0.80	83.00		AA181992	B	0.50-0.60	67 74 78	
1.0 2.0	Stiff brown very sandy gravelly CLAY with a medium cobble content. Sand is fine to coarse. Gravel is fine to coarse subrounded. Cobbles are subrounded to rounded of limestone.		2.30	81.50		AA181993	B	1.40-1.50		
3.0	Obstruction - Possible Boulders Boulders from 2.30m End of Trial Pit at 2.80m									

Groundwater Conditions
Dry

Stability
Good

General Remarks
Pit footprint scanned using cable avoidance tool [CAT]. Shear vanes (set of three) carried out at both 0.20m & 0.50m bgl. Vane attempted at 0.70m - too gravelly. Pit backfilled with arisings.

TRIAL PIT RECORD

REPORT NUMBER 24330

CONTRACT Halverstown

TRIAL PIT NO. TP32

SHEET Sheet 1 of 1

LOGGED BY MB

CO-ORDINATES 686,084.15 E
719,879.36 N

GROUND LEVEL (m) 83.16

DATE STARTED 17/10/2022

DATE COMPLETED 17/10/2022

CLIENT

ENGINEER DOBA

EXCAVATION METHOD 7t Hitachi

	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples			Vane Test (KPa)	Hand Penetrometer (KPa)
						Sample Ref	Type	Depth		
0.0	TOPSOIL: Soft brown gravelly sandy CLAY with roolets. Sand is fine to coarse. Gravel is fine to medium subrounded.									
	Firm brown very sandy slightly gravelly silty CLAY. Sand is fine to coarse. Gravel is fine to coarse subrounded.Cobbles are subrounded to rounded of limestone.		0.30	82.86		AA181994	B	0.50-0.60	25 34 29 50 56 58	
1.0	Stiff brown very sandy slightly silty gravelly CLAY with a medium cobble content.Sand is fine to coarse. Gravel is fine to coarse subrounded. Cobbles are subrounded to rounded of limestone.		0.80	82.36		AA181995	B	1.40-1.50		
2.0										
	Stiff greyish brown sandy gravelly clayey SILT with a medium cobble content and occassional boulders. Sand is fine to coarse. Gravel is fine to coarse subrounded. Cobbles and boulders are subrounded to rounded of limestone.		2.30	80.86		AA181996	B	2.50-2.60		
	End of Trial Pit at 2.30m		2.80	80.36						
3.0										

Groundwater Conditions
Dry

Stability
Good

General Remarks
Pit footprint scanned using cable avoidance tool [CAT]. Shear vanes (set of three) carried out at both 0.20m & 0.50m bgl. Vane attempted at 0.70m - too stiff. Pit backfilled with arisings.

TRIAL PIT RECORD

REPORT NUMBER 24330

CONTRACT Halverstown

TRIAL PIT NO. TP33

SHEET Sheet 1 of 1

LOGGED BY MB

CO-ORDINATES 686,199.88 E
719,934.90 N

GROUND LEVEL (m) 84.73

DATE STARTED 17/10/2022

DATE COMPLETED 17/10/2022

CLIENT

ENGINEER DOBA

EXCAVATION METHOD 7t Hitachi

	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples			Vane Test (KPa)	Hand Penetrometer (KPa)
						Sample Ref	Type	Depth		
0.0	TOPSOIL: Soft brown gravelly sandy CLAY with roolets. Sand is fine to coarse. Gravel is fine to medium subrounded.								25 26 32	
	Firm brown very sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is fine to coarse subrounded.Cobbles are subrounded to rounded of limestone.		0.40	84.33		AA181989	B	0.50-0.60	51 53 48 58 62 63	
1.0	Stiff brown very sandy slightly silty gravelly CLAY with a medium cobble content.Sand is fine to coarse. Gravel is fine to coarse subrounded. Cobbles are subrounded to rounded of limestone.		0.90	83.83		AA181990	B	1.40-1.50		
2.0	Firm to stiff brown sandy gravelly clayey SILT with a medium cobble content and ocassional boulders. Sand is fine to coarse. Gravel is fine to coarse subrounded.Cobbles and bouldes are subrounded to rounded of limestone. Boulder at 2.70m (up to 500mm)		2.20	82.53		AA181991	B	2.50-2.60		
	End of Trial Pit at 2.80m		2.80	81.93						
3.0										

Groundwater Conditions
Dry

Stability
Good

General Remarks
Pit footprint scanned using cable avoidance tool [CAT]. Shear vanes (set of three) carried out at 0.20m, 0.50m & 0.70m bgl. Pit backfilled with arisings.

TRIAL PIT RECORD

REPORT NUMBER	24330		
CONTRACT	Halverstown	**TRIAL PIT NO.**	TP34
		SHEET	Sheet 1 of 1
LOGGED BY	MB	**DATE STARTED**	17/10/2022
CO-ORDINATES	686,182.78 E 719,866.42 N	**DATE COMPLETED**	17/10/2022
GROUND LEVEL (m)	83.94	**EXCAVATION METHOD**	7t Hitachi
CLIENT			
ENGINEER	DOBA		

	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples: Sample Ref	Samples: Type	Samples: Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0	TOPSOIL: Soft brown gravelly sandy CLAY with roolets. Sand is fine to coarse. Gravel is fine to medium subrounded.		0.30	83.64					25 23 26	
	Firm brown sandy slightly gravelly silty CLAY.Sand is fine to coarse. Gravel is fine to coarse subrounded.		0.90	83.04		AA181986	B	0.50-0.60	48 51 53 64 63 67	
1.0 2.0	Stiff brown very sandy slightly silty gravelly CLAY with a medium cobble content.Sand is fine to coarse. Gravel is fine to coarse subrounded. Cobbles are subrounded to rounded of limestone.		2.40	81.54		AA181987	B	1.40-1.50		
	Firm to stiff brown very sandy silty gravelly CLAY with a medium cobble content.Sand is fine to coarse. Gravel is fine to coarse subrounded. Cobbles are subrounded to rounded of limestone. Large boulder at 2.60m (up to 900mm)		3.00	80.94		AA181988	B	2.50-2.60		
3.0	End of Trial Pit at 3.00m									

Groundwater Conditions
Dry

Stability
Good

General Remarks
Pit footprint scanned using cable avoidance tool [CAT]. Shear vanes (set of three) carried out at 0.20m, 0.50m & 0.80m bgl. Pit backfilled with arisings.

TP01 – 1 of 3

TP01 – 2 of 3

TP01 – 3 of 3

TP02 – 1 of 3

TP02 – 2 of 3

TP02 – 3 of 3

TP03 – 1 of 3

TP03 – 2 of 3

TP03 – 3 of 3

TP04 – 1 of 3

TP04 – 2 of 3

TP04 – 3 of 3

TP05 – 1 of 4

TP05 – 2 of 4

TP05 – 3 of 4

TP05– 4 of 4

TP06 – 1 of 3

TP06 – 2 of 3

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TP07 – 1 of 3

TP07 – 2 of 3

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TP08 – 1 of 3

TP08 – 2 of 3

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TP09 – 1 of 3

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TP09 – 3 of 3

TP10 – 1 of 3

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TP11– 1 of 3

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TP31 – 1 of 3

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TP32 – 1 of 3

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TP32 – 3 of 3

TP33 – 1 of 4

TP33 – 2 of 4

TP33 – 3 of 4

TP33 – 4 of 4

TP34 – 1 of 4

TP34 – 2 of 4

<u>TP34 – 3 of 4</u>

<u>TP34 – 4 of 4</u>

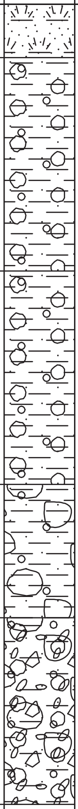
Appendix 1A

Trial Pit Logs (TP/RO) and Photographs

TRIAL PIT RECORD

REPORT NUMBER 24330

CONTRACT	Halverstown	**TRIAL PIT NO.**	**TP/RO01**
		SHEET	Sheet 1 of 1
LOGGED BY	IC	**DATE STARTED**	27/04/2023
CO-ORDINATES	686,147.64 E 719,931.87 N	**DATE COMPLETED**	27/04/2023
GROUND LEVEL (m)	84.10	**EXCAVATION METHOD**	13t Tracked Excavator
CLIENT			
ENGINEER	DOBA		



	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples: Sample Ref	Samples: Type	Samples: Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0	TOPSOIL: Soft to firm brown sandy clay with roolets. Sand is fine to coarse.		0.20	83.90						
	Firm greyish light brown very sandy gravelly CLAY with medium cobble content. Sand is fine to coarse. Gravel is fine to coarse subrounded to subangular. Cobbles are rounded to subangular of limestone.		1.00	83.10		AA198171	B	0.60-0.60	85 110	
1.0	Firm to stiff grey/brown very sandy very gravelly CLAY with high cobble content. Sand is fine to coarse. Gravel is fine to coarse subrounded to subangular. Cobbles are rounded to subangular of limestone.		1.80	82.30		AA198172	B	1.50-1.50		
2.0	Soft to firm grey/brown very sandy very gravelly CLAY with high cobble and medium boulder content. Sand is fine to coarse. Gravel is fine to coarse subrounded. Cobbles are rounded to subangular of limestone. Boulders are subrounded.		2.30	81.80		AA198173	B	2.10-2.10		
	Grey/brown sandy very clayey GRAVEL with high cobble and medium boulder content. Sand is fine to coarse. Gravel is fine to coarse subrounded to subangular. Cobbles are rounded to subangular of limestone. Boulders are subrounded of limestone (up to 400mm).		3.00	81.10	1 ▼ (Seepage)	AA198174	B	2.80-2.80		
3.0	End of Trial Pit at 3.00m									

Groundwater Conditions
Seepage at 2.40m

Stability
Slightly unstable from 1.90m

General Remarks
Pit footprint scanned using cable avoidance tool [CAT]. Shear vanes (set of three) carried out at 0.30m & 0.70m bgl. Pit backfilled with arisings.

TRIAL PIT RECORD

REPORT NUMBER 24330

CONTRACT	Halverstown	**TRIAL PIT NO.**	**TP/RO02**
		SHEET	Sheet 1 of 1
LOGGED BY	IC	**DATE STARTED**	02/05/2023
CO-ORDINATES	686,076.88 E 719,826.77 N	**DATE COMPLETED**	02/05/2023
GROUND LEVEL (m)	82.58	**EXCAVATION METHOD**	13t Tracked Excavator
CLIENT			
ENGINEER	DOBA		

	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples: Sample Ref	Samples: Type	Samples: Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0	TOPSOIL: Soft to firm light brown sandy clay with roolets. Sand is fine to coarse.		0.15	82.43						
	Firm light brown very sandy CLAY with occasional cobbles. Gravel is fine to coarse subrounded to subangular. Cobbles are rounded to subangular of limestone.		0.60	81.98		AA198190	B	0.50-0.50	80	
1.0	Firm greyish brown sandy gravelly CLAY with occasional cobbles. Gravel is fine to coarse subrounded to subangular. Cobbles are rounded to subangular of limestone.		1.20	81.38					105	
	Grey/brown slightly sandy very clayey GRAVEL with medium cobble content and occasional boulders. Sand is fine to coarse. Gravel is fine to coarse subrounded to subangular. Cobbles are rounded to subangular of limestone. Boulders are subrounded of limestone (up to 300mm).		1.80	80.78		AA198191	B	1.50-1.50		
2.0	Soft to firm brown slightly clayey very gravelly SAND with occasional cobbles, (possible sandy gravel). Sand is fine to coarse. Gravel is fine to coarse rounded to subangular. Cobbles are rounded to subangular of limestone.		2.20	80.38	1 (Seepage)	AA198192	B	2.00-2.00		
	Grey/brown sandy clayey GRAVEL with medium cobble and low boulder content. Sand is fine to coarse. Gravel is fine to coarse subrounded to subangular. Cobbles are rounded to subangular of limestone. Boulders are subrounded of limestone.		2.50	80.08		AA198193	B	2.50-2.50		
3.0	TP terminated due to major instability End of Trial Pit at 2.50m									

Groundwater Conditions
Seepage at 2.10m

Stability
Unstable from 0.40m

General Remarks
Pit footprint scanned using cable avoidance tool [CAT]. Shear vanes (set of three) carried out at 0.30m & 0.70m bgl. Pit backfilled with arisings.

TRIAL PIT RECORD

REPORT NUMBER 24330

CONTRACT	Halverstown	**TRIAL PIT NO.**	**TP/RO03**
		SHEET	Sheet 1 of 1
LOGGED BY	IC	**DATE STARTED**	02/05/2023
CO-ORDINATES	686,269.42 E 719,719.55 N	**DATE COMPLETED**	02/05/2023
GROUND LEVEL (m)	81.59	**EXCAVATION METHOD**	13t Tracked Excavator
CLIENT			
ENGINEER	DOBA		

	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples: Sample Ref	Samples: Type	Samples: Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0	TOPSOIL: Soft to firm light brown sandy clay with roolets. Sand is fine to coarse.		0.15	81.44						
	Firm light brown sandy CLAY with occasional cobbles. Gravel is fine to coarse subrounded to subangular. Cobbles are rounded to subangular of limestone.		0.50	81.09					90	
	Firm brown mottled golden brown and grey sandy slightly gravelly CLAY with occasional cobbles and occasional boulders. Sand is fine to coarse. Gravel is fine to coarse subrounded to subangular. Cobbles are rounded to subangular of limestone. Boulders are subrounded of limestone.		0.80	80.79		AA198187	B	0.50-0.50	87	
1.0	Firm light brown sandy very gravelly CLAY with high cobble content and medium boulder content. Sand is fine to coarse. Gravel is fine to coarse rounded to subangular. Cobbles are rounded to subangular of limestone. Boulders are subrounded of limestone.		2.30	79.29	1 (Seepage) 2 (Rapid)	AA198188 AA198189	B B	1.50-1.50 2.10-2.10		
2.0	TP terminated due to major instability and rapid water flow End of Trial Pit at 2.30m									
3.0										

Groundwater Conditions
Seepage at 1.50m; rapid water flow at 2.0m

Stability
Unstable from 1.00m

General Remarks
Pit footprint scanned using cable avoidance tool [CAT]. Shear vanes (set of three) carried out at 0.30m & 0.70m bgl. Pit backfilled with arisings.

TRIAL PIT RECORD

REPORT NUMBER 24330

CONTRACT	Halverstown	**TRIAL PIT NO.**	**TP/RO04**
		SHEET	Sheet 1 of 1
LOGGED BY	IC	**DATE STARTED**	02/05/2023
CO-ORDINATES	686,165.76 E 719,660.76 N	**DATE COMPLETED**	02/05/2023
GROUND LEVEL (m)	80.35	**EXCAVATION METHOD**	13t Tracked Excavator
CLIENT			
ENGINEER	DOBA		

	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples			Vane Test (KPa)	Hand Penetrometer (KPa)
						Sample Ref	Type	Depth		
0.0	TOPSOIL: Soft to firm light brown sandy clay with roolets. Sand is fine to coarse.		0.15	80.20						
	Firm light brown slightly sandy CLAY. Sand is fine to coarse.		0.30	80.05						
	Firm yellowish brown very sandy gravelly CLAY with occasional cobbles. Sand is fine to coarse. Gravel is fine to coarse rounded to subangular. Cobbles are rounded to subangular of limestone.		1.00	79.35		AA193200	B	0.50-0.50	85 65	
1.0	Soft to firm light brown sandy very gravelly CLAY with high cobble content and medium boulder content. Sand is fine to coarse. Gravel is fine to coarse rounded to subangular. Cobbles are rounded to subangular of limestone. Boulders are subrounded of limestone.		1.70	78.65		AA193201	B	1.50-1.50		
2.0	Grey/brown sandy very clayey GRAVEL with high cobble content and occasional boulders. Sand is fine to coarse. Gravel is fine to coarse rounded to subangular. Cobbles are rounded to subangular of limestone. Boulders are subrounded of limestone.		2.30	78.05	▼1 (Rapid)	AA193202	B	2.20-2.20		
	TP terminated due to major instability and rapid water flow End of Trial Pit at 2.30m									
3.0										

Groundwater Conditions
Rapid water flow at 1.80m

Stability
Unstable from 1.50m

General Remarks
Pit footprint scanned using cable avoidance tool [CAT]. Shear vanes (set of three) carried out at 0.40m & 0.70m bgl. Pit backfilled with arisings.

TRIAL PIT RECORD

REPORT NUMBER	24330
CONTRACT	Halverstown
TRIAL PIT NO.	**TP/RO05**
SHEET	Sheet 1 of 1
LOGGED BY	IC
CO-ORDINATES	686,384.21 E 719,792.15 N
GROUND LEVEL (m)	84.68
DATE STARTED	27/04/2023
DATE COMPLETED	27/04/2023
CLIENT	
ENGINEER	DOBA
EXCAVATION METHOD	13t Tracked Excavator

	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples: Sample Ref	Samples: Type	Samples: Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0	TOPSOIL: Firm brown sandy clay with roolets. Sand is fine to coarse.		0.15	84.53						
	Firm brown sandy slightly gravelly CLAY with occasional cobbles. Sand is fine to coarse. Gravel is fine to coarse rounded to subangular. Cobbles are rounded to subangular of limestone.		0.80	83.88		AA198237	B	0.50-0.50	90	
1.0	Firm yellowish brown sandy very gravelly CLAY with occasional cobbles. Sand is fine to coarse. Gravel is fine to coarse rounded to subangular. Cobbles are rounded to subangular of limestone and mudstone.		1.50	83.18		AA198238	B	1.20-1.20	110	
2.0	Brownish grey sandy clayey GRAVEL with medium cobble and medium boulder content. Sand is fine to coarse. Gravel is fine to coarse rounded to subangular. Cobbles are rounded to subangular of limestone. Boulders are subrounded of limestone.		2.90	81.78	1 (Moderate)	AA198239	B	2.10-2.10		
3.0	Firm grey/brown sandy very gravelly CLAY with medium cobble and medium boulder content. Sand is fine to coarse. Gravel is fine to coarse rounded to subangular. Cobbles are rounded to subangular of limestone. Boulders are subrounded of limestone.		3.60	81.08		AA198240	B	3.30-3.30		
	End of Trial Pit at 3.60m									

Groundwater Conditions
Moderate flow at 2.30m

Stability
Slightly unstable from 1.50m

General Remarks
Pit footprint scanned using cable avoidance tool [CAT]. Shear vanes (set of three) carried out at 0.40m & 0.80m bgl. Pit backfilled with arisings.

TRIAL PIT RECORD

REPORT NUMBER 24330

CONTRACT	Halverstown	**TRIAL PIT NO.**	**TP/RO06**
		SHEET	Sheet 1 of 1
LOGGED BY	IC	**DATE STARTED**	26/04/2023
CO-ORDINATES	686,490.29 E 719,819.15 N	**DATE COMPLETED**	26/04/2023
GROUND LEVEL (m)	84.92	**EXCAVATION METHOD**	13t Tracked Excavator
CLIENT			
ENGINEER	DOBA		

	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples			Vane Test (KPa)	Hand Penetrometer (KPa)
						Sample Ref	Type	Depth		
0.0	TOPSOIL: Soft to firm brown sandy clay with roolets. Sand is fine to coarse.		0.15	84.77						
	Firm yellowish brown sandy CLAY. Sand is fine to coarse.		0.70	84.22		AA198233	B	0.50-0.50	92	
1.0	Firm to stiff greyish brown sandy slightly gravelly CLAY with occasional cobbles. Sand is fine to coarse. Gravel is fine to coarse rounded to subangular. Cobbles are rounded to subangular of limestone.		1.50	83.42		AA198234	B	1.10-1.10	97	
2.0	Soft to firm light brown sandy very gravelly CLAY with medium cobble content and occasional boulders. Sand is fine to coarse. Gravel is fine to coarse rounded to subangular. Cobbles are rounded to subangular of limestone. Boulders are subrounded of limestone (up to 500mm).		2.50	82.42	1 (Seepage)	AA198235	B	2.00-2.00		
3.0	Grey/brown sandy very clayey GRAVEL with high cobble and medium boulder content. Sand is fine to coarse. Gravel is fine to coarse rounded to subangular. Cobbles are rounded to subangular of limestone. Boulders are subrounded of limestone (up to 500mm).		3.30	81.62	2 (Seepage)	AA198236	B	3.20-3.20		
	End of Trial Pit at 3.30m									

Groundwater Conditions
Seepage at 2.0m and 3.0m

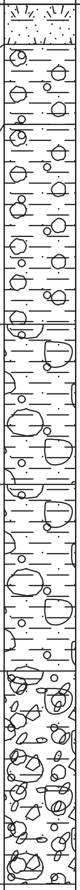
Stability
Slightly unstable from 1.50m

General Remarks
Pit footprint scanned using cable avoidance tool [CAT]. Shear vanes (set of three) carried out at 0.30m & 0.70m bgl. Pit backfilled with arisings.

TRIAL PIT RECORD

REPORT NUMBER 24330

CONTRACT	Halverstown	**TRIAL PIT NO.**	**TP/RO07**
		SHEET	Sheet 1 of 1
LOGGED BY	IC	**DATE STARTED**	26/04/2023
CO-ORDINATES	686,613.61 E 719,733.59 N	**DATE COMPLETED**	26/04/2023
GROUND LEVEL (m)	82.86	**EXCAVATION METHOD**	13t Tracked Excavator
CLIENT			
ENGINEER	DOBA		



	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples: Sample Ref	Samples: Type	Samples: Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0	TOPSOIL: Firm brown sandy clay with roolets. Sand is fine to coarse.		0.15	82.71						
	Firm brown sandy slightly gravelly CLAY with occasional cobbles. Sand is fine to medium. Gravel is fine to coarse rounded to subangular. Cobbles are rounded to subangular of limestone.		0.45	82.41		AA198233	B	0.40-0.40	100	
1.0	Firm greyish brown sandy gravelly CLAY with occasional cobbles, frequent pockets of sand. Sand is fine to coarse. Gravel is fine to coarse rounded to subangular. Cobbles are rounded to subangular of limestone.		1.20	81.66		AA198234	B	0.70-0.70	79	
	Firm brown mottled golden brown and grey sandy gravelly CLAY with medium cobble and medium boulder content, frequent pockets of sand. Sand is fine to medium. Gravel is fine to coarse rounded to subangular. Cobbles are rounded to subangular of limestone. Boulders are subrounded of limestone.		1.80	81.06	1 (Seepage)	AA198235	B	1.40-1.40		
2.0	Soft to firm light brown sandy very gravelly CLAY with medium cobble medium boulder content. Sand is fine to coarse. Gravel is fine to coarse rounded to subangular. Cobbles are rounded to subangular of limestone. Boulders are subrounded of limestone.		2.50	80.36	2 (Rapid)	AA198236	B	2.00-2.00		
3.0	Grey/brown sandy very clayey GRAVEL with high cobble and medium boulder content. Sand is fine to coarse. Gravel is fine to coarse rounded to angular. Cobbles are rounded to subangular of limestone. Boulders are subrounded of limestone.		3.30	79.56		AA198237	B	3.20-3.20		
	End of Trial Pit at 3.30m									

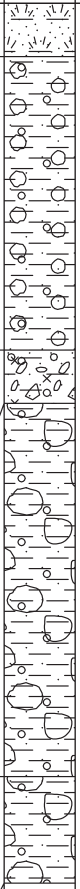
Groundwater Conditions
Seepage at 1.80m; rapid water flow at 2.40

Stability
Slightly unstable from 1.10m

General Remarks
Pit footprint scanned using cable avoidance tool [CAT]. Shear vanes (set of three) carried out at 0.30m & 0.70m bgl. Pit backfilled with arisings.

TRIAL PIT RECORD

REPORT NUMBER	24330		
CONTRACT	Halverstown	**TRIAL PIT NO.**	**TP/RO08**
		SHEET	Sheet 1 of 1
LOGGED BY	IC	**DATE STARTED**	27/04/2023
CO-ORDINATES	686,448.20 E 719,589.83 N	**DATE COMPLETED**	27/04/2023
GROUND LEVEL (m)	81.40	**EXCAVATION METHOD**	13t Tracked Excavator
CLIENT			
ENGINEER	DOBA		

Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples Sample Ref	Type	Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
TOPSOIL: Firm light brown sandy clay with roolets. Sand is fine to coarse.		0.20	81.20						
Firm greyish brown very sandy gravelly CLAY with occasional cobbles. Sand is fine to coarse. Gravel is fine to coarse rounded to subangular. Cobbles are rounded to subangular of limestone.		1.30	80.10		AA198167	B	0.60-0.60	112 70	
Grey/brown very sandy very clayey GRAVEL with high cobble content. Sand is fine to coarse. Gravel is fine to coarse rounded to angular. Cobbles are rounded to subangular of limestone.		1.50	79.90		AA198168	B	1.40-1.40		
Firm grey/brown sandy very gravelly CLAY with high cobble and medium boulder content. Sand is fine to coarse. Gravel is fine to coarse rounded to subangular. Cobbles are rounded to subangular of limestone. Boulders are subrounded of limestone.		2.90	78.50	1 (seepage)	AA198169	B	2.50-2.50		
Stiff to very stiff dark brown slightly sandy very gravelly CLAY with high cobble and medium boulder content. Sand is fine to coarse. Gravel is fine to coarse rounded to subangular. Cobbles are rounded to subangular of limestone. Boulders are subrounded of limestone (up to 300mm).		3.30	78.10		AA198170	B	3.30-3.30		
End of Trial Pit at 3.30m									

Groundwater Conditions
Seepage at 2.30m

Stability
Slightly unstable from 2.00m

General Remarks
Pit footprint scanned using cable avoidance tool [CAT]. Shear vanes (set of three) carried out at 0.40m & 0.80m bgl. Pit backfilled with arisings.

TRIAL PIT RECORD

REPORT NUMBER	24330		
CONTRACT	Halverstown	**TRIAL PIT NO.**	**TP/RO09**
		SHEET	Sheet 1 of 1
LOGGED BY	IC	**DATE STARTED**	28/04/2023
		DATE COMPLETED	28/04/2023
CO-ORDINATES	686,263.95 E 719,467.48 N	**EXCAVATION METHOD**	13t Tracked Excavator
GROUND LEVEL (m)	77.31		
CLIENT			
ENGINEER	DOBA		

	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples: Sample Ref	Samples: Type	Samples: Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0	TOPSOIL: Firm dark brown sandy clay with roolets. Sand is fine to coarse.		0.15	77.16						
	Firm dark brown sandy CLAY. Sand is fine to coarse.		0.30	77.01						
	Grey very sandy GRAVEL with medium cobble and medium boulder content. Sand is fine to coarse. Gravel is fine to coarse rounded to subangular. Cobbles are rounded to subangular of limestone. Boulders are subrounded of limestone.		1.00	76.31		AA198179	B	0.60-0.60	70	
1.0 2.0	Grey slightly gravelly silty SAND with rare cobbles of limestone.		2.80	74.51		AA198180 AA198176	B B	1.50-1.50 2.50-2.50		
3.0	TP terminated due to major instability End of Trial Pit at 2.80m									

Groundwater Conditions
Dry

Stability
Unstable from 2.80m

General Remarks
Pit footprint scanned using cable avoidance tool [CAT]. Shear vanes (set of three) carried out at 0.30m & 0.70m bgl. Pit backfilled with arisings.

TRIAL PIT RECORD

REPORT NUMBER	24330		
CONTRACT	Halverstown	**TRIAL PIT NO.**	**TP/RO10**
		SHEET	Sheet 1 of 1
LOGGED BY	IC	**DATE STARTED**	27/04/2023
CO-ORDINATES	686,258.36 E 719,471.03 N	**DATE COMPLETED**	27/04/2023
GROUND LEVEL (m)	77.27	**EXCAVATION METHOD**	13t Tracked Excavator
CLIENT			
ENGINEER	DOBA		

	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples			Vane Test (KPa)	Hand Penetrometer (KPa)
						Sample Ref	Type	Depth		
0.0	TOPSOIL: Firm brown sandy clay with roolets. Sand is fine to coarse.		0.20	77.07						
	Firm greyish brown very sandy gravelly CLAY with medium cobble content, frequent pockets of sand. Sand is fine to coarse. Gravel is fine to coarse rounded to subangular. Cobbles are rounded to subangular of limestone.		1.00	76.27		AA198163	B	0.60-0.60	72 110	
1.0	Soft to firm grey brown sandy very gravelly CLAY with high cobble content, frequent pockets of sand. Sand is fine to coarse. Gravel is fine to coarse rounded to subangular. Cobbles are rounded to subangular of limestone.		1.80	75.47		AA198164	B	1.50-1.50		
2.0	Firm grey brown sandy very gravelly CLAY with high cobble and medium boulder content, frequent pockets of sand. Sand is fine to coarse. Gravel is fine to coarse rounded to subangular. Cobbles are rounded to subangular of limestone. Boulders are subrounded of limestone.		2.70	74.57		AA198165	B	2.50-2.50		
3.0	Stiff to very stiff dark brown sandy very gravelly CLAY with medium cobble and medium boulder content. Sand is fine to coarse. Gravel is fine to coarse rounded to subangular. Cobbles are rounded to subangular of limestone. Boulders are subrounded of limestone (up to 300mm).		3.60	73.67		AA198166	B	3.50-3.50		
	End of Trial Pit at 3.60m									

Groundwater Conditions
Dry

Stability
Unstable from 0.40m

General Remarks
Pit footprint scanned using cable avoidance tool [CAT]. Shear vanes (set of three) carried out at 0.40m & 0.90m bgl. Pit backfilled with arisings.

TP/RO1 – 1 of 4

TP/RO1 – 2 of 4

TP/RO1 – 3 of 4

TP/RO1 – 4 of 4

TP/RO2 – 1 of 4

TP/RO2 – 2 of 4

TP/RO2 – 3 of 4

TP/RO2 – 4 of 4

TP/RO3 – 1 of 4

TP/RO3 – 2 of 4

TP/RO3 – 3 of 4

TP/RO3 – 4 of 4

TP/RO4 – 1 of 5

TP/RO4 – 2 of 5

TP/RO4 – 3 of 5

TP/RO4 – 4 of 5

TP/RO4 – 5 of 5

TP/RO5 – 1 of 4

TP/RO5 – 2 of 4

TP/RO5 – 3 of 4

TP/RO5 – 4 of 4

TP/RO6 – 1 of 4

TP/RO6 – 2 of 4

TP/RO6 – 3 of 4

TP/RO6 – 4 of 4

TP/RO7 – 1 of 4

TP/RO7 – 2 of 4

TP/RO7 – 3 of 4

TP/RO7 – 4 of 4

TP/RO8 – 1 of 4

TP/RO8 – 2 of 4

TP/RO8 – 3 of 4

TP/RO8 – 4 of 4

TP/RO9 – 1 of 5

TP/RO9 – 2 of 5

TP/RO9 – 3 of 5

TP/RO9 – 4 of 5

TP/RO9– 5 of 5

TP/RO10 – 1 of 4

TP/RO10 – 2 of 4

TP/RO10 – 3 of 4

TP/RO10 – 4 of 4

Appendix 2

Cable Percussion Borehole Records

GEOTECHNICAL BORING RECORD

REPORT NUMBER 24330

CONTRACT	Halverstown	**BOREHOLE NO.**	**BH01**
		SHEET	Sheet 1 of 1
CO-ORDINATES	686,116.61 E 719,653.02 N	**RIG TYPE**	Dando 2000
GROUND LEVEL (mOD)	80.04	**BOREHOLE DIAMETER (mm)**	200
		BOREHOLE DEPTH (m)	3.10
		DATE COMMENCED	03/11/2022
		DATE COMPLETED	03/11/2022
CLIENT		**SPT HAMMER REF. NO.**	
ENGINEER	DOBA	**ENERGY RATIO (%)**	
BORED BY	W.Cahill	**PROCESSED BY**	JL

Depth (m)	Description	Legend	Elevation	Depth (m)	Samples Ref. Number	Sample Type	Depth (m)	Recovery	Field Test Results	Standpipe Details
0	Soft to firm dark brown sandy gravelly silty CLAY									
1					AA184687	B	1.00-1.45		N = 10 (2, 2, 3, 2, 2, 3)	
			78.64	1.40						
	Firm to stiff dark brown sandy gravelly silty CLAY with cobbles and boulders									
2					AA184688	B	2.00-2.45		N = 17 (3, 3, 3, 4, 5, 5)	
3			76.94	3.10					N = 50/40 mm (25, 50)	
	End of Borehole at 3.10 m									
4										

HARD STRATA BORING/CHISELLING

From (m)	To (m)	Time (h)	Comments
2.80	3.10	1.5	

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
2.80	2.80	No	1.30	20	Moderate

GROUNDWATER PROGRESS

Date	Hole Depth	Casing Depth	Depth to Water	Comments

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type

REMARKS CAT scanned location and hand dug inspection pit carried out.

Sample Legend

D - Small Disturbed (tub)	UT - Undisturbed 100mm Diameter Sample
B - Bulk Disturbed	P - Undisturbed Piston Sample
LB - Large Bulk Disturbed	W - Water Sample
Env - Environmental Sample (Jar + Vial + Tub)	

GEOTECHNICAL BORING RECORD

REPORT NUMBER 24330

CONTRACT	Halverstown	**BOREHOLE NO.**	**BH02**
		SHEET	Sheet 1 of 1
CO-ORDINATES	686,178.44 E 719,760.90 N	**RIG TYPE**	Dando 2000
GROUND LEVEL (mOD)	81.86	**BOREHOLE DIAMETER (mm)**	200
		BOREHOLE DEPTH (m)	1.80
		DATE COMMENCED	03/11/2022
		DATE COMPLETED	03/11/2022
CLIENT		**SPT HAMMER REF. NO.**	
ENGINEER	DOBA	**ENERGY RATIO (%)**	
BORED BY	W.Cahill	**PROCESSED BY**	JL

Depth (m)	Description	Legend	Elevation	Depth (m)	Samples Ref. Number	Samples Sample Type	Samples Depth (m)	Samples Recovery	Field Test Results	Standpipe Details
0	Firm dark brown sandy gravelly silty CLAY									
1					AA184689	B	1.00-1.45		N = 13 (2, 2, 3, 3, 3, 4)	
			80.36	1.50						
	Stiff light brown very sandy gravelly CLAY with cobbles and boulders		80.06	1.80						
	End of Borehole at 1.80 m									
2										
3										
4										

HARD STRATA BORING/CHISELLING

From (m)	To (m)	Time (h)	Comments
1.50	1.80	1.5	

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
					No water strike

GROUNDWATER PROGRESS

Date	Hole Depth	Casing Depth	Depth to Water	Comments

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type

REMARKS CAT scanned location and hand dug inspection pit carried out.

Sample Legend
D - Small Disturbed (tub)
B - Bulk Disturbed
LB - Large Bulk Disturbed
Env - Environmental Sample (Jar + Vial + Tub)
UT - Undisturbed 100mm Diameter Sample
P - Undisturbed Piston Sample
W - Water Sample

GEOTECHNICAL BORING RECORD

REPORT NUMBER 24330

CONTRACT	Halverstown	**BOREHOLE NO.**	**BH03**
		SHEET	Sheet 1 of 1
CO-ORDINATES	686,206.06 E 719,531.92 N	**RIG TYPE**	Dando 2000
GROUND LEVEL (mOD)	78.62	**BOREHOLE DIAMETER (mm)**	200
		BOREHOLE DEPTH (m)	3.80
		DATE COMMENCED	03/11/2022
		DATE COMPLETED	04/11/2022
CLIENT		**SPT HAMMER REF. NO.**	
ENGINEER	DOBA	**ENERGY RATIO (%)**	
		BORED BY	W.Cahill
		PROCESSED BY	JL

Depth (m)	Description	Legend	Elevation	Depth (m)	Samples Ref. Number	Sample Type	Depth (m)	Recovery	Field Test Results	Standpipe Details
0	Firm to stiff and stiff dark brown sandy gravelly silty CLAY									
1					AA184690	B	1.00-1.45		N = 23 (2, 3, 3, 5, 6, 9)	
			77.12	1.50						
	Stiff light brown very sandy gravelly CLAY									
2					AA184691	B	2.00-2.45		N = 35 (4, 6, 6, 8, 10, 11)	
3					AA184692	B	3.00-3.45		N = 48 (6, 7, 9, 10, 14, 15)	
			75.52	3.10						
	Very stiff dark and light brown sandy gravelly silty CLAY with cobbles									
			74.82	3.80						
	End of Borehole at 3.80 m									
4										

HARD STRATA BORING/CHISELLING

From (m)	To (m)	Time (h)	Comments
3.50	3.80	1.5	

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
2.70	2.70	No	0.60	20	Moderate

GROUNDWATER PROGRESS

Date	Hole Depth	Casing Depth	Depth to Water	Comments

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type
04-11-22	3.80	1.00	3.80	50mm SP

REMARKS CAT scanned location and hand dug inspection pit carried out.

Sample Legend

D - Small Disturbed (tub)	UT - Undisturbed 100mm Diameter Sample
B - Bulk Disturbed	P - Undisturbed Piston Sample
LB - Large Bulk Disturbed	W - Water Sample
Env - Environmental Sample (Jar + Vial + Tub)	

GEOTECHNICAL BORING RECORD

REPORT NUMBER 24330

CONTRACT	Halverstown	**BOREHOLE NO.**	**BH04**
		SHEET	Sheet 1 of 1
CO-ORDINATES	686,291.68 E 719,659.60 N	**RIG TYPE**	Dando 2000
GROUND LEVEL (mOD)	81.06	**BOREHOLE DIAMETER (mm)**	200
		BOREHOLE DEPTH (m)	2.80
		DATE COMMENCED	04/11/2022
		DATE COMPLETED	04/11/2022
CLIENT		**SPT HAMMER REF. NO.**	
ENGINEER	DOBA	**ENERGY RATIO (%)**	
BORED BY	W.Cahill	**PROCESSED BY**	JL

Depth (m)	Description	Legend	Elevation	Depth (m)	Samples: Ref. Number	Sample Type	Depth (m)	Recovery	Field Test Results	Standpipe Details
0	Firm dark brown sandy gravelly silty CLAY									
1			79.86	1.20	AA184693	B	1.00-1.45		N = 11 (2, 3, 3, 3, 2, 3)	
	Firm to stiff and stiff dark and light brown sandy gravelly silty CLAY with cobbles and boulders									
2			78.26	2.80	AA184694	B	2.00-2.45		N = 20 (3, 2, 4, 4, 5, 7)	
3	End of Borehole at 2.80 m									
4										

HARD STRATA BORING/CHISELLING

From (m)	To (m)	Time (h)	Comments
2.60	2.80	1.5	

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
1.60	1.60	No	0.60	20	Slow

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type

GROUNDWATER PROGRESS

Date	Hole Depth	Casing Depth	Depth to Water	Comments

REMARKS CAT scanned location and hand dug inspection pit carried out.

Sample Legend
D - Small Disturbed (tub)
B - Bulk Disturbed
LB - Large Bulk Disturbed
Env - Environmental Sample (Jar + Vial + Tub)
UT - Undisturbed 100mm Diameter Sample
P - Undisturbed Piston Sample
W - Water Sample

GEOTECHNICAL BORING RECORD

REPORT NUMBER 24330

CONTRACT	Halverstown	**BOREHOLE NO.**	**BH05**
		SHEET	Sheet 1 of 1
CO-ORDINATES	686,340.00 E 719,449.17 N	**RIG TYPE**	Dando 2000
		BOREHOLE DIAMETER (mm)	200
GROUND LEVEL (mOD)	77.88	**BOREHOLE DEPTH (m)**	3.60
		DATE COMMENCED	24/10/2022
		DATE COMPLETED	24/10/2022
CLIENT		**SPT HAMMER REF. NO.**	
ENGINEER	DOBA	**ENERGY RATIO (%)**	
BORED BY	W.Cahill	**PROCESSED BY**	FC

Depth (m)	Description	Legend	Elevation	Depth (m)	Samples Ref. Number	Sample Type	Depth (m)	Recovery	Field Test Results	Standpipe Details
0	TOPSOIL		77.73	0.15						
	Brown sandy SILT/CLAY with occasional fine gravel		77.58	0.30						
	Dark brown sandy SILT/CLAY with some gravel and occasional cobbles		77.08	0.80						
	Stff to very stiff dark brown sandy silty gravelly CLAY with occasional cobbles									
1					AA184670	B	1.00		N = 19 (2, 3, 4, 5, 6, 4)	
2					AA184671	B	2.00		N = 16 (3, 3, 4, 4, 3, 5)	
3					AA184672	B	3.00		N = 42 (4, 6, 6, 9, 11, 16)	
			74.28	3.60						
	Obstruction End of Borehole at 3.60 m									
4										

HARD STRATA BORING/CHISELLING

From (m)	To (m)	Time (h)	Comments
3.40	3.60	1.5	

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
2.80	2.80	No	1.50	20	Moderate

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type

GROUNDWATER PROGRESS

Date	Hole Depth	Casing Depth	Depth to Water	Comments

REMARKS CAT scanned location and hand dug inspection pit carried out.

Sample Legend

D - Small Disturbed (tub)	UT - Undisturbed 100mm Diameter Sample
B - Bulk Disturbed	P - Undisturbed Piston Sample
LB - Large Bulk Disturbed	W - Water Sample
Env - Environmental Sample (Jar + Vial + Tub)	

GEOTECHNICAL BORING RECORD

REPORT NUMBER 24330

CONTRACT Halverstown

BOREHOLE NO. **BH06**
SHEET Sheet 1 of 1

CO-ORDINATES 686,418.25 E
719,599.10 N
GROUND LEVEL (mOD) 81.29

RIG TYPE Dando 2000
BOREHOLE DIAMETER (mm) 200
BOREHOLE DEPTH (m) 1.10

DATE COMMENCED 21/10/2022
DATE COMPLETED 21/10/2022

CLIENT
ENGINEER DOBA

SPT HAMMER REF. NO.
ENERGY RATIO (%)

BORED BY W.Cahill
PROCESSED BY FC

Depth (m)	Description	Legend	Elevation	Depth (m)	Samples Ref. Number	Sample Type	Depth (m)	Recovery	Field Test Results	Standpipe Details
0	TOPSOIL		81.09	0.20						
	Light brown sandy SILT/CLAY with occasional fine gravel		80.19	1.10	AA184669	B	1.00		N = 48/225 mm (8, 11, 17, 27, 4)	
1	Very stiff light brown sandy silty CLAY with occasional cobbles End of Borehole at 1.10 m									
2										
3										
4										

HARD STRATA BORING/CHISELLING

From (m)	To (m)	Time (h)	Comments
0.90	1.10	1.5	

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
					No water strike

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type

GROUNDWATER PROGRESS

Date	Hole Depth	Casing Depth	Depth to Water	Comments

REMARKS CAT scanned location and hand dug inspection pit carried out.

Sample Legend
D - Small Disturbed (tub)
B - Bulk Disturbed
LB - Large Bulk Disturbed
Env - Environmental Sample (Jar + Vial + Tub)
UT - Undisturbed 100mm Diameter Sample
P - Undisturbed Piston Sample
W - Water Sample

GEOTECHNICAL BORING RECORD

REPORT NUMBER 24330

CONTRACT	Halverstown	**BOREHOLE NO.**	**BH07**
		SHEET	Sheet 1 of 1
CO-ORDINATES	686,452.03 E 719,373.68 N	**RIG TYPE**	Dando 2000
		BOREHOLE DIAMETER (mm)	200
GROUND LEVEL (mOD)	77.94	**BOREHOLE DEPTH (m)**	2.80
		DATE COMMENCED	21/10/2022
		DATE COMPLETED	21/10/2022
CLIENT		**SPT HAMMER REF. NO.**	
ENGINEER	DOBA	**ENERGY RATIO (%)**	
BORED BY	W.Cahill	**PROCESSED BY**	FC

Depth (m)	Description	Legend	Elevation	Depth (m)	Samples: Ref. Number	Sample Type	Depth (m)	Recovery	Field Test Results	Standpipe Details
0	TOPSOIL		77.74	0.20						
	Brown sandy SILT/CLAY with occasional fine gravel		77.44	0.50						
	Soft dark brown sandy SILT/CLAY with occasional cobbles									
1					AA184673	B	1.00		N = 7 (1, 1, 2, 2, 1, 2)	
			76.24	1.70						
	Stiff dark brown sandy silty gravelly CLAY with some cobbles									
2					AA184674	B	2.00		N = 29 (2, 4, 4, 6, 8, 11)	
			75.14	2.80						
3	Obstruction End of Borehole at 2.80 m									
4										

HARD STRATA BORING/CHISELLING

From (m)	To (m)	Time (h)	Comments
2.60	2.80	1.5	

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
1.30	1.30	No	0.90	20	Slow

GROUNDWATER PROGRESS

Date	Hole Depth	Casing Depth	Depth to Water	Comments

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type

REMARKS CAT scanned location and hand dug inspection pit carried out.

Sample Legend

D - Small Disturbed (tub)	UT - Undisturbed 100mm Diameter Sample
B - Bulk Disturbed	P - Undisturbed Piston Sample
LB - Large Bulk Disturbed	W - Water Sample
Env - Environmental Sample (Jar + Vial + Tub)	

GEOTECHNICAL BORING RECORD

REPORT NUMBER	24330
CONTRACT	Halverstown
BOREHOLE NO.	**BH08**
SHEET	Sheet 1 of 1
CO-ORDINATES	686,549.61 E 719,522.50 N
GROUND LEVEL (mOD)	81.03
RIG TYPE	Dando 2000
BOREHOLE DIAMETER (mm)	200
BOREHOLE DEPTH (m)	1.30
DATE COMMENCED	21/10/2022
DATE COMPLETED	21/10/2022
CLIENT	
ENGINEER	DOBA
SPT HAMMER REF. NO.	
ENERGY RATIO (%)	
BORED BY	W.Cahill
PROCESSED BY	FC

Depth (m)	Description	Legend	Elevation	Depth (m)	Samples				Field Test Results	Standpipe Details
					Ref. Number	Sample Type	Depth (m)	Recovery		
0	TOPSOIL		80.83	0.20						▨
	Light brown sandy SILT/CLAY with occasional fine gravel		80.63	0.40						▨
	Very stiff light brown sandy silty CLAY with occasional cobbles									▨
1					AA184668	B	1.00		N = 50/225 mm (8, 11, 17, 29, 4)	▨
			79.73	1.30						▨
	Obstruction End of Borehole at 1.30 m									
2										
3										
4										

HARD STRATA BORING/CHISELLING

From (m)	To (m)	Time (h)	Comments
1.10	1.30	1.5	

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
					No water strike

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type

GROUNDWATER PROGRESS

Date	Hole Depth	Casing Depth	Depth to Water	Comments

REMARKS CAT scanned location and hand dug inspection pit carried out.

Sample Legend

D - Small Disturbed (tub)
B - Bulk Disturbed
LB - Large Bulk Disturbed
Env - Environmental Sample (Jar + Vial + Tub)
UT - Undisturbed 100mm Diameter Sample
P - Undisturbed Piston Sample
W - Water Sample

GEOTECHNICAL BORING RECORD

REPORT NUMBER 24330

CONTRACT	Halverstown	**BOREHOLE NO.**	**BH09**
		SHEET	Sheet 1 of 1
CO-ORDINATES	686,290.64 E 719,822.45 N	**RIG TYPE**	Dando 2000
		BOREHOLE DIAMETER (mm)	200
GROUND LEVEL (mOD)	83.98	**BOREHOLE DEPTH (m)**	3.90
		DATE COMMENCED	27/10/2022
		DATE COMPLETED	27/10/2022
CLIENT		**SPT HAMMER REF. NO.**	
ENGINEER	DOBA	**ENERGY RATIO (%)**	
BORED BY	W.Cahill	**PROCESSED BY**	FC

Depth (m)	Description	Legend	Elevation	Depth (m)	Samples: Ref. Number	Sample Type	Depth (m)	Recovery	Field Test Results	Standpipe Details
0	TOPSOIL		83.78	0.20						
	Brown sandy SILT/CLAY with occasional fine gravel		83.53	0.45						
	Firm to stiff mottled light/dark brown sandy silty CLAY with occasional cobbles		80.18	3.80						
1					AA184679	B	1.00		N = 14 (2, 2, 3, 4, 3, 4)	
2					AA184680	B	2.00		N = 15 (2, 3, 3, 4, 4, 4)	
3					AA184681	B	3.00		N = 24 (3, 4, 5, 6, 6, 7)	
4	Obstruction End of Borehole at 3.90 m									

HARD STRATA BORING/CHISELLING

From (m)	To (m)	Time (h)	Comments
3.60	3.80	1.5	

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
					No water strike

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type

GROUNDWATER PROGRESS

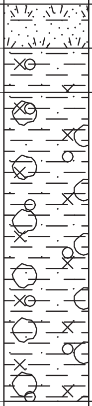
Date	Hole Depth	Casing Depth	Depth to Water	Comments

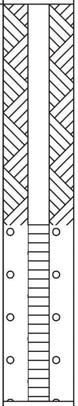
REMARKS CAT scanned location and hand dug inspection pit carried out.

Sample Legend
D - Small Disturbed (tub)
B - Bulk Disturbed
LB - Large Bulk Disturbed
Env - Environmental Sample (Jar + Vial + Tub)
UT - Undisturbed 100mm Diameter Sample
P - Undisturbed Piston Sample
W - Water Sample

GEOTECHNICAL BORING RECORD

REPORT NUMBER	24330
CONTRACT	Halverstown
BOREHOLE NO.	BH10
SHEET	Sheet 1 of 1
CO-ORDINATES	686,436.07 E 719,740.74 N
GROUND LEVEL (mOD)	84.79
RIG TYPE	Dando 2000
BOREHOLE DIAMETER (mm)	200
BOREHOLE DEPTH (m)	1.80
DATE COMMENCED	27/11/2022
DATE COMPLETED	27/11/2022
CLIENT	
ENGINEER	DOBA
SPT HAMMER REF. NO.	
ENERGY RATIO (%)	
BORED BY	W.Cahill
PROCESSED BY	FC





Depth (m)	Description	Legend	Elevation	Depth (m)	Samples Ref. Number	Sample Type	Depth (m)	Recovery	Field Test Results	Standpipe Details
0	TOPSOIL		84.59	0.20						
	Brown sandy SILT/CLAY with occasional fine gravel		84.39	0.40						
	Firm dark brown sandy SILT/CLAY with some gravel and occasional cobbles									
1					AA174678	B	1.00		N = 14 (2, 3, 3, 4, 3, 4)	
			82.99	1.80						
	Obstruction End of Borehole at 1.80 m									
2										
3										
4										

HARD STRATA BORING/CHISELLING

From (m)	To (m)	Time (h)	Comments
1.50	1.80	1.5	

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
					No water strike

GROUNDWATER PROGRESS

Date	Hole Depth	Casing Depth	Depth to Water	Comments

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type
27-10-22	1.80	1.00	1.80	50mm SP

REMARKS CAT scanned location and hand dug inspection pit carried out.

Sample Legend
D - Small Disturbed (tub)
B - Bulk Disturbed
LB - Large Bulk Disturbed
Env - Environmental Sample (Jar + Vial + Tub)
UT - Undisturbed 100mm Diameter Sample
P - Undisturbed Piston Sample
W - Water Sample

GEOTECHNICAL BORING RECORD

REPORT NUMBER 24330

CONTRACT Halverstown

BOREHOLE NO. **BH11**
SHEET Sheet 1 of 1

CO-ORDINATES 686,586.06 E
719,791.67 N
GROUND LEVEL (mOD) 83.53

RIG TYPE Dando 2000
BOREHOLE DIAMETER (mm) 200
BOREHOLE DEPTH (m) 3.30

DATE COMMENCED 26/10/2022
DATE COMPLETED 26/10/2022

CLIENT
ENGINEER DOBA

SPT HAMMER REF. NO.
ENERGY RATIO (%)

BORED BY W.Cahill
PROCESSED BY FC

Depth (m)	Description	Legend	Elevation	Depth (m)	Samples				Field Test Results	Standpipe Details
					Ref. Number	Sample Type	Depth (m)	Recovery		
0	TOPSOIL		83.38	0.15						
	Brown sandy SILT/CLAY with occasional fine gravel		83.23	0.30						
	Soft to firm dark brown sandy SILT/CLAY with some gravel and occasional cobbles									
1					AA184677	B	1.00		N = 10 (2, 2, 2, 3, 3, 2)	
2					AA184678	B	2.00		N = 20 (3, 3, 4, 5, 5, 6)	
			81.13	2.40						
	Stiff to very stiff light brown sandy sandy silty gravelly CLAY with some cobbles and occasional boulders									
3					AA184679	B	3.00		N = 50/150 mm (18, 7, 39, 11)	
			80.03	3.50						
	Obstruction End of Borehole at 3.30 m									
4										

HARD STRATA BORING/CHISELLING

From (m)	To (m)	Time (h)	Comments
3.00	3.30	1.5	

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
					No water strike

GROUNDWATER PROGRESS

Date	Hole Depth	Casing Depth	Depth to Water	Comments

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type

REMARKS CAT scanned location and hand dug inspection pit carried out.

Sample Legend
D - Small Disturbed (tub)
B - Bulk Disturbed
LB - Large Bulk Disturbed
Env - Environmental Sample (Jar + Vial + Tub)
UT - Undisturbed 100mm Diameter Sample
P - Undisturbed Piston Sample
W - Water Sample

GEOTECHNICAL BORING RECORD

REPORT NUMBER 24330

CONTRACT Halverstown

BOREHOLE NO. BH12
SHEET Sheet 1 of 1

CO-ORDINATES 686,747.60 E
719,716.71 N
GROUND LEVEL (mOD) 80.50

RIG TYPE Dando 2000
BOREHOLE DIAMETER (mm) 200
BOREHOLE DEPTH (m) 2.40

DATE COMMENCED 25/10/2022
DATE COMPLETED 25/10/2022

CLIENT
ENGINEER DOBA

SPT HAMMER REF. NO.
ENERGY RATIO (%)

BORED BY W.Cahill
PROCESSED BY FC

Depth (m)	Description	Legend	Elevation	Depth (m)	Samples: Ref. Number	Sample Type	Depth (m)	Recovery	Field Test Results	Standpipe Details
0	TOPSOIL		80.30	0.20						
	Dark brown sandy SILT/CLAY with occasional fine gravel		80.10	0.40						
1	Soft to firm light brown sandy silty gravellly CLAY with occasional cobbles		78.70	1.80	AA184675	B	1.00		N = 10 (2, 2, 2, 3, 2, 3)	
2	Very stiff light brown sandy silty gravellly CLAY with some cobbles		78.10	2.40	AA184676	B	2.00		N = 50/225 mm (8, 12, 16, 19, 15)	
3 4	Obstruction End of Borehole at 2.40 m									

HARD STRATA BORING/CHISELLING

From (m)	To (m)	Time (h)	Comments
2.20	2.40	1.5	

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
2.20	2.20	No	0.70	20	Moderate

GROUNDWATER PROGRESS

Date	Hole Depth	Casing Depth	Depth to Water	Comments

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type
25-10-22	2.40	1.00	2.40	50mm SP

REMARKS Very wet ground conditions. CAT scanned location and hand dug inspection pit carried out.

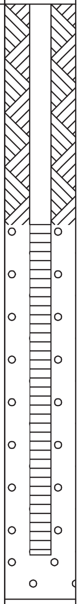
Sample Legend
D - Small Disturbed (tub)
B - Bulk Disturbed
LB - Large Bulk Disturbed
Env - Environmental Sample (Jar + Vial + Tub)
UT - Undisturbed 100mm Diameter Sample
P - Undisturbed Piston Sample
W - Water Sample

GEOTECHNICAL BORING RECORD

REPORT NUMBER 24330

CONTRACT	Halverstown	**BOREHOLE NO.**	**BH13**
		SHEET	Sheet 1 of 1
CO-ORDINATES	686,124.91 E 719,837.47 N	**RIG TYPE**	Dando 2000
		BOREHOLE DIAMETER (mm)	200
GROUND LEVEL (mOD)	82.80	**BOREHOLE DEPTH (m)**	2.70
		DATE COMMENCED	01/11/2022
		DATE COMPLETED	01/11/2022
CLIENT		**SPT HAMMER REF. NO.**	
ENGINEER	DOBA	**ENERGY RATIO (%)**	
BORED BY	W.Cahill	**PROCESSED BY**	JL

Depth (m)	Description	Legend	Elevation	Depth (m)	Samples: Ref. Number	Samples: Sample Type	Samples: Depth (m)	Samples: Recovery	Field Test Results	Standpipe Details
0	Firm brown sandy gravelly silty CLAY									
1					AA184685	B	1.00-1.45		N = 13 (2, 2, 3, 3, 4, 3)	
			81.20	1.60						
	Stiff brown sandy gravelly silty CLAY with cobbles and boulders									
2					AA184686	B	2.00-2.45		N = 34 (3, 3, 4, 7, 9, 14)	
			80.10	2.70						
	End of Borehole at 2.70 m									
3										
4										



HARD STRATA BORING/CHISELLING

From (m)	To (m)	Time (h)	Comments
2.40	2.70	1.5	

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
					No water strike

GROUNDWATER PROGRESS

Date	Hole Depth	Casing Depth	Depth to Water	Comments

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type
01-11-22	2.50	1.00	2.70	50mm SP

REMARKS CAT scanned location and hand dug inspection pit carried out.

Sample Legend
D - Small Disturbed (tub)
B - Bulk Disturbed
LB - Large Bulk Disturbed
Env - Environmental Sample (Jar + Vial + Tub)
UT - Undisturbed 100mm Diameter Sample
P - Undisturbed Piston Sample
W - Water Sample

GEOTECHNICAL BORING RECORD

REPORT NUMBER 24330

CONTRACT	Halverstown	**BOREHOLE NO.**	**BH14**
		SHEET	Sheet 1 of 1
CO-ORDINATES	686,152.24 E 719,976.74 N	**RIG TYPE**	Dando 2000
		BOREHOLE DIAMETER (mm)	200
GROUND LEVEL (mOD)	84.27	**BOREHOLE DEPTH (m)**	3.90
		DATE COMMENCED	28/10/2022
		DATE COMPLETED	28/10/2022
CLIENT		**SPT HAMMER REF. NO.**	
ENGINEER	DOBA	**ENERGY RATIO (%)**	
BORED BY	W.Cahill	**PROCESSED BY**	FC

Depth (m)	Description	Legend	Elevation	Depth (m)	Samples Ref. Number	Samples Sample Type	Samples Depth (m)	Samples Recovery	Field Test Results	Standpipe Details
0	TOPSOIL		84.12	0.15						
	Brown sandy SILT/CLAY with occasional gravel		83.87	0.40						
	Soft to firm dark brown sandy silty gravelly CLAY with some cobbles									
1					AA184682	B	1.00		N = 3 (0, 1, 1, 0, 1, 1)	
2					AA184683	B	2.00		N = 15 (2, 2, 3, 4, 3, 5)	
3					AA184684	B	3.00		N = 19 (4, 4, 5, 3, 5, 6)	
			80.37	3.90						
4	Obstruction End of Borehole at 3.90 m									

HARD STRATA BORING/CHISELLING

From (m)	To (m)	Time (h)	Comments
3.70	3.90	1.5	

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
					No water strike

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type

GROUNDWATER PROGRESS

Date	Hole Depth	Casing Depth	Depth to Water	Comments

REMARKS CAT scanned location and hand dug inspection pit carried out.

Sample Legend

D - Small Disturbed (tub)	UT - Undisturbed 100mm Diameter Sample
B - Bulk Disturbed	P - Undisturbed Piston Sample
LB - Large Bulk Disturbed	W - Water Sample
Env - Environmental Sample (Jar + Vial + Tub)	

Appendix 3

Dynamic Probehole Records

DYNAMIC PROBE RECORD

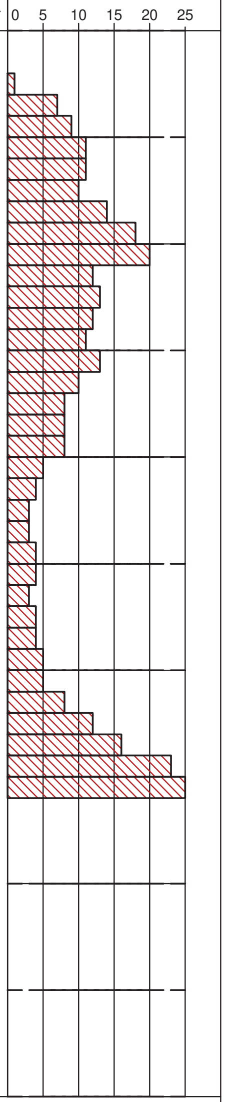
REPORT NUMBER 24330

CONTRACT	Halverstown	**PROBE NO.**	**DP01**
		SHEET	Sheet 1 of 1
CO-ORDINATES	686,043.01 E 719,643.63 N	**DATE COMMENCED**	13/10/2022
GROUND LEVEL (mOD)	78.58	**DATE COMPLETED**	24/10/2022
CLIENT		**PROBE TYPE**	DPH
ENGINEER	DOBA		
HAMMER MASS (kg)	50		
INCREMENT SIZE (mm)	100		
FALL HEIGHT (mm)	500		

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water
0.0	.				
3.60	End of Probe at 3.60 m			74.98	

Depth (m)	Probe Readings (Blows/Increment)
0.00	0
0.10	0
0.20	1
0.30	7
0.40	9
0.50	11
0.60	11
0.70	10
0.80	14
0.90	18
1.00	20
1.10	12
1.20	13
1.30	12
1.40	11
1.50	13
1.60	10
1.70	8
1.80	8
1.90	8
2.00	5
2.10	4
2.20	3
2.30	3
2.40	4
2.50	4
2.60	3
2.70	4
2.80	4
2.90	5
3.00	5
3.10	8
3.20	12
3.30	16
3.40	23
3.50	25

Graphic Probe Record



GROUNDWATER OBSERVATIONS

REMARKS

DYNAMIC PROBE RECORD

REPORT NUMBER 24330

CONTRACT Halverstown

PROBE NO. DP02
SHEET Sheet 1 of 1

CO-ORDINATES 686,126.87 E
719,587.15 N
GROUND LEVEL (mOD) 79.02

HAMMER MASS (kg) 50
INCREMENT SIZE (mm) 100
FALL HEIGHT (mm) 500

DATE COMMENCED 13/10/2022
DATE COMPLETED 24/10/2022

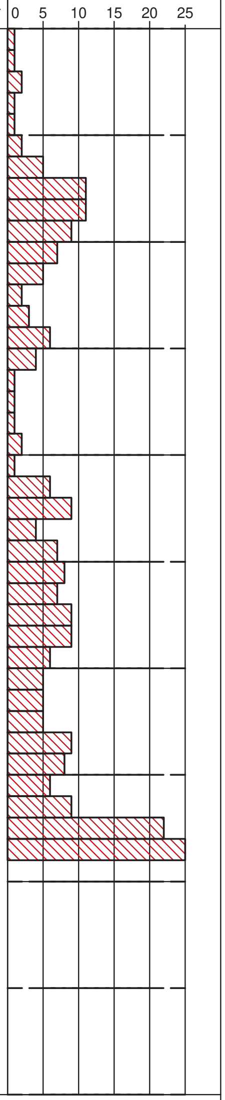
CLIENT
ENGINEER DOBA

PROBE TYPE DPH

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water
0.0	.				
3.90	End of Probe at 3.90 m			75.12	

Depth (m)	Probe Readings (Blows/Increment)
0.00	1
0.10	1
0.20	2
0.30	1
0.40	1
0.50	2
0.60	5
0.70	11
0.80	11
0.90	9
1.00	7
1.10	5
1.20	2
1.30	3
1.40	6
1.50	4
1.60	1
1.70	1
1.80	1
1.90	2
2.00	1
2.10	6
2.20	9
2.30	4
2.40	7
2.50	8
2.60	7
2.70	9
2.80	9
2.90	6
3.00	5
3.10	5
3.20	5
3.30	9
3.40	8
3.50	6
3.60	9
3.70	22
3.80	25

Graphic Probe Record



GROUNDWATER OBSERVATIONS

REMARKS

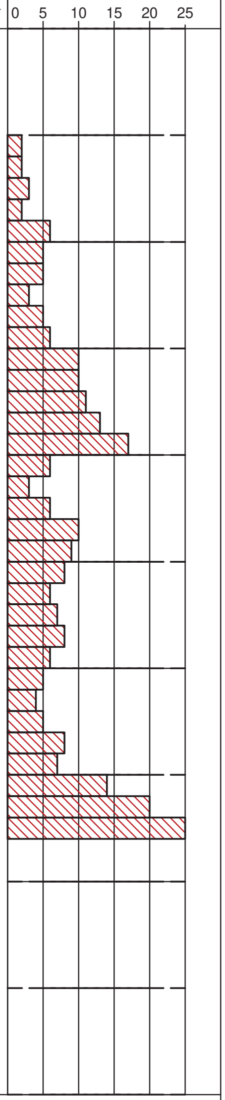
DYNAMIC PROBE RECORD

REPORT NUMBER 24330

CONTRACT	Halverstown	**PROBE NO.**	DP03
		SHEET	Sheet 1 of 1
CO-ORDINATES	686,108.07 E 719,656.12 N	**DATE COMMENCED**	13/10/2022
GROUND LEVEL (mOD)	79.95	**DATE COMPLETED**	24/10/2022
HAMMER MASS (kg)	50		
INCREMENT SIZE (mm)	100		
FALL HEIGHT (mm)	500	**PROBE TYPE**	DPH
CLIENT			
ENGINEER	DOBA		

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water	Depth (m)	Probe Readings (Blows/Increment)
0.0	.					0.00	0
						0.10	0
						0.20	0
						0.30	0
						0.40	0
						0.50	2
						0.60	2
						0.70	3
						0.80	2
						0.90	6
1.0						1.00	5
						1.10	5
						1.20	3
						1.30	5
						1.40	6
						1.50	10
						1.60	10
						1.70	11
						1.80	13
						1.90	17
2.0						2.00	6
						2.10	3
						2.20	6
						2.30	10
						2.40	9
						2.50	8
						2.60	6
						2.70	7
						2.80	8
						2.90	6
3.0						3.00	5
						3.10	4
						3.20	5
						3.30	8
						3.40	7
						3.50	14
						3.60	20
						3.70	25
	End of Probe at 3.80 m			76.15			
4.0							

Graphic Probe Record



GROUNDWATER OBSERVATIONS

REMARKS

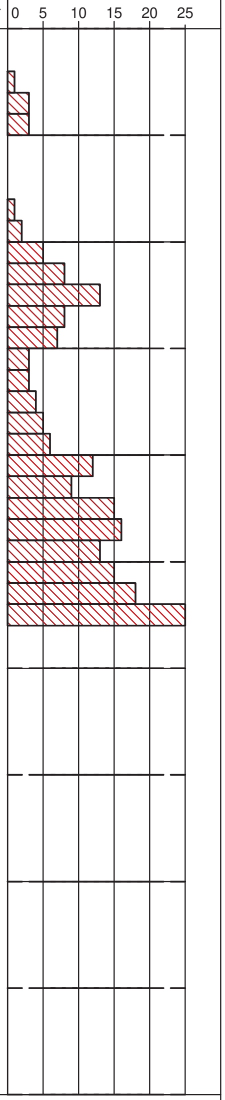
DYNAMIC PROBE RECORD

REPORT NUMBER 24330

CONTRACT	Halverstown	**PROBE NO.**	DP04
		SHEET	Sheet 1 of 1
CO-ORDINATES	686,094.86 E 719,707.93 N	**DATE COMMENCED**	13/10/2022
GROUND LEVEL (mOD)	80.69	**DATE COMPLETED**	24/10/2022
HAMMER MASS (kg)	50	**PROBE TYPE**	DPH
INCREMENT SIZE (mm)	100		
FALL HEIGHT (mm)	500		
CLIENT			
ENGINEER	DOBA		

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water	Depth (m)	Probe Readings (Blows/Increment)
0.0	.					0.00	0
						0.10	0
						0.20	1
						0.30	3
						0.40	3
						0.50	0
						0.60	0
						0.70	0
						0.80	1
						0.90	2
1.0						1.00	5
						1.10	8
						1.20	13
						1.30	8
						1.40	7
						1.50	3
						1.60	3
						1.70	4
						1.80	5
						1.90	6
2.0						2.00	12
						2.10	9
						2.20	15
						2.30	16
						2.40	13
						2.50	15
						2.60	18
						2.70	25
	End of Probe at 2.80 m			77.89			
3.0							
4.0							

Graphic Probe Record



GROUNDWATER OBSERVATIONS

REMARKS

DYNAMIC PROBE RECORD

REPORT NUMBER 24330

CONTRACT Halverstown

PROBE NO. DP05
SHEET Sheet 1 of 1

CO-ORDINATES 686,174.73 E
719,662.34 N
GROUND LEVEL (mOD) 80.41

HAMMER MASS (kg) 50
INCREMENT SIZE (mm) 100
FALL HEIGHT (mm) 500

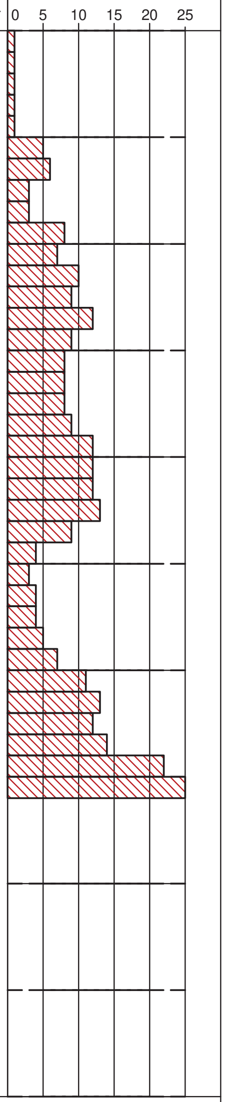
DATE COMMENCED 13/10/2022
DATE COMPLETED 24/10/2022

CLIENT
ENGINEER DOBA

PROBE TYPE DPH

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water	Depth (m)	Probe Readings (Blows/Increment)
0.0	.					0.00	1
						0.10	1
						0.20	1
						0.30	1
						0.40	1
						0.50	5
						0.60	6
						0.70	3
						0.80	3
						0.90	8
1.0						1.00	7
						1.10	10
						1.20	9
						1.30	12
						1.40	9
						1.50	8
						1.60	8
						1.70	8
						1.80	9
						1.90	12
2.0						2.00	12
						2.10	12
						2.20	13
						2.30	9
						2.40	4
						2.50	3
						2.60	4
						2.70	4
						2.80	5
						2.90	7
3.0						3.00	11
						3.10	13
						3.20	12
						3.30	14
						3.40	22
						3.50	25
	End of Probe at 3.60 m			76.81			
4.0							

Graphic Probe Record



GROUNDWATER OBSERVATIONS

REMARKS

IGSL DP LOG 100MM INCREMENTS 24330.GPJ IGSL.GDT 31/1/23

DYNAMIC PROBE RECORD

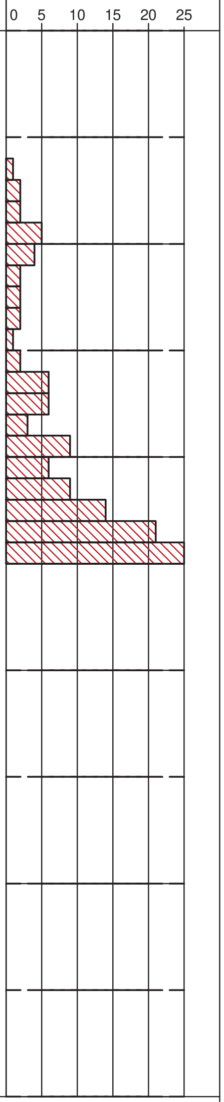
REPORT NUMBER 24330

CONTRACT	Halverstown	**PROBE NO.**	DP06
		SHEET	Sheet 1 of 1
CO-ORDINATES	686,152.47 E 719,720.80 N	**DATE COMMENCED**	13/10/2022
GROUND LEVEL (mOD)	81.09	**DATE COMPLETED**	24/10/2022
HAMMER MASS (kg)	50		
INCREMENT SIZE (mm)	100		
FALL HEIGHT (mm)	500	**PROBE TYPE**	DPH
CLIENT			
ENGINEER	DOBA		

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water
0.0	.				
2.50	End of Probe at 2.50 m			78.59	

Depth (m)	Probe Readings (Blows/Increment)
0.00	0
0.10	0
0.20	0
0.30	0
0.40	0
0.50	0
0.60	1
0.70	2
0.80	2
0.90	5
1.00	4
1.10	2
1.20	2
1.30	2
1.40	1
1.50	2
1.60	6
1.70	6
1.80	3
1.90	9
2.00	6
2.10	9
2.20	14
2.30	21
2.40	25

Graphic Probe Record



GROUNDWATER OBSERVATIONS

REMARKS

DYNAMIC PROBE RECORD

REPORT NUMBER 24330

CONTRACT Halverstown

PROBE NO. **DP07**
SHEET Sheet 1 of 1

CO-ORDINATES 686,209.81 E
719,726.09 N
GROUND LEVEL (mOD) 81.20

HAMMER MASS (kg) 50
INCREMENT SIZE (mm) 100
FALL HEIGHT (mm) 500

DATE COMMENCED 13/10/2022
DATE COMPLETED 24/10/2022

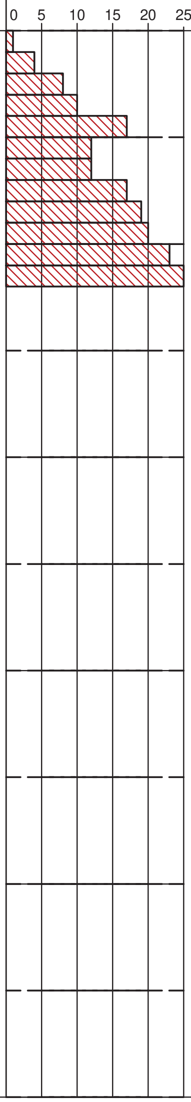
CLIENT
ENGINEER DOBA

PROBE TYPE DPH

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water
0.0	.				
1.0					
	End of Probe at 1.20 m			80.00	
2.0					
3.0					
4.0					

Depth (m)	Probe Readings (Blows/Increment)
0.00	1
0.10	4
0.20	8
0.30	10
0.40	17
0.50	12
0.60	12
0.70	17
0.80	19
0.90	20
1.00	23
1.10	25

Graphic Probe Record



GROUNDWATER OBSERVATIONS

REMARKS

DYNAMIC PROBE RECORD

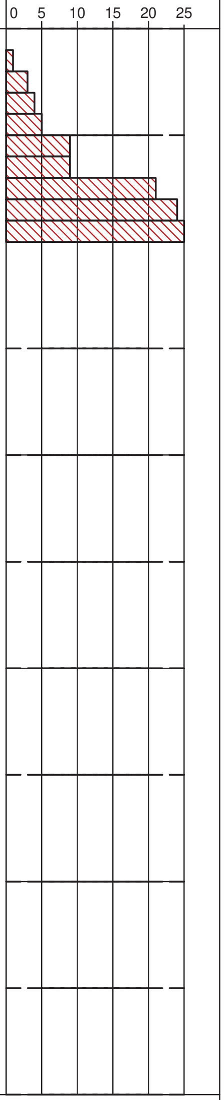
REPORT NUMBER 24330

CONTRACT	Halverstown	**PROBE NO.**	DP08
		SHEET	Sheet 1 of 1
CO-ORDINATES	686,166.66 E 719,743.78 N	**DATE COMMENCED**	13/10/2022
GROUND LEVEL (mOD)	81.46	**DATE COMPLETED**	24/10/2022
HAMMER MASS (kg)	50	**PROBE TYPE**	DPH
INCREMENT SIZE (mm)	100		
FALL HEIGHT (mm)	500		
CLIENT			
ENGINEER	DOBA		

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water
0.0	.				
1.0	End of Probe at 1.00 m			80.46	

Depth (m)	Probe Readings (Blows/Increment)
0.00	0
0.10	1
0.20	3
0.30	4
0.40	5
0.50	9
0.60	9
0.70	21
0.80	24
0.90	25

Graphic Probe Record



GROUNDWATER OBSERVATIONS

REMARKS

DYNAMIC PROBE RECORD

REPORT NUMBER 24330

CONTRACT Halverstown

PROBE NO. **DP09**
SHEET Sheet 1 of 1

CO-ORDINATES 686,164.89 E
719,562.10 N
GROUND LEVEL (mOD) 79.00

HAMMER MASS (kg) 50
INCREMENT SIZE (mm) 100
FALL HEIGHT (mm) 500

DATE COMMENCED 13/10/2022
DATE COMPLETED 24/10/2022

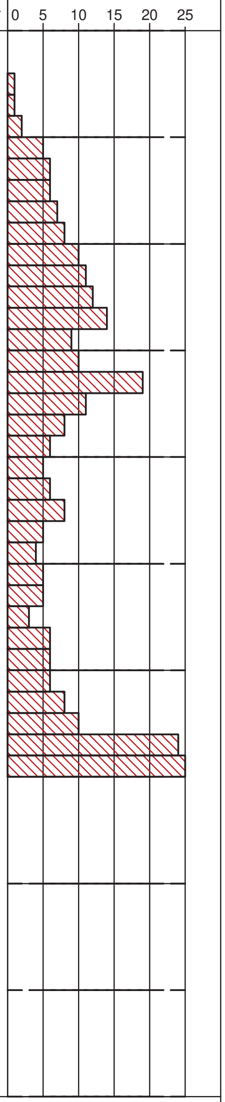
CLIENT
ENGINEER DOBA

PROBE TYPE DPH

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water
0.0	.				
3.50	End of Probe at 3.50 m			75.50	

Depth (m)	Probe Readings (Blows/Increment)
0.00	0
0.10	0
0.20	1
0.30	1
0.40	2
0.50	5
0.60	6
0.70	6
0.80	7
0.90	8
1.00	10
1.10	11
1.20	12
1.30	14
1.40	9
1.50	10
1.60	19
1.70	11
1.80	8
1.90	6
2.00	5
2.10	6
2.20	8
2.30	5
2.40	4
2.50	5
2.60	5
2.70	3
2.80	6
2.90	6
3.00	6
3.10	8
3.20	10
3.30	24
3.40	25

Graphic Probe Record



Depth (m): 0.0, 1.0, 2.0, 3.0, 4.0

GROUNDWATER OBSERVATIONS

REMARKS

DYNAMIC PROBE RECORD

REPORT NUMBER 24330

CONTRACT Halverstown

PROBE NO. DP10

SHEET Sheet 1 of 1

CO-ORDINATES 686,250.86 E
719,508.89 N

GROUND LEVEL (mOD) 78.53

HAMMER MASS (kg) 50

INCREMENT SIZE (mm) 100

FALL HEIGHT (mm) 500

DATE COMMENCED 13/10/2022

DATE COMPLETED 24/10/2022

CLIENT

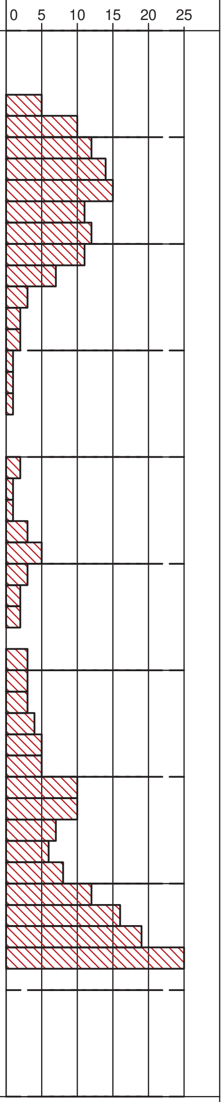
ENGINEER DOBA

PROBE TYPE DPH

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water
0.0	.				
4.40	End of Probe at 4.40 m			74.13	

Depth (m)	Probe Readings (Blows/Increment)
0.00	0
0.10	0
0.20	0
0.30	5
0.40	10
0.50	12
0.60	14
0.70	15
0.80	11
0.90	12
1.00	11
1.10	7
1.20	3
1.30	2
1.40	2
1.50	1
1.60	1
1.70	1
1.80	0
1.90	0
2.00	2
2.10	1
2.20	1
2.30	3
2.40	5
2.50	3
2.60	2
2.70	2
2.80	0
2.90	3
3.00	3
3.10	3
3.20	4
3.30	5
3.40	5
3.50	10
3.60	10
3.70	7
3.80	6
3.90	8
4.00	12
4.10	16
4.20	19
4.30	25

Graphic Probe Record



GROUNDWATER OBSERVATIONS

REMARKS

DYNAMIC PROBE RECORD

REPORT NUMBER 24330

CONTRACT Halverstown

PROBE NO. DP11

SHEET Sheet 1 of 1

CO-ORDINATES 686,231.66 E
719,574.04 N

GROUND LEVEL (mOD) 79.81

HAMMER MASS (kg) 50

INCREMENT SIZE (mm) 100

FALL HEIGHT (mm) 500

DATE COMMENCED 13/10/2022

DATE COMPLETED 24/10/2022

CLIENT

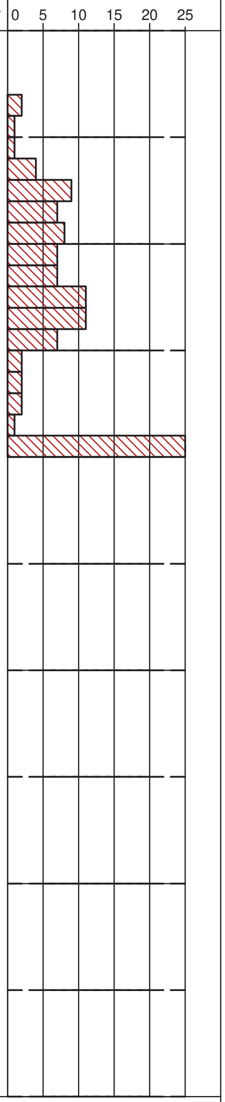
ENGINEER DOBA

PROBE TYPE DPH

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water
0.0	.				
2.0	End of Probe at 2.00 m			77.81	

Depth (m)	Probe Readings (Blows/Increment)
0.00	0
0.10	0
0.20	0
0.30	2
0.40	1
0.50	1
0.60	4
0.70	9
0.80	7
0.90	8
1.00	7
1.10	7
1.20	11
1.30	11
1.40	7
1.50	2
1.60	2
1.70	2
1.80	1
1.90	25

Graphic Probe Record



GROUNDWATER OBSERVATIONS

REMARKS

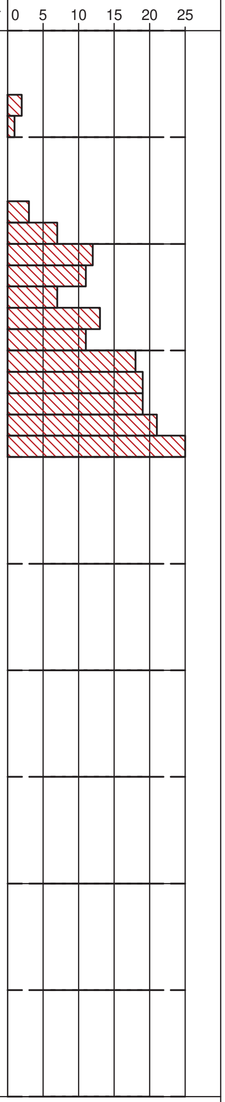
DYNAMIC PROBE RECORD

REPORT NUMBER 24330

CONTRACT	Halverstown	**PROBE NO.**	**DP12**
		SHEET	Sheet 1 of 1
CO-ORDINATES	686,211.86 E 719,636.56 N	**DATE COMMENCED**	13/10/2022
GROUND LEVEL (mOD)	80.38	**DATE COMPLETED**	24/10/2022
HAMMER MASS (kg)	50		
INCREMENT SIZE (mm)	100	**PROBE TYPE**	DPH
FALL HEIGHT (mm)	500		
CLIENT			
ENGINEER	DOBA		

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water	Depth (m)	Probe Readings (Blows/Increment)
0.0	.					0.00	0
						0.10	0
						0.20	0
						0.30	2
						0.40	1
						0.50	0
						0.60	0
						0.70	0
						0.80	3
						0.90	7
1.0						1.00	12
						1.10	11
						1.20	7
						1.30	13
						1.40	11
						1.50	18
						1.60	19
						1.70	19
						1.80	21
						1.90	25
2.0	End of Probe at 2.00 m			78.38			
3.0							
4.0							

Graphic Probe Record



GROUNDWATER OBSERVATIONS

REMARKS

DYNAMIC PROBE RECORD

REPORT NUMBER 24330

CONTRACT Halverstown

PROBE NO. **DP13**

SHEET Sheet 1 of 1

CO-ORDINATES 686,296.88 E
719,581.50 N

GROUND LEVEL (mOD) 80.33

HAMMER MASS (kg) 50

INCREMENT SIZE (mm) 100

FALL HEIGHT (mm) 500

DATE COMMENCED 13/10/2022

DATE COMPLETED 24/10/2022

CLIENT

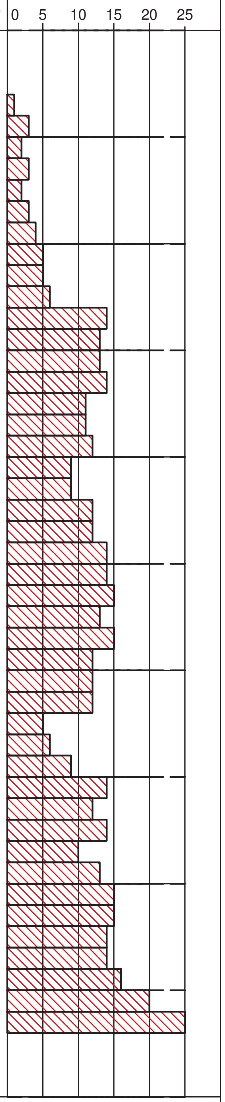
ENGINEER DOBA

PROBE TYPE DPH

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water
0.0	.				
1.0					
2.0					
3.0					
4.0					
	End of Probe at 4.70 m			75.63	

Depth (m)	Probe Readings (Blows/Increment)
0.00	0
0.10	0
0.20	0
0.30	1
0.40	3
0.50	2
0.60	3
0.70	2
0.80	3
0.90	4
1.00	5
1.10	5
1.20	6
1.30	14
1.40	13
1.50	13
1.60	14
1.70	11
1.80	11
1.90	12
2.00	9
2.10	9
2.20	12
2.30	12
2.40	14
2.50	14
2.60	15
2.70	13
2.80	15
2.90	12
3.00	12
3.10	12
3.20	5
3.30	6
3.40	9
3.50	14
3.60	12
3.70	14
3.80	10
3.90	13
4.00	15
4.10	15
4.20	14
4.30	14
4.40	16
4.50	20
4.60	25

Graphic Probe Record



GROUNDWATER OBSERVATIONS

REMARKS

DYNAMIC PROBE RECORD

REPORT NUMBER 24330

CONTRACT Halverstown

PROBE NO. DP14
SHEET Sheet 1 of 2

CO-ORDINATES 686,274.54 E
719,641.63 N
GROUND LEVEL (mOD) 80.83

HAMMER MASS (kg) 50
INCREMENT SIZE (mm) 100
FALL HEIGHT (mm) 500

DATE COMMENCED 13/10/2022
DATE COMPLETED 24/10/2022

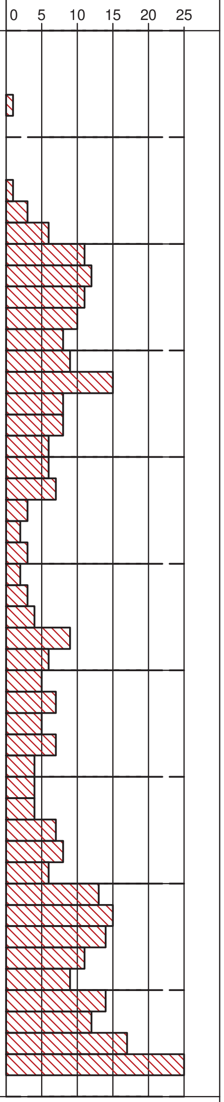
CLIENT
ENGINEER DOBA

PROBE TYPE DPH

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water
0.0	.				
	End of Probe at 4.90 m				

Depth (m)	Probe Readings (Blows/Increment)
0.00	0
0.10	0
0.20	0
0.30	1
0.40	0
0.50	0
0.60	0
0.70	1
0.80	3
0.90	6
1.00	11
1.10	12
1.20	11
1.30	10
1.40	8
1.50	9
1.60	15
1.70	8
1.80	8
1.90	6
2.00	6
2.10	7
2.20	3
2.30	2
2.40	3
2.50	2
2.60	3
2.70	4
2.80	9
2.90	6
3.00	5
3.10	7
3.20	5
3.30	7
3.40	4
3.50	4
3.60	4
3.70	7
3.80	8
3.90	6
4.00	13
4.10	15
4.20	14
4.30	11
4.40	9
4.50	14
4.60	12
4.70	17
4.80	25

Graphic Probe Record



GROUNDWATER OBSERVATIONS

REMARKS

DYNAMIC PROBE RECORD

REPORT NUMBER 24330

CONTRACT Halverstown

PROBE NO. **DP14**
SHEET Sheet 2 of 2

CO-ORDINATES 686,274.54 E
719,641.63 N
GROUND LEVEL (mOD) 80.83

HAMMER MASS (kg) 50
INCREMENT SIZE (mm) 100
FALL HEIGHT (mm) 500

DATE COMMENCED 13/10/2022
DATE COMPLETED 24/10/2022

CLIENT
ENGINEER DOBA

PROBE TYPE DPH

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water	Depth (m)	Probe Readings (Blows/Increment)	Graphic Probe Record 0 5 10 15 20 25
5.0				75.93				
6.0								
7.0								
8.0								
9.0								

GROUNDWATER OBSERVATIONS

REMARKS

DYNAMIC PROBE RECORD

REPORT NUMBER 24330

CONTRACT Halverstown

PROBE NO. DP15

SHEET Sheet 1 of 1

CO-ORDINATES 686,256.18 E
719,704.87 N

GROUND LEVEL (mOD) 81.30

HAMMER MASS (kg) 50

INCREMENT SIZE (mm) 100

FALL HEIGHT (mm) 500

DATE COMMENCED 13/10/2022

DATE COMPLETED 24/10/2022

CLIENT

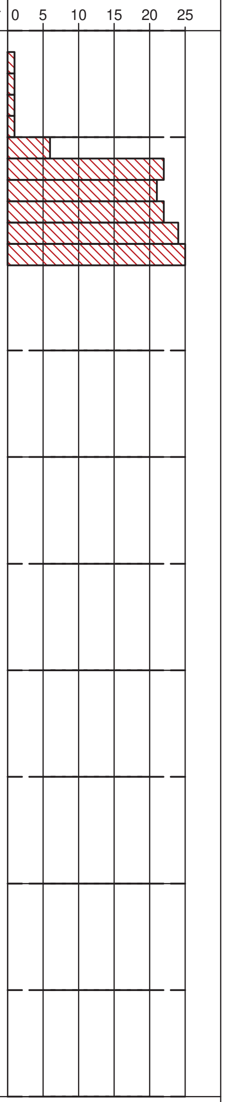
ENGINEER DOBA

PROBE TYPE DPH

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water
0.0	.				
1.0					
	End of Probe at 1.10 m			80.20	
2.0					
3.0					
4.0					

Depth (m)	Probe Readings (Blows/Increment)
0.00	0
0.10	1
0.20	1
0.30	1
0.40	1
0.50	6
0.60	22
0.70	21
0.80	22
0.90	24
1.00	25

Graphic Probe Record



GROUNDWATER OBSERVATIONS

REMARKS

DYNAMIC PROBE RECORD

REPORT NUMBER 24330

CONTRACT Halverstown

PROBE NO. DP16
SHEET Sheet 1 of 1

CO-ORDINATES 686,327.65 E
719,646.84 N
GROUND LEVEL (mOD) 81.00

HAMMER MASS (kg) 50
INCREMENT SIZE (mm) 100
FALL HEIGHT (mm) 500

DATE COMMENCED 13/10/2022
DATE COMPLETED 24/10/2022

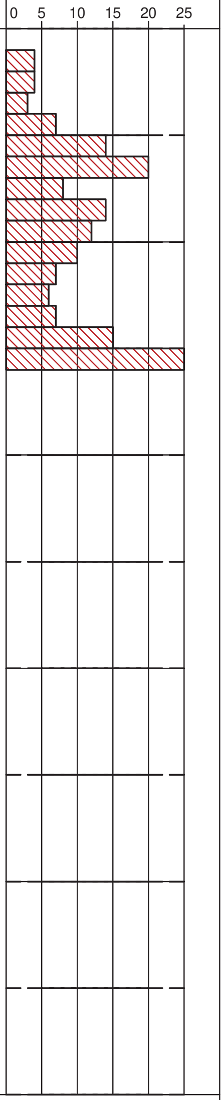
CLIENT
ENGINEER DOBA

PROBE TYPE DPH

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water
0.0	.				
	End of Probe at 1.60 m			79.40	

Depth (m)	Probe Readings (Blows/Increment)
0.00	0
0.10	4
0.20	4
0.30	3
0.40	7
0.50	14
0.60	20
0.70	8
0.80	14
0.90	12
1.00	10
1.10	7
1.20	6
1.30	7
1.40	15
1.50	25

Graphic Probe Record



Depth (m): 0.0, 1.0, 2.0, 3.0, 4.0

GROUNDWATER OBSERVATIONS

REMARKS

DYNAMIC PROBE RECORD

REPORT NUMBER 24330

CONTRACT Halverstown

PROBE NO. DP17
SHEET Sheet 1 of 1

CO-ORDINATES 686,289.55 E
719,484.59 N
GROUND LEVEL (mOD) 78.26

HAMMER MASS (kg) 50
INCREMENT SIZE (mm) 100
FALL HEIGHT (mm) 500

DATE COMMENCED 13/10/2022
DATE COMPLETED 24/10/2022

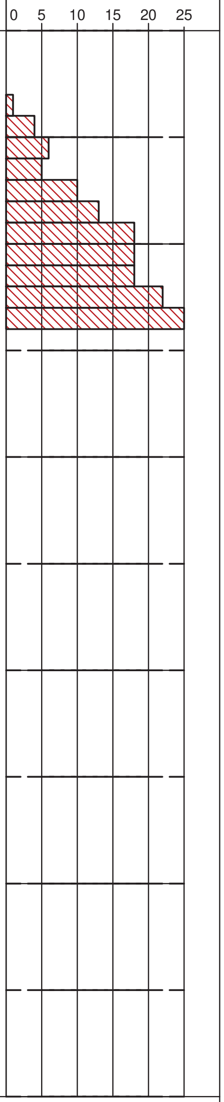
CLIENT
ENGINEER DOBA

PROBE TYPE DPH

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water
0.0	.				
	End of Probe at 1.40 m			76.86	

Depth (m)	Probe Readings (Blows/Increment)
0.00	0
0.10	0
0.20	0
0.30	1
0.40	4
0.50	6
0.60	5
0.70	10
0.80	13
0.90	18
1.00	18
1.10	18
1.20	22
1.30	25

Graphic Probe Record



GROUNDWATER OBSERVATIONS

REMARKS

DYNAMIC PROBE RECORD

REPORT NUMBER 24330

CONTRACT Halverstown

PROBE NO. DP18
SHEET Sheet 1 of 2

CO-ORDINATES 686,375.70 E
719,431.73 N
GROUND LEVEL (mOD) 77.94

HAMMER MASS (kg) 50
INCREMENT SIZE (mm) 100
FALL HEIGHT (mm) 500

DATE COMMENCED 13/10/2022
DATE COMPLETED 24/10/2022

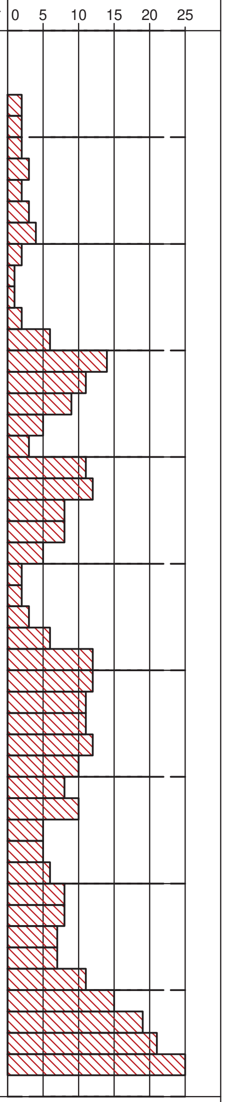
CLIENT
ENGINEER DOBA

PROBE TYPE DPH

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water
0.0	.				
1.0					
2.0					
3.0					
4.0					
	End of Probe at 4.90 m				

Depth (m)	Probe Readings (Blows/Increment)
0.00	0
0.10	0
0.20	0
0.30	2
0.40	2
0.50	2
0.60	3
0.70	2
0.80	3
0.90	4
1.00	2
1.10	1
1.20	1
1.30	2
1.40	6
1.50	14
1.60	11
1.70	9
1.80	5
1.90	3
2.00	11
2.10	12
2.20	8
2.30	8
2.40	5
2.50	2
2.60	2
2.70	3
2.80	6
2.90	12
3.00	12
3.10	11
3.20	11
3.30	12
3.40	10
3.50	8
3.60	10
3.70	5
3.80	5
3.90	6
4.00	8
4.10	8
4.20	7
4.30	7
4.40	11
4.50	15
4.60	19
4.70	21
4.80	25

Graphic Probe Record



GROUNDWATER OBSERVATIONS

REMARKS

DYNAMIC PROBE RECORD

REPORT NUMBER 24330

CONTRACT	Halverstown	**PROBE NO.**	**DP18**
		SHEET	Sheet 2 of 2
CO-ORDINATES	686,375.70 E 719,431.73 N	**DATE COMMENCED**	13/10/2022
GROUND LEVEL (mOD)	77.94	**DATE COMPLETED**	24/10/2022
HAMMER MASS (kg)	50		
INCREMENT SIZE (mm)	100		
FALL HEIGHT (mm)	500	**PROBE TYPE**	DPH
CLIENT			
ENGINEER	DOBA		

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water	Depth (m)	Probe Readings (Blows/Increment)	Graphic Probe Record 0 5 10 15 20 25
5.0				73.04				
6.0								
7.0								
8.0								
9.0								

GROUNDWATER OBSERVATIONS

REMARKS

DYNAMIC PROBE RECORD

REPORT NUMBER 24330

CONTRACT Halverstown

PROBE NO. DP19
SHEET Sheet 1 of 2

CO-ORDINATES 686,354.17 E
719,487.04 N
GROUND LEVEL (mOD) 79.01

HAMMER MASS (kg) 50
INCREMENT SIZE (mm) 100
FALL HEIGHT (mm) 500

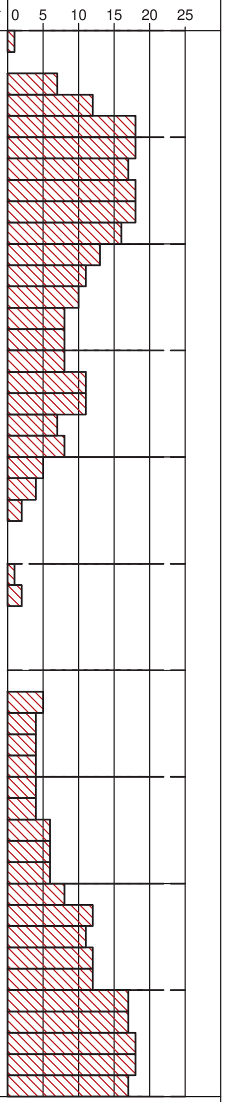
DATE COMMENCED 13/10/2022
DATE COMPLETED 24/10/2022

CLIENT
ENGINEER DOBA

PROBE TYPE DPH

Depth (m)	Probe Readings (Blows/Increment)
0.00	1
0.10	0
0.20	7
0.30	12
0.40	18
0.50	18
0.60	17
0.70	18
0.80	18
0.90	16
1.00	13
1.10	11
1.20	10
1.30	8
1.40	8
1.50	8
1.60	11
1.70	11
1.80	7
1.90	8
2.00	5
2.10	4
2.20	2
2.30	0
2.40	0
2.50	1
2.60	2
2.70	0
2.80	0
2.90	0
3.00	0
3.10	5
3.20	4
3.30	4
3.40	4
3.50	4
3.60	4
3.70	6
3.80	6
3.90	6
4.00	8
4.10	12
4.20	11
4.30	12
4.40	12
4.50	17
4.60	17
4.70	18
4.80	18
4.90	17

Graphic Probe Record



GROUNDWATER OBSERVATIONS

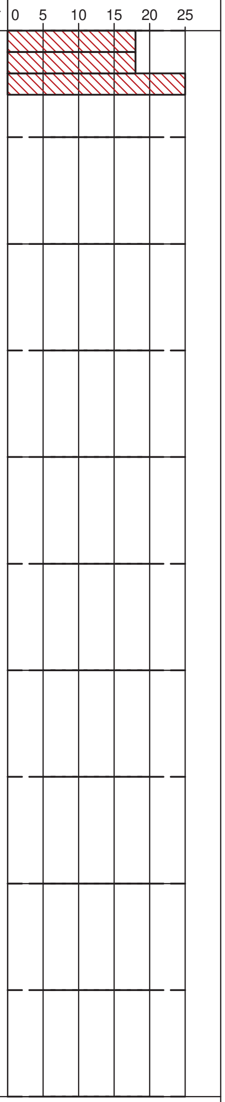
REMARKS

DYNAMIC PROBE RECORD

REPORT NUMBER	24330
CONTRACT	Halverstown
PROBE NO.	DP19
SHEET	Sheet 2 of 2
CO-ORDINATES	686,354.17 E 719,487.04 N
GROUND LEVEL (mOD)	79.01
CLIENT	
ENGINEER	DOBA
HAMMER MASS (kg)	50
INCREMENT SIZE (mm)	100
FALL HEIGHT (mm)	500
DATE COMMENCED	13/10/2022
DATE COMPLETED	24/10/2022
PROBE TYPE	DPH

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water	Depth (m)	Probe Readings (Blows/Increment)
5.0	. *(continued)*					5.00 5.10 5.20	18 18 25
	End of Probe at 5.30 m			73.71			
6.0							
7.0							
8.0							
9.0							

Graphic Probe Record



GROUNDWATER OBSERVATIONS

REMARKS

DYNAMIC PROBE RECORD

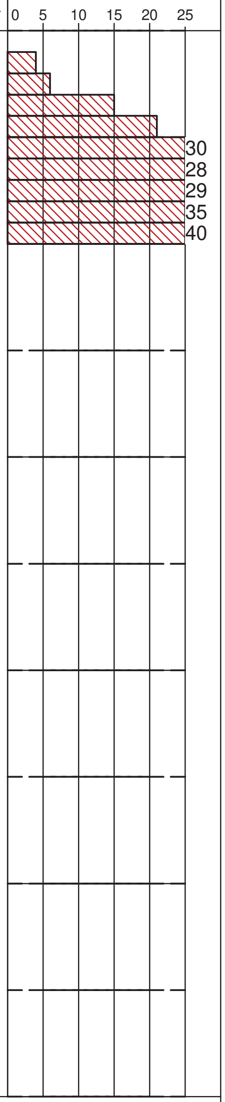
REPORT NUMBER 24330

CONTRACT	Halverstown	**PROBE NO.**	**DP20**
		SHEET	Sheet 1 of 1
CO-ORDINATES	686,329.28 E 719,557.71 N	**DATE COMMENCED**	13/10/2022
GROUND LEVEL (mOD)	80.10	**DATE COMPLETED**	24/10/2022
HAMMER MASS (kg)	50	**PROBE TYPE**	DPH
INCREMENT SIZE (mm)	100		
FALL HEIGHT (mm)	500		
CLIENT			
ENGINEER	DOBA		

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water
0.0	.				
1.0	End of Probe at 1.00 m			79.10	

Depth (m)	Probe Readings (Blows/Increment)
0.00	0
0.10	4
0.20	6
0.30	15
0.40	21
0.50	30
0.60	28
0.70	29
0.80	35
0.90	40

Graphic Probe Record



Depth (m): 0.0, 1.0, 2.0, 3.0, 4.0

GROUNDWATER OBSERVATIONS

REMARKS

DYNAMIC PROBE RECORD

REPORT NUMBER 24330

CONTRACT Halverstown

PROBE NO. DP21
SHEET Sheet 1 of 1

CO-ORDINATES 686,420.96 E
719,504.62 N
GROUND LEVEL (mOD) 79.74

HAMMER MASS (kg) 50
INCREMENT SIZE (mm) 100
FALL HEIGHT (mm) 500

DATE COMMENCED 13/10/2022
DATE COMPLETED 24/10/2022

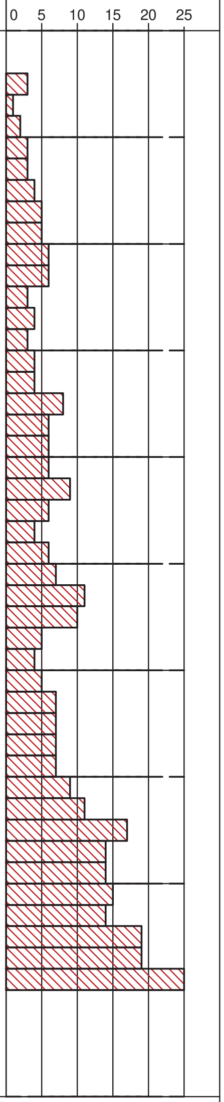
CLIENT
ENGINEER DOBA

PROBE TYPE DPH

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water
0.0	.				
4.50	End of Probe at 4.50 m			75.24	

Depth (m)	Probe Readings (Blows/Increment)
0.00	0
0.10	0
0.20	3
0.30	1
0.40	2
0.50	3
0.60	3
0.70	4
0.80	5
0.90	5
1.00	6
1.10	6
1.20	3
1.30	4
1.40	3
1.50	4
1.60	4
1.70	8
1.80	6
1.90	6
2.00	6
2.10	9
2.20	6
2.30	4
2.40	6
2.50	7
2.60	11
2.70	10
2.80	5
2.90	4
3.00	5
3.10	7
3.20	7
3.30	7
3.40	7
3.50	9
3.60	11
3.70	17
3.80	14
3.90	14
4.00	15
4.10	14
4.20	19
4.30	19
4.40	25

Graphic Probe Record



GROUNDWATER OBSERVATIONS

REMARKS

DYNAMIC PROBE RECORD

REPORT NUMBER 24330

CONTRACT Halverstown

PROBE NO. DP22

SHEET Sheet 1 of 1

CO-ORDINATES 686,398.41 E
719,564.25 N

GROUND LEVEL (mOD) 80.57

HAMMER MASS (kg) 50

INCREMENT SIZE (mm) 100

FALL HEIGHT (mm) 500

DATE COMMENCED 13/10/2022

DATE COMPLETED 24/10/2022

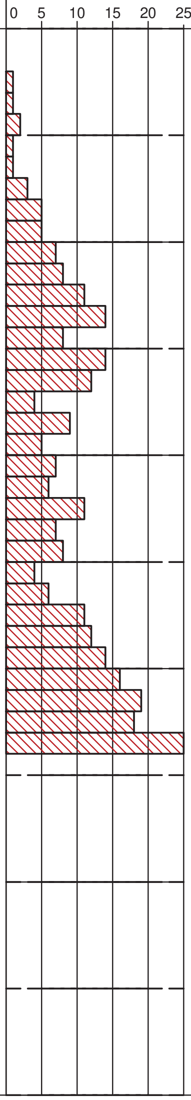
CLIENT

ENGINEER DOBA

PROBE TYPE DPH

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water	Depth (m)	Probe Readings (Blows/Increment)
0.0	.					0.00	0
						0.10	0
						0.20	1
						0.30	1
						0.40	2
						0.50	1
						0.60	1
						0.70	3
						0.80	5
						0.90	5
1.0						1.00	7
						1.10	8
						1.20	11
						1.30	14
						1.40	8
						1.50	14
						1.60	12
						1.70	4
						1.80	9
						1.90	5
2.0						2.00	7
						2.10	6
						2.20	11
						2.30	7
						2.40	8
						2.50	4
						2.60	6
						2.70	11
						2.80	12
						2.90	14
3.0						3.00	16
						3.10	19
						3.20	18
						3.30	25
	End of Probe at 3.40 m			77.17			
4.0							

Graphic Probe Record



GROUNDWATER OBSERVATIONS

REMARKS

DYNAMIC PROBE RECORD

REPORT NUMBER 24330

CONTRACT Halverstown

PROBE NO. **DP23**
SHEET Sheet 1 of 1

CO-ORDINATES 686,380.37 E
719,630.14 N
GROUND LEVEL (mOD) 81.50

HAMMER MASS (kg) 50
INCREMENT SIZE (mm) 100
FALL HEIGHT (mm) 500

DATE COMMENCED 13/10/2022
DATE COMPLETED 24/10/2022

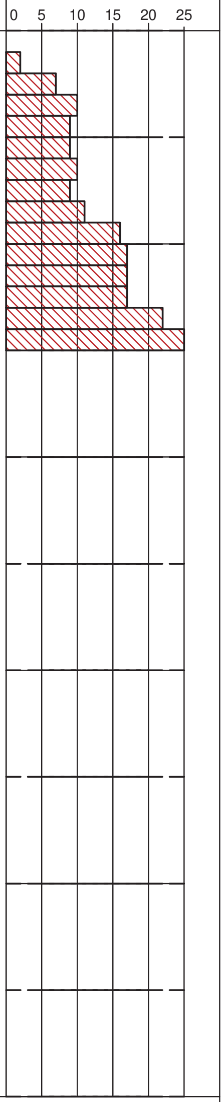
CLIENT
ENGINEER DOBA

PROBE TYPE DPH

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water
0.0	.				
1.0					
	End of Probe at 1.50 m			80.00	
2.0					
3.0					
4.0					

Depth (m)	Probe Readings (Blows/Increment)
0.00	0
0.10	2
0.20	7
0.30	10
0.40	9
0.50	9
0.60	10
0.70	9
0.80	11
0.90	16
1.00	17
1.10	17
1.20	17
1.30	22
1.40	25

Graphic Probe Record



GROUNDWATER OBSERVATIONS

REMARKS

IGSL DP LOG 100MM INCREMENTS 24330.GPJ IGSL.GDT 31/1/23

DYNAMIC PROBE RECORD

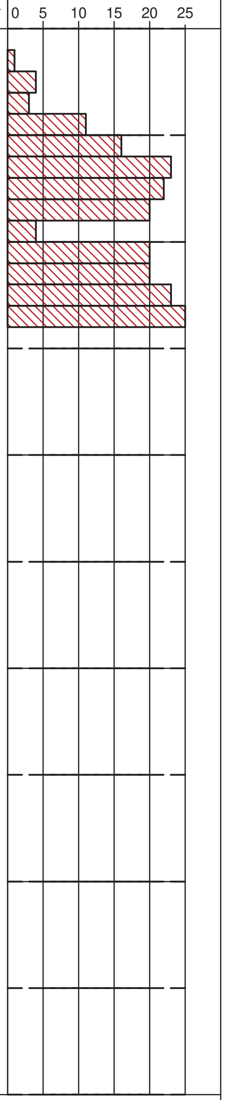
REPORT NUMBER 24330

CONTRACT	Halverstown	**PROBE NO.**	DP24
		SHEET	Sheet 1 of 1
CO-ORDINATES	686,465.77 E 719,575.00 N	**DATE COMMENCED**	13/10/2022
GROUND LEVEL (mOD)	81.35	**DATE COMPLETED**	24/10/2022
HAMMER MASS (kg)	50		
INCREMENT SIZE (mm)	100		
FALL HEIGHT (mm)	500	**PROBE TYPE**	DPH
CLIENT			
ENGINEER	DOBA		

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water
0.0	.				
1.40	End of Probe at 1.40 m			79.95	

Depth (m)	Probe Readings (Blows/Increment)
0.00	0
0.10	1
0.20	4
0.30	3
0.40	11
0.50	16
0.60	23
0.70	22
0.80	20
0.90	4
1.00	20
1.10	20
1.20	23
1.30	25

Graphic Probe Record



GROUNDWATER OBSERVATIONS

REMARKS

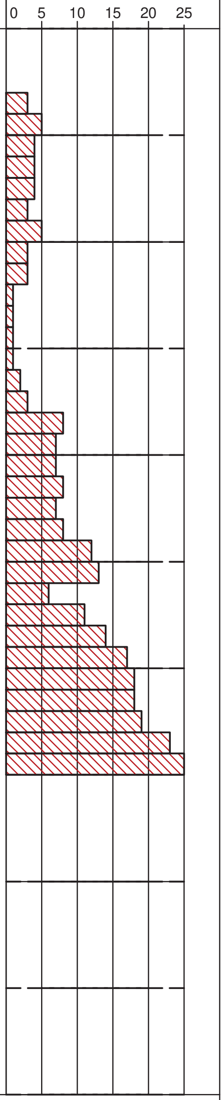
DYNAMIC PROBE RECORD

REPORT NUMBER	24330
CONTRACT	Halverstown
PROBE NO.	DP25
SHEET	Sheet 1 of 1
CO-ORDINATES	686,412.89 E 719,404.73 N
GROUND LEVEL (mOD)	78.12
CLIENT	
ENGINEER	DOBA
HAMMER MASS (kg)	50
INCREMENT SIZE (mm)	100
FALL HEIGHT (mm)	500
DATE COMMENCED	13/10/2022
DATE COMPLETED	24/10/2022
PROBE TYPE	DPH

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water
0.0	.				
3.50	End of Probe at 3.50 m			74.62	

Depth (m)	Probe Readings (Blows/Increment)
0.00	0
0.10	0
0.20	0
0.30	3
0.40	5
0.50	4
0.60	4
0.70	4
0.80	3
0.90	5
1.00	3
1.10	3
1.20	1
1.30	1
1.40	1
1.50	1
1.60	2
1.70	3
1.80	8
1.90	7
2.00	7
2.10	8
2.20	7
2.30	8
2.40	12
2.50	13
2.60	6
2.70	11
2.80	14
2.90	17
3.00	18
3.10	18
3.20	19
3.30	23
3.40	25

Graphic Probe Record



GROUNDWATER OBSERVATIONS

REMARKS

DYNAMIC PROBE RECORD

REPORT NUMBER 24330

CONTRACT Halverstown

PROBE NO. DP26

SHEET Sheet 1 of 2

CO-ORDINATES 686,498.38 E
719,350.64 N

GROUND LEVEL (mOD) 78.29

HAMMER MASS (kg) 50

INCREMENT SIZE (mm) 100

FALL HEIGHT (mm) 500

DATE COMMENCED 13/10/2022

DATE COMPLETED 24/10/2022

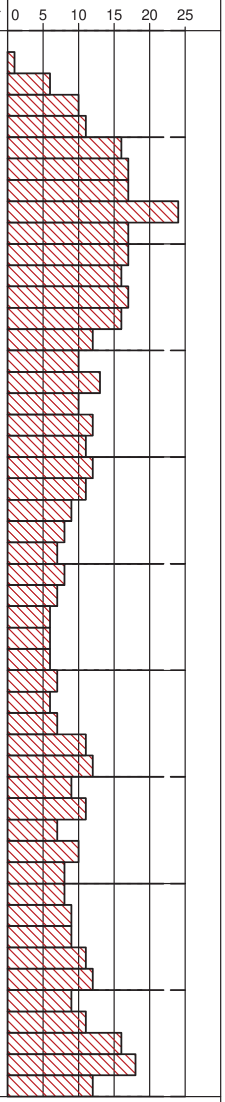
CLIENT

ENGINEER DOBA

PROBE TYPE DPH

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water	Depth (m)	Probe Readings (Blows/Increment)
0.0	.					0.00	0
						0.10	1
						0.20	6
						0.30	10
						0.40	11
						0.50	16
						0.60	17
						0.70	17
						0.80	24
						0.90	17
1.0						1.00	17
						1.10	16
						1.20	17
						1.30	16
						1.40	12
						1.50	10
						1.60	13
						1.70	10
						1.80	12
						1.90	11
2.0						2.00	12
						2.10	11
						2.20	9
						2.30	8
						2.40	7
						2.50	8
						2.60	7
						2.70	6
						2.80	6
						2.90	6
3.0						3.00	7
						3.10	6
						3.20	7
						3.30	11
						3.40	12
						3.50	9
						3.60	11
						3.70	7
						3.80	10
						3.90	8
4.0						4.00	8
						4.10	9
						4.20	9
						4.30	11
						4.40	12
						4.50	9
						4.60	11
						4.70	16
						4.80	18
						4.90	12

Graphic Probe Record



GROUNDWATER OBSERVATIONS

REMARKS

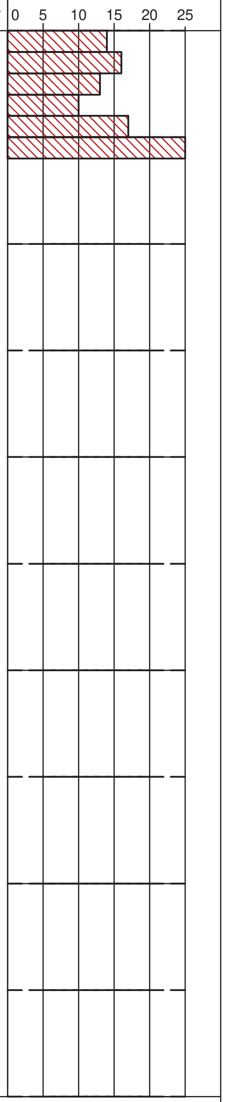
DYNAMIC PROBE RECORD

REPORT NUMBER 24330

CONTRACT	Halverstown	**PROBE NO.**	**DP26**
		SHEET	Sheet 2 of 2
CO-ORDINATES	686,498.38 E 719,350.64 N	**DATE COMMENCED**	13/10/2022
GROUND LEVEL (mOD)	78.29	**DATE COMPLETED**	24/10/2022
HAMMER MASS (kg)	50		
INCREMENT SIZE (mm)	100	**PROBE TYPE**	DPH
FALL HEIGHT (mm)	500		
CLIENT			
ENGINEER	DOBA		

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water	Depth (m)	Probe Readings (Blows/Increment)
5.0	*. (continued)*					5.00	14
						5.10	16
						5.20	13
						5.30	10
						5.40	17
						5.50	25
	End of Probe at 5.60 m			72.69			
6.0							
7.0							
8.0							
9.0							

Graphic Probe Record



GROUNDWATER OBSERVATIONS

REMARKS

DYNAMIC PROBE RECORD

REPORT NUMBER 24330

CONTRACT Halverstown

PROBE NO. DP27
SHEET Sheet 1 of 2

CO-ORDINATES 686,478.95 E
719,416.85 N
GROUND LEVEL (mOD) 78.88

HAMMER MASS (kg) 50
INCREMENT SIZE (mm) 100
FALL HEIGHT (mm) 500

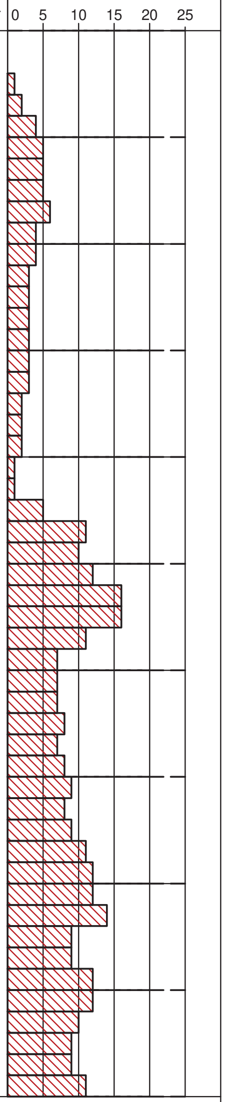
DATE COMMENCED 13/10/2022
DATE COMPLETED 24/10/2022

CLIENT
ENGINEER DOBA

PROBE TYPE DPH

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water	Depth (m)	Probe Readings (Blows/Increment)
0.0	.					0.00	0
						0.10	0
						0.20	1
						0.30	2
						0.40	4
						0.50	5
						0.60	5
						0.70	5
						0.80	6
						0.90	4
1.0						1.00	4
						1.10	3
						1.20	3
						1.30	3
						1.40	3
						1.50	3
						1.60	3
						1.70	2
						1.80	2
						1.90	2
2.0						2.00	1
						2.10	1
						2.20	5
						2.30	11
						2.40	10
						2.50	12
						2.60	16
						2.70	16
						2.80	11
						2.90	7
3.0						3.00	7
						3.10	7
						3.20	8
						3.30	7
						3.40	8
						3.50	9
						3.60	8
						3.70	9
						3.80	11
						3.90	12
4.0						4.00	12
						4.10	14
						4.20	9
						4.30	9
						4.40	12
						4.50	12
						4.60	10
						4.70	9
						4.80	9
						4.90	11

Graphic Probe Record



GROUNDWATER OBSERVATIONS

REMARKS

DYNAMIC PROBE RECORD

REPORT NUMBER 24330

CONTRACT Halverstown

PROBE NO. DP27
SHEET Sheet 2 of 2

CO-ORDINATES 686,478.95 E
719,416.85 N
GROUND LEVEL (mOD) 78.88

HAMMER MASS (kg) 50
INCREMENT SIZE (mm) 100
FALL HEIGHT (mm) 500

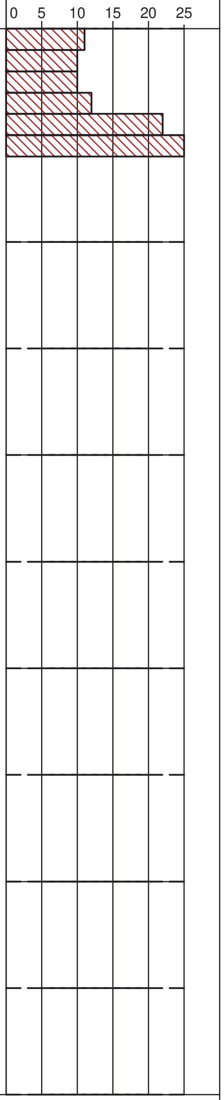
DATE COMMENCED 13/10/2022
DATE COMPLETED 24/10/2022

CLIENT
ENGINEER DOBA

PROBE TYPE DPH

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water	Depth (m)	Probe Readings (Blows/Increment)
5.0	. *(continued)*					5.00	11
						5.10	10
						5.20	10
						5.30	12
						5.40	22
						5.50	25
	End of Probe at 5.60 m			73.28			
6.0							
7.0							
8.0							
9.0							

Graphic Probe Record



GROUNDWATER OBSERVATIONS

REMARKS

DYNAMIC PROBE RECORD

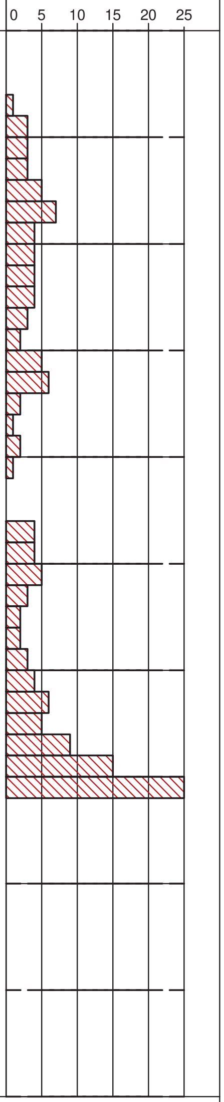
REPORT NUMBER 24330

CONTRACT	Halverstown	**PROBE NO.**	DP28
		SHEET	Sheet 1 of 1
CO-ORDINATES	686,458.71 E 719,479.23 N	**DATE COMMENCED**	13/10/2022
GROUND LEVEL (mOD)	79.66	**DATE COMPLETED**	24/10/2022
HAMMER MASS (kg)	50		
INCREMENT SIZE (mm)	100	**PROBE TYPE**	DPH
FALL HEIGHT (mm)	500		
CLIENT			
ENGINEER	DOBA		

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water
0.0	.				
	End of Probe at 3.60 m			76.06	

Depth (m)	Probe Readings (Blows/Increment)
0.00	0
0.10	0
0.20	0
0.30	1
0.40	3
0.50	3
0.60	3
0.70	5
0.80	7
0.90	4
1.00	4
1.10	4
1.20	4
1.30	3
1.40	2
1.50	5
1.60	6
1.70	2
1.80	1
1.90	2
2.00	1
2.10	0
2.20	0
2.30	4
2.40	4
2.50	5
2.60	3
2.70	2
2.80	2
2.90	3
3.00	4
3.10	6
3.20	5
3.30	9
3.40	15
3.50	25

Graphic Probe Record



GROUNDWATER OBSERVATIONS

REMARKS

DYNAMIC PROBE RECORD

REPORT NUMBER 24330

CONTRACT Halverstown

PROBE NO. **DP29**

SHEET Sheet 1 of 2

CO-ORDINATES 686,544.37 E
719,424.74 N

GROUND LEVEL (mOD) 79.26

HAMMER MASS (kg) 50

INCREMENT SIZE (mm) 100

FALL HEIGHT (mm) 500

DATE COMMENCED 13/10/2022

DATE COMPLETED 24/10/2022

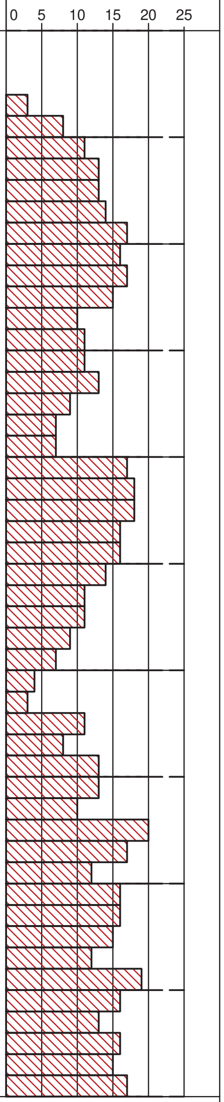
CLIENT

ENGINEER DOBA

PROBE TYPE DPH

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water	Depth (m)	Probe Readings (Blows/Increment)
0.0	.					0.00	0
						0.10	0
						0.20	0
						0.30	3
						0.40	8
						0.50	11
						0.60	13
						0.70	13
						0.80	14
						0.90	17
1.0						1.00	16
						1.10	17
						1.20	15
						1.30	10
						1.40	11
						1.50	11
						1.60	13
						1.70	9
						1.80	7
						1.90	7
2.0						2.00	17
						2.10	18
						2.20	18
						2.30	16
						2.40	16
						2.50	14
						2.60	11
						2.70	11
						2.80	9
						2.90	7
3.0						3.00	4
						3.10	3
						3.20	11
						3.30	8
						3.40	13
						3.50	13
						3.60	10
						3.70	20
						3.80	17
						3.90	12
4.0						4.00	16
						4.10	16
						4.20	15
						4.30	12
						4.40	19
						4.50	16
						4.60	13
						4.70	16
						4.80	15
						4.90	17

Graphic Probe Record



GROUNDWATER OBSERVATIONS

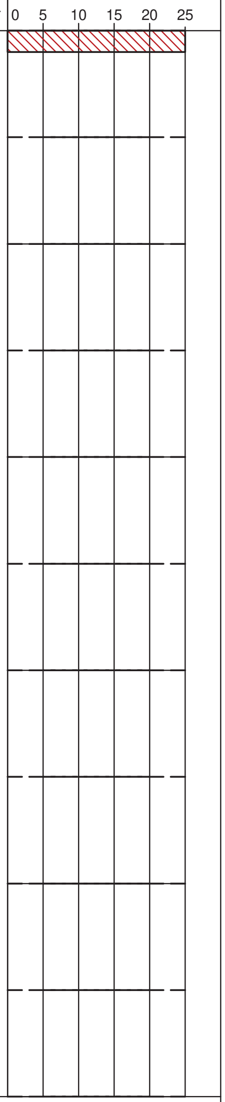
REMARKS

DYNAMIC PROBE RECORD

REPORT NUMBER 24330

CONTRACT	Halverstown	**PROBE NO.**	**DP29**
		SHEET	Sheet 2 of 2
CO-ORDINATES	686,544.37 E 719,424.74 N	**DATE COMMENCED**	13/10/2022
GROUND LEVEL (mOD)	79.26	**DATE COMPLETED**	24/10/2022
HAMMER MASS (kg)	50		
INCREMENT SIZE (mm)	100		
FALL HEIGHT (mm)	500	**PROBE TYPE**	DPH
CLIENT			
ENGINEER	DOBA		

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water	Depth (m)	Probe Readings (Blows/Increment)	Graphic Probe Record
5.0						5.00	25	
	End of Probe at 5.10 m			74.16				
6.0								
7.0								
8.0								
9.0								



GROUNDWATER OBSERVATIONS

REMARKS

DYNAMIC PROBE RECORD

REPORT NUMBER 24330

CONTRACT Halverstown

PROBE NO. DP30
SHEET Sheet 1 of 1

CO-ORDINATES 686,521.92 E
719,484.32 N
GROUND LEVEL (mOD) 79.97

DATE COMMENCED 13/10/2022
DATE COMPLETED 24/10/2022

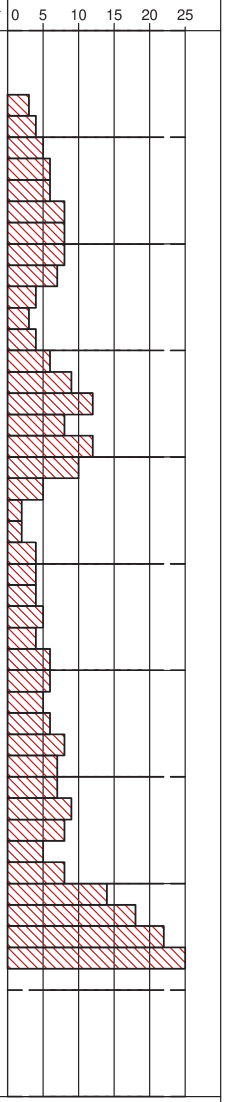
HAMMER MASS (kg) 50
INCREMENT SIZE (mm) 100
FALL HEIGHT (mm) 500

CLIENT
ENGINEER DOBA

PROBE TYPE DPH

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water	Depth (m)	Probe Readings (Blows/Increment)
0.0	.					0.00	0
						0.10	0
						0.20	0
						0.30	3
						0.40	4
						0.50	5
						0.60	6
						0.70	6
						0.80	8
						0.90	8
1.0						1.00	8
						1.10	7
						1.20	4
						1.30	3
						1.40	4
						1.50	6
						1.60	9
						1.70	12
						1.80	8
						1.90	12
2.0						2.00	10
						2.10	5
						2.20	2
						2.30	2
						2.40	4
						2.50	4
						2.60	4
						2.70	5
						2.80	4
						2.90	6
3.0						3.00	6
						3.10	5
						3.20	6
						3.30	8
						3.40	7
						3.50	7
						3.60	9
						3.70	8
						3.80	5
						3.90	8
4.0						4.00	14
						4.10	18
						4.20	22
						4.30	25
	End of Probe at 4.40 m			75.57			

Graphic Probe Record



GROUNDWATER OBSERVATIONS

REMARKS

DYNAMIC PROBE RECORD

REPORT NUMBER
24330

CONTRACT Halverstown

PROBE NO. **DP31**
SHEET Sheet 1 of 1

CO-ORDINATES 686,502.22 E
719,558.13 N
GROUND LEVEL (mOD) 81.27

HAMMER MASS (kg) 50
INCREMENT SIZE (mm) 100
FALL HEIGHT (mm) 500

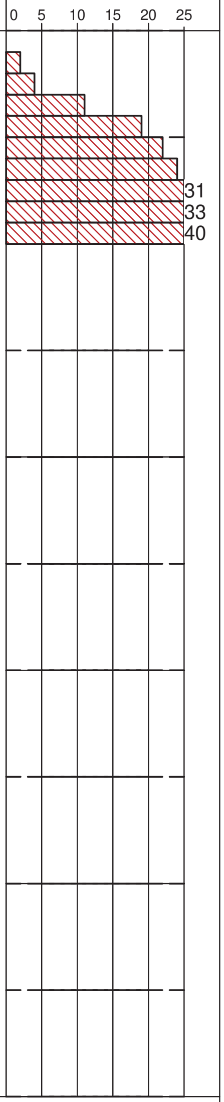
DATE COMMENCED 13/10/2022
DATE COMPLETED 24/10/2022

CLIENT
ENGINEER DOBA

PROBE TYPE DPH

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water	Depth (m)	Probe Readings (Blows/Increment)
0.0	.					0.00	0
						0.10	2
						0.20	4
						0.30	11
						0.40	19
						0.50	22
						0.60	24
						0.70	31
						0.80	33
						0.90	40
1.0	End of Probe at 1.00 m			80.27			
2.0							
3.0							
4.0							

Graphic Probe Record



GROUNDWATER OBSERVATIONS

REMARKS

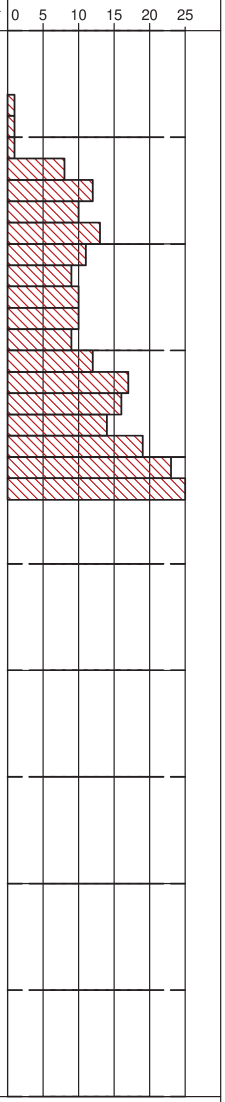
DYNAMIC PROBE RECORD

REPORT NUMBER 24330

CONTRACT	Halverstown	**PROBE NO.**	DP32
		SHEET	Sheet 1 of 1
CO-ORDINATES	686,574.11 E 719,490.99 N	**DATE COMMENCED**	13/10/2022
GROUND LEVEL (mOD)	80.56	**DATE COMPLETED**	24/10/2022
HAMMER MASS (kg)	50		
INCREMENT SIZE (mm)	100		
FALL HEIGHT (mm)	500	**PROBE TYPE**	DPH
CLIENT			
ENGINEER	DOBA		

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water	Depth (m)	Probe Readings (Blows/Increment)
0.0	.					0.00	0
						0.10	0
						0.20	0
						0.30	1
						0.40	1
						0.50	1
						0.60	8
						0.70	12
						0.80	10
						0.90	13
1.0						1.00	11
						1.10	9
						1.20	10
						1.30	10
						1.40	9
						1.50	12
						1.60	17
						1.70	16
						1.80	14
						1.90	19
2.0						2.00	23
						2.10	25
	End of Probe at 2.20 m			78.36			
3.0							
4.0							

Graphic Probe Record



GROUNDWATER OBSERVATIONS

REMARKS

DYNAMIC PROBE RECORD

REPORT NUMBER 24330

CONTRACT Halverstown

PROBE NO. DP33

SHEET Sheet 1 of 1

CO-ORDINATES 686,261.46 E
719,795.33 N

GROUND LEVEL (mOD) 83.07

HAMMER MASS (kg) 50

INCREMENT SIZE (mm) 100

FALL HEIGHT (mm) 500

DATE COMMENCED 13/10/2022

DATE COMPLETED 24/10/2022

CLIENT

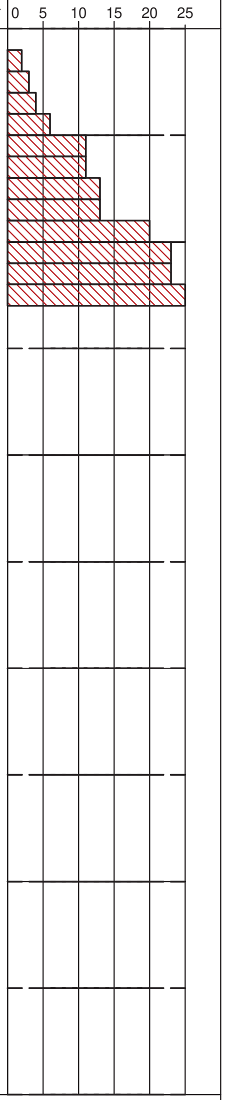
ENGINEER DOBA

PROBE TYPE DPH

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water
0.0	.				
1.30	End of Probe at 1.30 m			81.77	

Depth (m)	Probe Readings (Blows/Increment)
0.00	0
0.10	2
0.20	3
0.30	4
0.40	6
0.50	11
0.60	11
0.70	13
0.80	13
0.90	20
1.00	23
1.10	23
1.20	25

Graphic Probe Record



GROUNDWATER OBSERVATIONS

REMARKS

IGSL DP LOG 100MM INCREMENTS 24330.GPJ IGSL.GDT 31/1/23

DYNAMIC PROBE RECORD

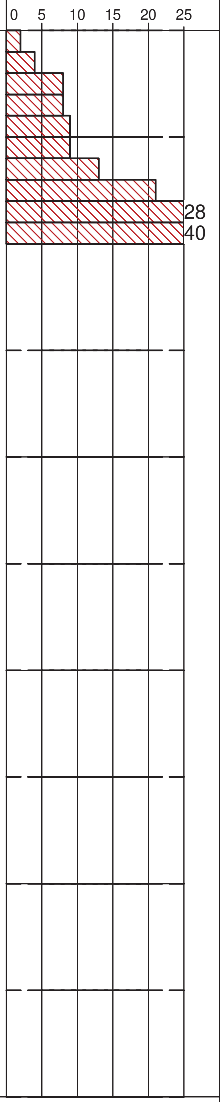
REPORT NUMBER 24330

CONTRACT	Halverstown	**PROBE NO.**	**DP34**
		SHEET	Sheet 1 of 1
CO-ORDINATES	686,326.45 E 719,842.17 N	**DATE COMMENCED**	13/10/2022
GROUND LEVEL (mOD)	84.72	**DATE COMPLETED**	24/10/2022
HAMMER MASS (kg)	50		
INCREMENT SIZE (mm)	100		
FALL HEIGHT (mm)	500	**PROBE TYPE**	DPH
CLIENT			
ENGINEER	DOBA		

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water
0.0	.				
1.0	End of Probe at 1.00 m			83.72	
2.0					
3.0					
4.0					

Depth (m)	Probe Readings (Blows/Increment)
0.00	2
0.10	4
0.20	8
0.30	8
0.40	9
0.50	9
0.60	13
0.70	21
0.80	28
0.90	40

Graphic Probe Record



GROUNDWATER OBSERVATIONS

REMARKS

IGSL DP LOG 100MM INCREMENTS 24330.GPJ IGSL.GDT 31/1/23

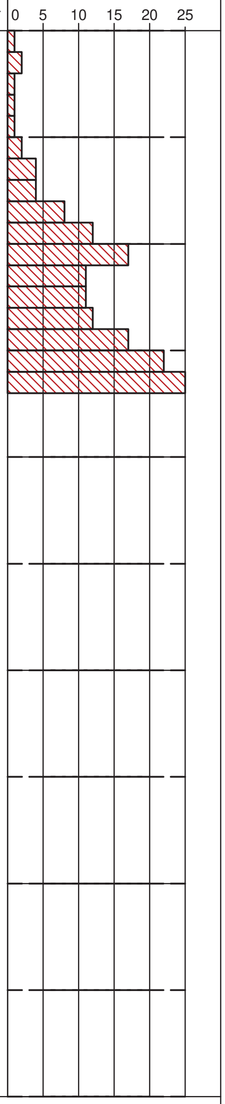
DYNAMIC PROBE RECORD

REPORT NUMBER 24330

CONTRACT	Halverstown	**PROBE NO.**	DP35
		SHEET	Sheet 1 of 1
CO-ORDINATES	686,324.99 E 719,813.24 N	**DATE COMMENCED**	13/10/2022
GROUND LEVEL (mOD)	84.32	**DATE COMPLETED**	24/10/2022
HAMMER MASS (kg)	50		
INCREMENT SIZE (mm)	100		
FALL HEIGHT (mm)	500	**PROBE TYPE**	DPH
CLIENT			
ENGINEER	DOBA		

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water	Depth (m)	Probe Readings (Blows/Increment)
0.0	.					0.00	1
						0.10	2
						0.20	1
						0.30	1
						0.40	1
						0.50	2
						0.60	4
						0.70	4
						0.80	8
						0.90	12
1.0						1.00	17
						1.10	11
						1.20	11
						1.30	12
						1.40	17
						1.50	22
						1.60	25
	End of Probe at 1.70 m			82.62			
2.0							
3.0							
4.0							

Graphic Probe Record



GROUNDWATER OBSERVATIONS

REMARKS

DYNAMIC PROBE RECORD

REPORT NUMBER 24330

CONTRACT Halverstown

PROBE NO. **DP36**
SHEET Sheet 1 of 1

CO-ORDINATES 686,334.59 E
719,748.61 N
GROUND LEVEL (mOD) 83.04

HAMMER MASS (kg) 50
INCREMENT SIZE (mm) 100
FALL HEIGHT (mm) 500

DATE COMMENCED 13/10/2022
DATE COMPLETED 24/10/2022

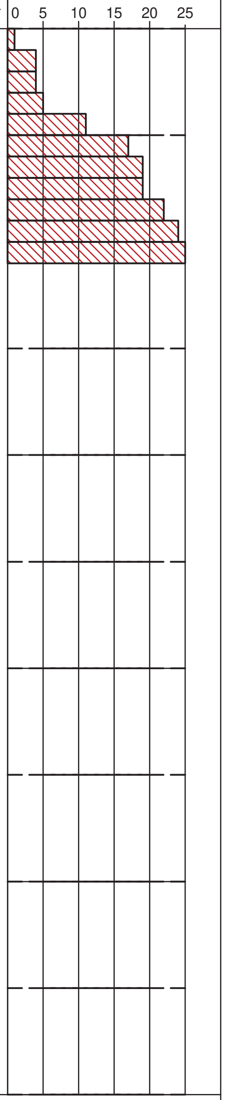
CLIENT
ENGINEER DOBA

PROBE TYPE DPH

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water
0.0	.				
1.0					
	End of Probe at 1.10 m			81.94	
2.0					
3.0					
4.0					

Depth (m)	Probe Readings (Blows/Increment)
0.00	1
0.10	4
0.20	4
0.30	5
0.40	11
0.50	17
0.60	19
0.70	19
0.80	22
0.90	24
1.00	25

Graphic Probe Record



GROUNDWATER OBSERVATIONS

REMARKS

DYNAMIC PROBE RECORD

REPORT NUMBER 24330

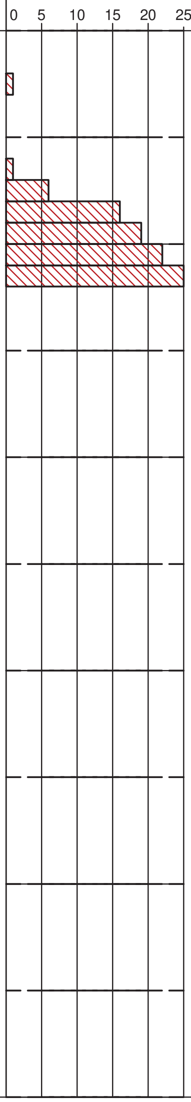
CONTRACT	Halverstown	**PROBE NO.**	DP37
		SHEET	Sheet 1 of 1
CO-ORDINATES	686,384.86 E 719,834.91 N	**DATE COMMENCED**	13/10/2022
GROUND LEVEL (mOD)	85.22	**DATE COMPLETED**	24/10/2022
CLIENT		**PROBE TYPE**	DPH
ENGINEER	DOBA		

HAMMER MASS (kg)	50
INCREMENT SIZE (mm)	100
FALL HEIGHT (mm)	500

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water
0.0	.				
	End of Probe at 1.20 m			84.02	

Depth (m)	Probe Readings (Blows/Increment)
0.00	0
0.10	0
0.20	1
0.30	0
0.40	0
0.50	0
0.60	1
0.70	6
0.80	16
0.90	19
1.00	22
1.10	25

Graphic Probe Record



GROUNDWATER OBSERVATIONS

REMARKS

DYNAMIC PROBE RECORD

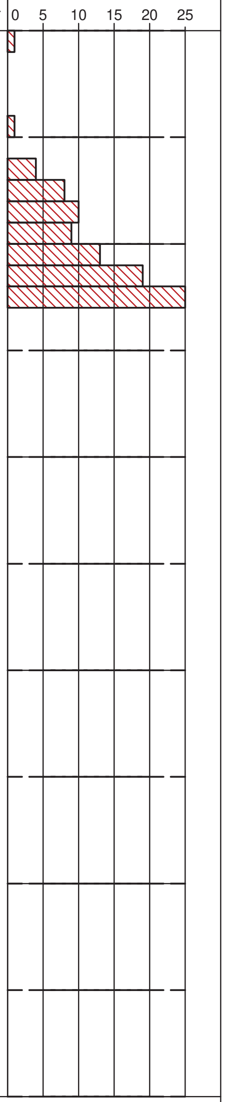
REPORT NUMBER 24330

CONTRACT	Halverstown	**PROBE NO.**	**DP38**
		SHEET	Sheet 1 of 1
CO-ORDINATES	686,399.34 E 719,770.79 N	**DATE COMMENCED**	13/10/2022
GROUND LEVEL (mOD)	84.73	**DATE COMPLETED**	24/10/2022
HAMMER MASS (kg)	50		
INCREMENT SIZE (mm)	100		
FALL HEIGHT (mm)	500	**PROBE TYPE**	DPH
CLIENT			
ENGINEER	DOBA		

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water
0.0	.				
	End of Probe at 1.30 m			83.43	

Depth (m)	Probe Readings (Blows/Increment)
0.00	1
0.10	0
0.20	0
0.30	0
0.40	1
0.50	0
0.60	4
0.70	8
0.80	10
0.90	9
1.00	13
1.10	19
1.20	25

Graphic Probe Record



Depth (m): 0.0, 1.0, 2.0, 3.0, 4.0

GROUNDWATER OBSERVATIONS

REMARKS

DYNAMIC PROBE RECORD

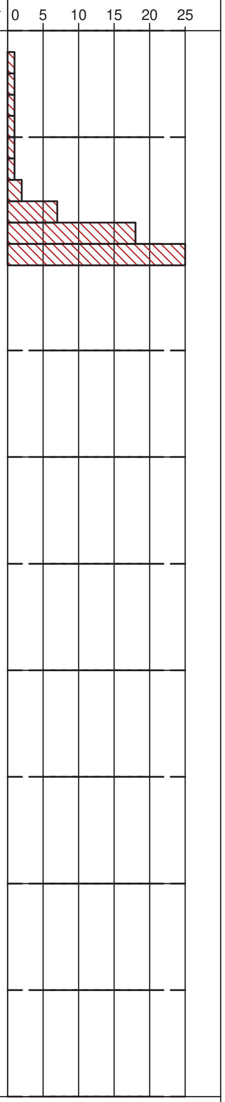
REPORT NUMBER 24330

CONTRACT	Halverstown	**PROBE NO.**	**DP39**
		SHEET	Sheet 1 of 1
CO-ORDINATES	686,441.39 E 719,786.19 N	**DATE COMMENCED**	13/10/2022
GROUND LEVEL (mOD)	85.33	**DATE COMPLETED**	24/10/2022
HAMMER MASS (kg)	50	**PROBE TYPE**	DPH
INCREMENT SIZE (mm)	100		
FALL HEIGHT (mm)	500		
CLIENT			
ENGINEER	DOBA		

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water
0.0	.				
1.0	End of Probe at 1.10 m			84.23	

Depth (m)	Probe Readings (Blows/Increment)
0.00	0
0.10	1
0.20	1
0.30	1
0.40	1
0.50	1
0.60	1
0.70	2
0.80	7
0.90	18
1.00	25

Graphic Probe Record



GROUNDWATER OBSERVATIONS

REMARKS

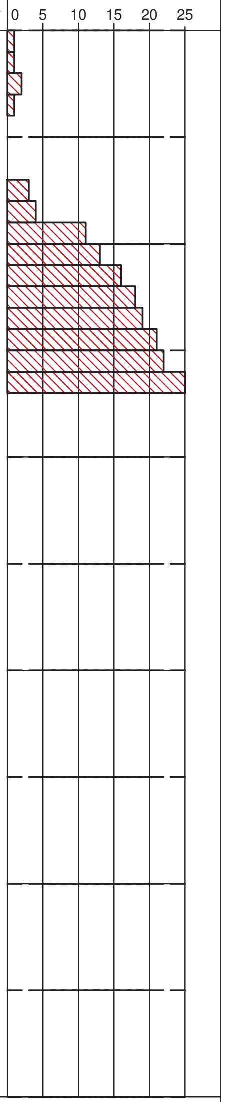
DYNAMIC PROBE RECORD

REPORT NUMBER	24330
CONTRACT	Halverstown
PROBE NO.	DP40
SHEET	Sheet 1 of 1
CO-ORDINATES	686,405.91 E 719,704.42 N
GROUND LEVEL (mOD)	83.51
HAMMER MASS (kg)	50
INCREMENT SIZE (mm)	100
FALL HEIGHT (mm)	500
DATE COMMENCED	13/10/2022
DATE COMPLETED	24/10/2022
CLIENT	
ENGINEER	DOBA
PROBE TYPE	DPH

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water
0.0	.				
1.0					
	End of Probe at 1.70 m			81.81	
2.0					
3.0					
4.0					

Depth (m)	Probe Readings (Blows/Increment)
0.00	1
0.10	1
0.20	2
0.30	1
0.40	0
0.50	0
0.60	0
0.70	3
0.80	4
0.90	11
1.00	13
1.10	16
1.20	18
1.30	19
1.40	21
1.50	22
1.60	25

Graphic Probe Record



GROUNDWATER OBSERVATIONS

REMARKS

DYNAMIC PROBE RECORD

REPORT NUMBER 24330

CONTRACT Halverstown

PROBE NO. DP41
SHEET Sheet 1 of 1

CO-ORDINATES 686,583.47 E
719,752.70 N
GROUND LEVEL (mOD) 83.73

HAMMER MASS (kg) 50
INCREMENT SIZE (mm) 100
FALL HEIGHT (mm) 500

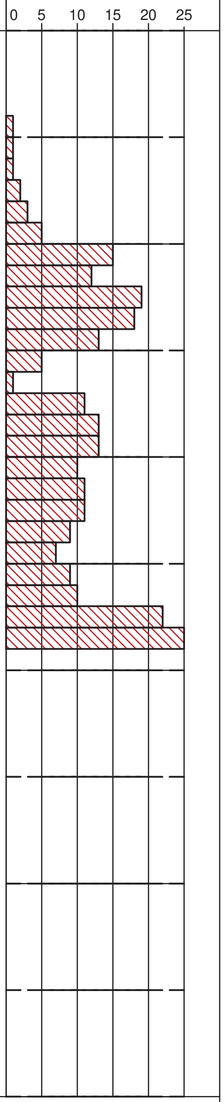
DATE COMMENCED 13/10/2022
DATE COMPLETED 24/10/2022

CLIENT
ENGINEER DOBA

PROBE TYPE DPH

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water	Depth (m)	Probe Readings (Blows/Increment)
0.0	.					0.00	0
						0.10	0
						0.20	0
						0.30	0
						0.40	1
						0.50	1
						0.60	1
						0.70	2
						0.80	3
						0.90	5
1.0						1.00	15
						1.10	12
						1.20	19
						1.30	18
						1.40	13
						1.50	5
						1.60	1
						1.70	11
						1.80	13
						1.90	13
2.0						2.00	10
						2.10	11
						2.20	11
						2.30	9
						2.40	7
						2.50	9
						2.60	10
						2.70	22
						2.80	25
	End of Probe at 2.90 m			80.83			
3.0							
4.0							

Graphic Probe Record



GROUNDWATER OBSERVATIONS

REMARKS

IGSL DP LOG 100MM INCREMENTS 24330.GPJ IGSL.GDT 31/1/23

DYNAMIC PROBE RECORD

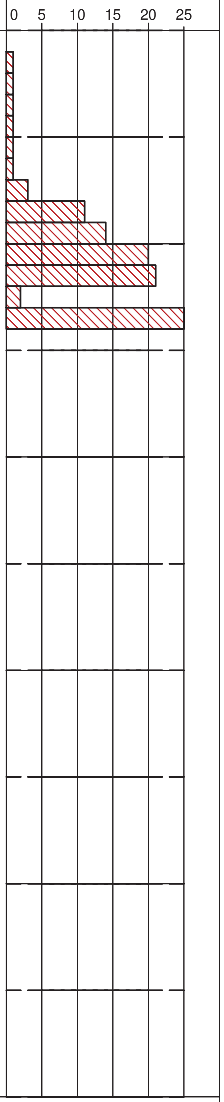
REPORT NUMBER 24330

CONTRACT	Halverstown	**PROBE NO.**	DP42
		SHEET	Sheet 1 of 1
CO-ORDINATES	686,612.89 E 719,835.08 N	**DATE COMMENCED**	13/10/2022
GROUND LEVEL (mOD)	82.60	**DATE COMPLETED**	24/10/2022
CLIENT		**PROBE TYPE**	DPH
ENGINEER	DOBA		
HAMMER MASS (kg)	50		
INCREMENT SIZE (mm)	100		
FALL HEIGHT (mm)	500		

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water
0.0	.				
1.40	End of Probe at 1.40 m			81.20	

Depth (m)	Probe Readings (Blows/Increment)
0.00	0
0.10	1
0.20	1
0.30	1
0.40	1
0.50	1
0.60	1
0.70	3
0.80	11
0.90	14
1.00	20
1.10	21
1.20	2
1.30	25

Graphic Probe Record



GROUNDWATER OBSERVATIONS

REMARKS

DYNAMIC PROBE RECORD

REPORT NUMBER 24330

CONTRACT Halverstown

PROBE NO. DP43
SHEET Sheet 1 of 1

CO-ORDINATES 686,631.36 E
719,771.95 N
GROUND LEVEL (mOD) 82.06

HAMMER MASS (kg) 50
INCREMENT SIZE (mm) 100
FALL HEIGHT (mm) 500

DATE COMMENCED 13/10/2022
DATE COMPLETED 24/10/2022

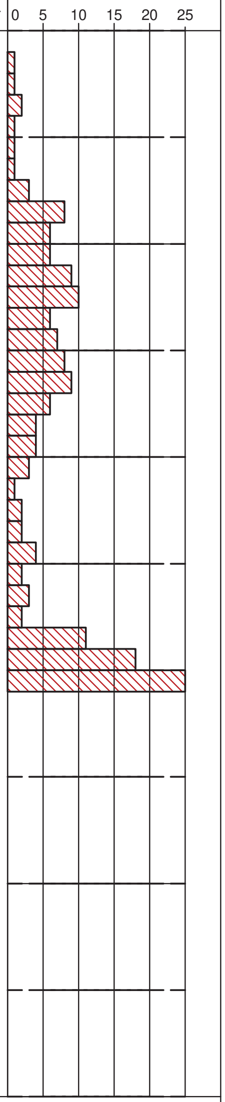
CLIENT
ENGINEER DOBA

PROBE TYPE DPH

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water
0.0	.				
3.10	End of Probe at 3.10 m			78.96	

Depth (m)	Probe Readings (Blows/Increment)
0.00	0
0.10	1
0.20	1
0.30	2
0.40	1
0.50	1
0.60	1
0.70	3
0.80	8
0.90	6
1.00	6
1.10	9
1.20	10
1.30	6
1.40	7
1.50	8
1.60	9
1.70	6
1.80	4
1.90	4
2.00	3
2.10	1
2.20	2
2.30	2
2.40	4
2.50	2
2.60	3
2.70	2
2.80	11
2.90	18
3.00	25

Graphic Probe Record



GROUNDWATER OBSERVATIONS

REMARKS

DYNAMIC PROBE RECORD

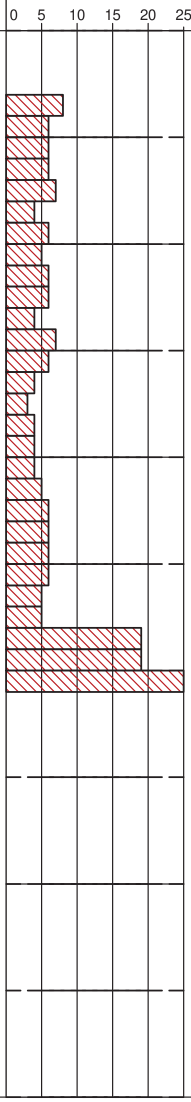
REPORT NUMBER 24330

CONTRACT	Halverstown	**PROBE NO.**	DP44
		SHEET	Sheet 1 of 1
CO-ORDINATES	686,689.29 E 719,801.45 N	**DATE COMMENCED**	13/10/2022
GROUND LEVEL (mOD)	80.29	**DATE COMPLETED**	24/10/2022
CLIENT		**PROBE TYPE**	DPH
ENGINEER	DOBA		

HAMMER MASS (kg) 50
INCREMENT SIZE (mm) 100
FALL HEIGHT (mm) 500

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water	Depth (m)	Probe Readings (Blows/Increment)
0.0	.					0.00	0
						0.10	0
						0.20	0
						0.30	8
						0.40	6
						0.50	6
						0.60	6
						0.70	7
						0.80	4
						0.90	6
1.0						1.00	5
						1.10	6
						1.20	6
						1.30	4
						1.40	7
						1.50	6
						1.60	4
						1.70	3
						1.80	4
						1.90	4
2.0						2.00	4
						2.10	5
						2.20	6
						2.30	6
						2.40	6
						2.50	6
						2.60	5
						2.70	5
						2.80	19
						2.90	19
3.0						3.00	25
	End of Probe at 3.10 m			77.19			
4.0							

Graphic Probe Record



GROUNDWATER OBSERVATIONS

REMARKS

DYNAMIC PROBE RECORD

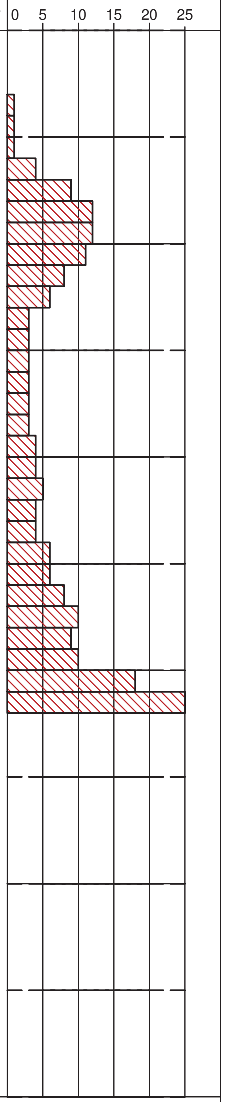
REPORT NUMBER 24330

CONTRACT	Halverstown	**PROBE NO.**	**DP45**
		SHEET	Sheet 1 of 1
CO-ORDINATES	686,651.20 E 719,711.31 N	**DATE COMMENCED**	13/10/2022
GROUND LEVEL (mOD)	81.80	**DATE COMPLETED**	24/10/2022
HAMMER MASS (kg)	50		
INCREMENT SIZE (mm)	100		
FALL HEIGHT (mm)	500	**PROBE TYPE**	DPH
CLIENT			
ENGINEER	DOBA		

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water
0.0	.				
	End of Probe at 3.20 m			78.60	

Depth (m)	Probe Readings (Blows/Increment)
0.00	0
0.10	0
0.20	0
0.30	1
0.40	1
0.50	1
0.60	4
0.70	9
0.80	12
0.90	12
1.00	11
1.10	8
1.20	6
1.30	3
1.40	3
1.50	3
1.60	3
1.70	3
1.80	3
1.90	4
2.00	4
2.10	5
2.20	4
2.30	4
2.40	6
2.50	6
2.60	8
2.70	10
2.80	9
2.90	10
3.00	18
3.10	25

Graphic Probe Record



GROUNDWATER OBSERVATIONS

REMARKS

DYNAMIC PROBE RECORD

REPORT NUMBER 24330

CONTRACT Halverstown

PROBE NO. **DP46**
SHEET Sheet 1 of 1

CO-ORDINATES 686,707.11 E
719,737.16 N
GROUND LEVEL (mOD) 80.60

HAMMER MASS (kg) 50
INCREMENT SIZE (mm) 100
FALL HEIGHT (mm) 500

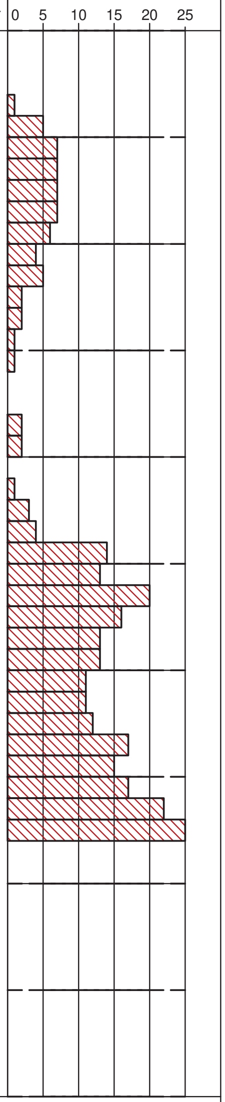
DATE COMMENCED 13/10/2022
DATE COMPLETED 24/10/2022

CLIENT
ENGINEER DOBA

PROBE TYPE DPH

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water	Depth (m)	Probe Readings (Blows/Increment)
0.0	.					0.00	0
						0.10	0
						0.20	0
						0.30	1
						0.40	5
						0.50	7
						0.60	7
						0.70	7
						0.80	7
						0.90	6
1.0						1.00	4
						1.10	5
						1.20	2
						1.30	2
						1.40	1
						1.50	1
						1.60	0
						1.70	0
						1.80	2
						1.90	2
2.0						2.00	0
						2.10	1
						2.20	3
						2.30	4
						2.40	14
						2.50	13
						2.60	20
						2.70	16
						2.80	13
						2.90	13
3.0						3.00	11
						3.10	11
						3.20	12
						3.30	17
						3.40	15
						3.50	17
						3.60	22
						3.70	25
	End of Probe at 3.80 m			76.80			
4.0							

Graphic Probe Record



GROUNDWATER OBSERVATIONS

REMARKS

IGSL DP LOG 100MM INCREMENTS 24330.GPJ IGSL.GDT 31/1/23

DYNAMIC PROBE RECORD

REPORT NUMBER 24330

CONTRACT Halverstown

PROBE NO. DP47

SHEET Sheet 1 of 1

CO-ORDINATES 686,765.22 E
719,769.16 N

GROUND LEVEL (mOD) 81.09

HAMMER MASS (kg) 50

INCREMENT SIZE (mm) 100

FALL HEIGHT (mm) 500

DATE COMMENCED 13/10/2022

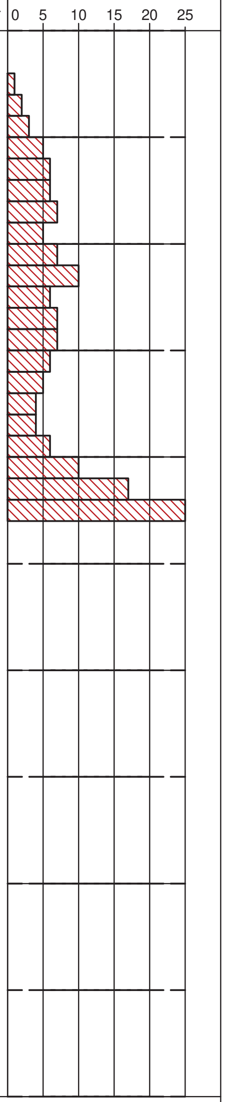
DATE COMPLETED 24/10/2022

CLIENT

ENGINEER DOBA

PROBE TYPE DPH

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water	Depth (m)	Probe Readings (Blows/Increment)	Graphic Probe Record
0.0	.					0.00	0	
						0.10	0	
						0.20	1	
						0.30	2	
						0.40	3	
						0.50	5	
						0.60	6	
						0.70	6	
						0.80	7	
						0.90	5	
1.0						1.00	7	
						1.10	10	
						1.20	6	
						1.30	7	
						1.40	7	
						1.50	6	
						1.60	5	
						1.70	4	
						1.80	4	
						1.90	6	
2.0						2.00	10	
						2.10	17	
						2.20	25	
	End of Probe at 2.30 m			78.79				
3.0								
4.0								



GROUNDWATER OBSERVATIONS

REMARKS

DYNAMIC PROBE RECORD

REPORT NUMBER 24330

CONTRACT Halverstown

PROBE NO. **DP48**
SHEET Sheet 1 of 1

CO-ORDINATES 686,725.82 E
719,678.88 N
GROUND LEVEL (mOD) 80.69

HAMMER MASS (kg) 50
INCREMENT SIZE (mm) 100
FALL HEIGHT (mm) 500

DATE COMMENCED 13/10/2022
DATE COMPLETED 24/10/2022

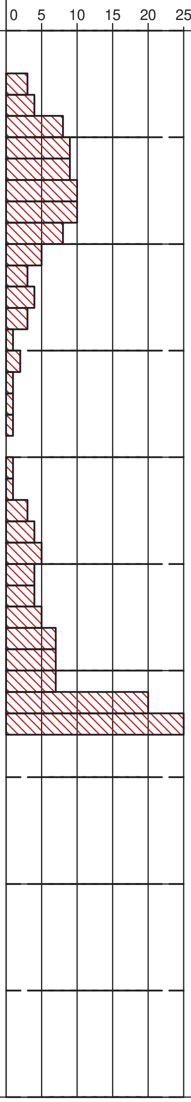
CLIENT
ENGINEER DOBA

PROBE TYPE DPH

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water
0.0	.				
3.30	End of Probe at 3.30 m			77.39	

Depth (m)	Probe Readings (Blows/Increment)
0.00	0
0.10	0
0.20	3
0.30	4
0.40	8
0.50	9
0.60	9
0.70	10
0.80	10
0.90	8
1.00	5
1.10	3
1.20	4
1.30	3
1.40	1
1.50	2
1.60	1
1.70	1
1.80	1
1.90	0
2.00	1
2.10	1
2.20	3
2.30	4
2.40	5
2.50	4
2.60	4
2.70	5
2.80	7
2.90	7
3.00	7
3.10	20
3.20	25

Graphic Probe Record



GROUNDWATER OBSERVATIONS

REMARKS

DYNAMIC PROBE RECORD

REPORT NUMBER 24330

CONTRACT Halverstown

PROBE NO. DP49
SHEET Sheet 1 of 1

CO-ORDINATES 686,106.77 E
719,990.16 N
GROUND LEVEL (mOD) 83.74

HAMMER MASS (kg) 50
INCREMENT SIZE (mm) 100
FALL HEIGHT (mm) 500

DATE COMMENCED 13/10/2022
DATE COMPLETED 24/10/2022

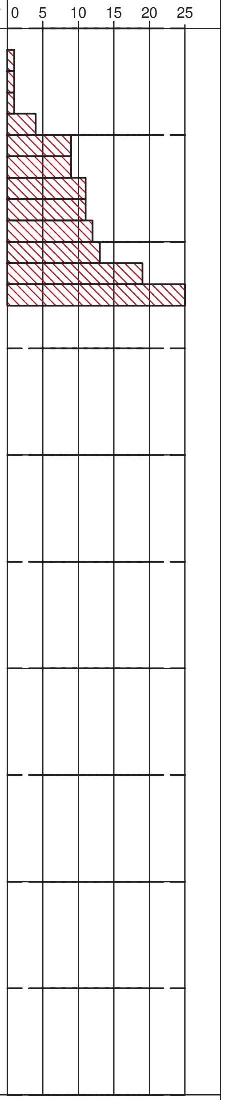
CLIENT
ENGINEER DOBA

PROBE TYPE DPH

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water
0.0	.				
	End of Probe at 1.30 m			82.44	

Depth (m)	Probe Readings (Blows/Increment)
0.00	0
0.10	1
0.20	1
0.30	1
0.40	4
0.50	9
0.60	9
0.70	11
0.80	11
0.90	12
1.00	13
1.10	19
1.20	25

Graphic Probe Record



Depth (m): 0.0, 1.0, 2.0, 3.0, 4.0

GROUNDWATER OBSERVATIONS

REMARKS

DYNAMIC PROBE RECORD

REPORT NUMBER 24330

CONTRACT Halverstown

PROBE NO. DP50
SHEET Sheet 1 of 1

CO-ORDINATES 686,210.39 E
719,967.00 N
GROUND LEVEL (mOD) 85.05

HAMMER MASS (kg) 50
INCREMENT SIZE (mm) 100
FALL HEIGHT (mm) 500

DATE COMMENCED 13/10/2022
DATE COMPLETED 24/10/2022

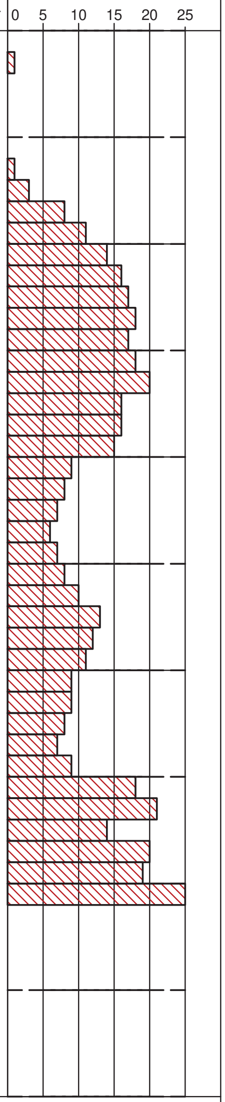
CLIENT
ENGINEER DOBA

PROBE TYPE DPH

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water
0.0	.				
4.10	End of Probe at 4.10 m			80.95	

Depth (m)	Probe Readings (Blows/Increment)
0.00	0
0.10	1
0.20	0
0.30	0
0.40	0
0.50	0
0.60	1
0.70	3
0.80	8
0.90	11
1.00	14
1.10	16
1.20	17
1.30	18
1.40	17
1.50	18
1.60	20
1.70	16
1.80	16
1.90	15
2.00	9
2.10	8
2.20	7
2.30	6
2.40	7
2.50	8
2.60	10
2.70	13
2.80	12
2.90	11
3.00	9
3.10	9
3.20	8
3.30	7
3.40	9
3.50	18
3.60	21
3.70	14
3.80	20
3.90	19
4.00	25

Graphic Probe Record



GROUNDWATER OBSERVATIONS

REMARKS

DYNAMIC PROBE RECORD

REPORT NUMBER 24330

CONTRACT Halverstown

PROBE NO. DP51
SHEET Sheet 1 of 1

CO-ORDINATES 686,092.79 E
719,923.60 N
GROUND LEVEL (mOD) 83.59

HAMMER MASS (kg) 50
INCREMENT SIZE (mm) 100
FALL HEIGHT (mm) 500

DATE COMMENCED 13/10/2022
DATE COMPLETED 24/10/2022

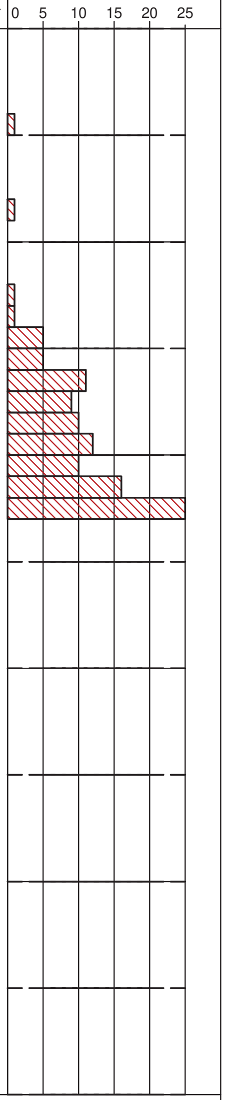
CLIENT
ENGINEER DOBA

PROBE TYPE DPH

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water
0.0	.				
	End of Probe at 2.30 m			81.29	

Depth (m)	Probe Readings (Blows/Increment)
0.00	0
0.10	0
0.20	0
0.30	0
0.40	1
0.50	0
0.60	0
0.70	0
0.80	1
0.90	0
1.00	0
1.10	0
1.20	1
1.30	1
1.40	5
1.50	5
1.60	11
1.70	9
1.80	10
1.90	12
2.00	10
2.10	16
2.20	25

Graphic Probe Record



GROUNDWATER OBSERVATIONS

REMARKS

DYNAMIC PROBE RECORD

REPORT NUMBER 24330

CONTRACT Halverstown

PROBE NO. DP52

SHEET Sheet 1 of 1

CO-ORDINATES 686,144.75 E
719,915.16 N

GROUND LEVEL (mOD) 83.98

HAMMER MASS (kg) 50

INCREMENT SIZE (mm) 100

FALL HEIGHT (mm) 500

DATE COMMENCED 13/10/2022

DATE COMPLETED 24/10/2022

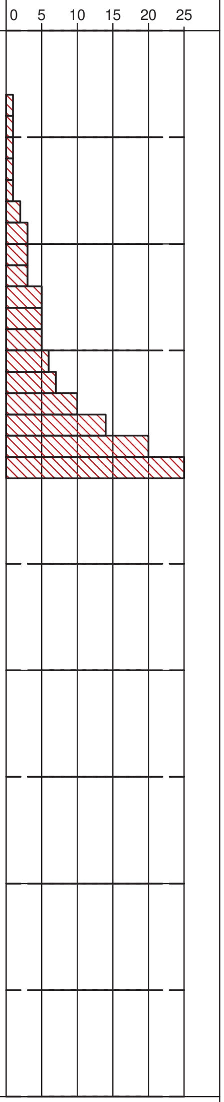
CLIENT

ENGINEER DOBA

PROBE TYPE DPH

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water	Depth (m)	Probe Readings (Blows/Increment)
0.0	.					0.00	0
						0.10	0
						0.20	0
						0.30	1
						0.40	1
						0.50	1
						0.60	1
						0.70	1
						0.80	2
						0.90	3
1.0						1.00	3
						1.10	3
						1.20	5
						1.30	5
						1.40	5
						1.50	6
						1.60	7
						1.70	10
						1.80	14
						1.90	20
2.0						2.00	25
	End of Probe at 2.10 m			81.88			
3.0							
4.0							

Graphic Probe Record



GROUNDWATER OBSERVATIONS

REMARKS

DYNAMIC PROBE RECORD

REPORT NUMBER 24330

CONTRACT	Halverstown	**PROBE NO.**	**DP53**
		SHEET	Sheet 1 of 1
CO-ORDINATES	686,195.84 E 719,902.81 N	**DATE COMMENCED**	13/10/2022
GROUND LEVEL (mOD)	84.37	**DATE COMPLETED**	24/10/2022
CLIENT		**PROBE TYPE**	DPH
ENGINEER	DOBA		

HAMMER MASS (kg) 50

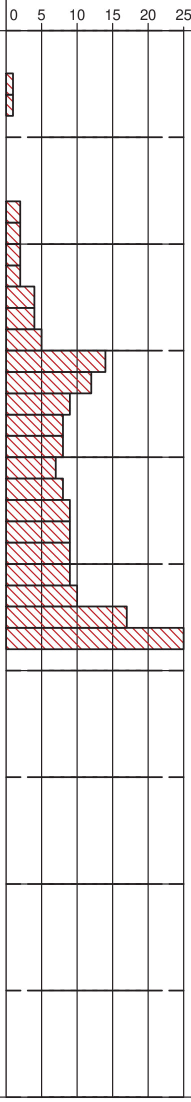
INCREMENT SIZE (mm) 100

FALL HEIGHT (mm) 500

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water
0.0	.				
	End of Probe at 2.90 m			81.47	

Depth (m)	Probe Readings (Blows/Increment)
0.00	0
0.10	0
0.20	1
0.30	1
0.40	0
0.50	0
0.60	0
0.70	0
0.80	2
0.90	2
1.00	2
1.10	2
1.20	4
1.30	4
1.40	5
1.50	14
1.60	12
1.70	9
1.80	8
1.90	8
2.00	7
2.10	8
2.20	9
2.30	9
2.40	9
2.50	9
2.60	10
2.70	17
2.80	25

Graphic Probe Record



Depth (m): 0.0, 1.0, 2.0, 3.0, 4.0

GROUNDWATER OBSERVATIONS

REMARKS

DYNAMIC PROBE RECORD

REPORT NUMBER 24330

CONTRACT Halverstown

PROBE NO. DP54

SHEET Sheet 1 of 1

CO-ORDINATES 686,072.66 E
719,843.36 N

GROUND LEVEL (mOD) 82.74

HAMMER MASS (kg) 50

INCREMENT SIZE (mm) 100

FALL HEIGHT (mm) 500

DATE COMMENCED 13/10/2022

DATE COMPLETED 24/10/2022

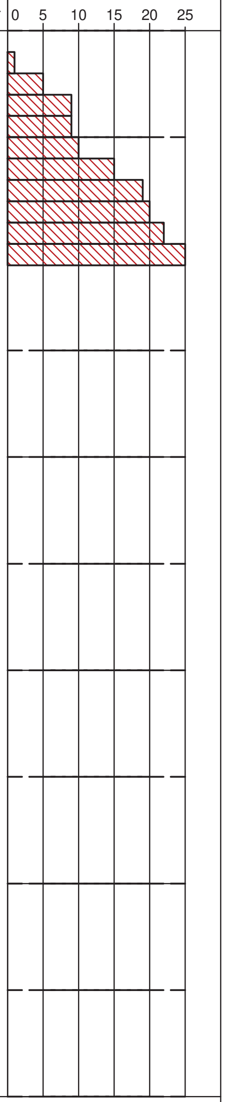
CLIENT

ENGINEER DOBA

PROBE TYPE DPH

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water	Depth (m)	Probe Readings (Blows/Increment)
0.0	.					0.00	0
						0.10	1
						0.20	5
						0.30	9
						0.40	9
						0.50	10
						0.60	15
						0.70	19
						0.80	20
						0.90	22
1.0						1.00	25
	End of Probe at 1.10 m			81.64			
2.0							
3.0							
4.0							

Graphic Probe Record



GROUNDWATER OBSERVATIONS

REMARKS

DYNAMIC PROBE RECORD

REPORT NUMBER 24330

CONTRACT Halverstown

PROBE NO. DP55
SHEET Sheet 1 of 1

CO-ORDINATES 686,165.55 E
719,844.59 N
GROUND LEVEL (mOD) 83.28

HAMMER MASS (kg) 50
INCREMENT SIZE (mm) 100
FALL HEIGHT (mm) 500

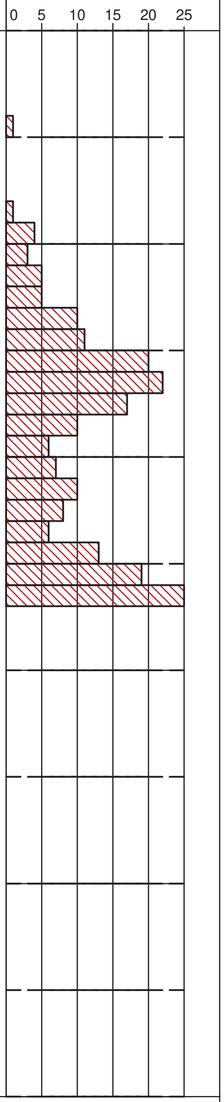
DATE COMMENCED 13/10/2022
DATE COMPLETED 24/10/2022

CLIENT
ENGINEER DOBA

PROBE TYPE DPH

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water	Depth (m)	Probe Readings (Blows/Increment)
0.0	.					0.00	0
						0.10	0
						0.20	0
						0.30	0
						0.40	1
						0.50	0
						0.60	0
						0.70	0
						0.80	1
						0.90	4
1.0						1.00	3
						1.10	5
						1.20	5
						1.30	10
						1.40	11
						1.50	20
						1.60	22
						1.70	17
						1.80	10
						1.90	6
2.0						2.00	7
						2.10	10
						2.20	8
						2.30	6
						2.40	13
						2.50	19
						2.60	25
	End of Probe at 2.70 m			80.58			
3.0							
4.0							

Graphic Probe Record



GROUNDWATER OBSERVATIONS

REMARKS

IGSL DP LOG 100MM INCREMENTS 24330.GPJ IGSL.GDT 31/1/23

Appendix 4

Plate Bearing Test Records and Photographs

Plate Bearing Test Location	Easting	Northing	Ground Elevation (m OD)
PB01	686026.191	719628.483	77.374
PB02	686136.534	719561.308	78.464
PB03	686256.743	719477.368	77.388
PB04	686382.137	719393.367	77.658
PB05	686492.325	719325.948	77.892
PB06	686083.424	719690.995	80.212
PB07	686195.383	719648.688	80.35
PB08	686321.511	719577.541	80.422
PB09	686449.717	719504.272	79.958
PB10	686560.525	719440.269	79.465
PB11	686111.564	719816.693	82.453
PB12	686257.433	719770.027	82.442
PB13	686376.995	719691.499	82.736
PB14	686508.037	719616.149	82.784
PB15	686669.886	719527.151	82.074
PB16	686223.894	719890.232	84.622
PB17	686250.619	719960.215	85.033
PB18	686538.545	719817.48	84.393
PB19	686382.704	719872.799	85.448
PB20	686620.439	719708.606	82.783
PB21	686739.46	719661.977	80.75
PB22	686775.685	719756.63	81.147
PB23	686604.429	719849.736	82.676

PLATE TEST REPORT SHEET (F3.1)

Applied Pressure/Settlement Curve

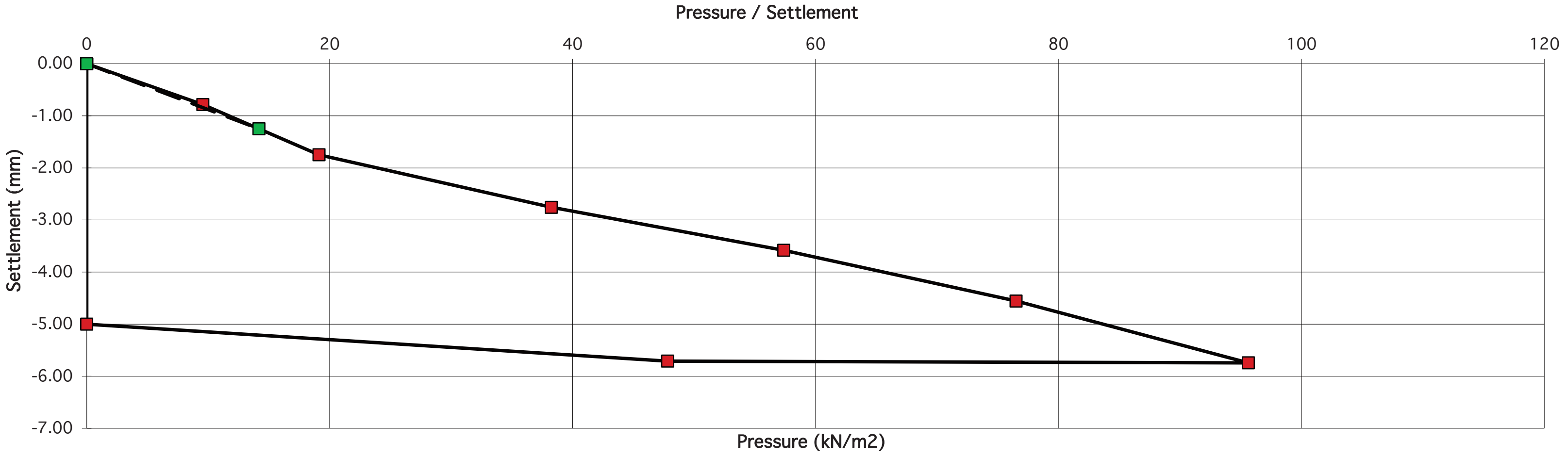
Reference No.	R139820
Contract	24330 Halverstown
Test No.	PBT01 (Load)
Location	See Site Map
Depth	0.60
Client	DOBA
Plate Diameter:	450 mm
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician	M.Brown
Authorised by	
Date	18/10/2022

Description of soil under test
(natural soil, placed fill, sub-base)

Light brownish grey gravelly silty SAND.

Sample Ref No.

Depth m bgl



Gradient at 1.25 mm settlement intersection = 11

Modulus of subgrade reaction = 7 MPa/m

Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 0.3 %

PLATE TEST REPORT SHEET (F3.1)

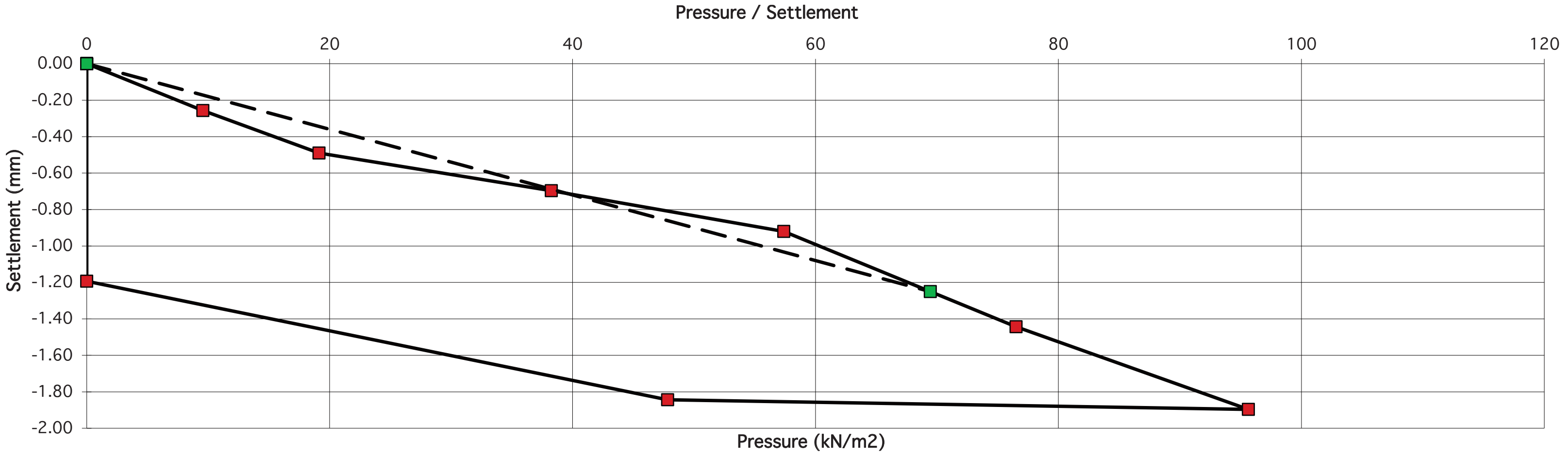
Applied Pressure/Settlement Curve

Reference No.	R139820
Contract	24330 Halverstown
Test No.	PBT01 (Reload)
Location	See Site Map
Depth	0.60
Client	DOBA
Plate Diameter:	450 mm
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician	M.Brown
Authorised by	
Date	18/10/2022

Description of soil under test
(natural soil, placed fill, sub-base)

Light brownish grey gravelly silty SAND.

Sample Ref No.
Depth m bgl



Gradient at 1.25 mm settlement intersection = 56
Modulus of subgrade reaction = 36 MPa/m
Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 4.7 %

PLATE TEST REPORT SHEET (F3.1)

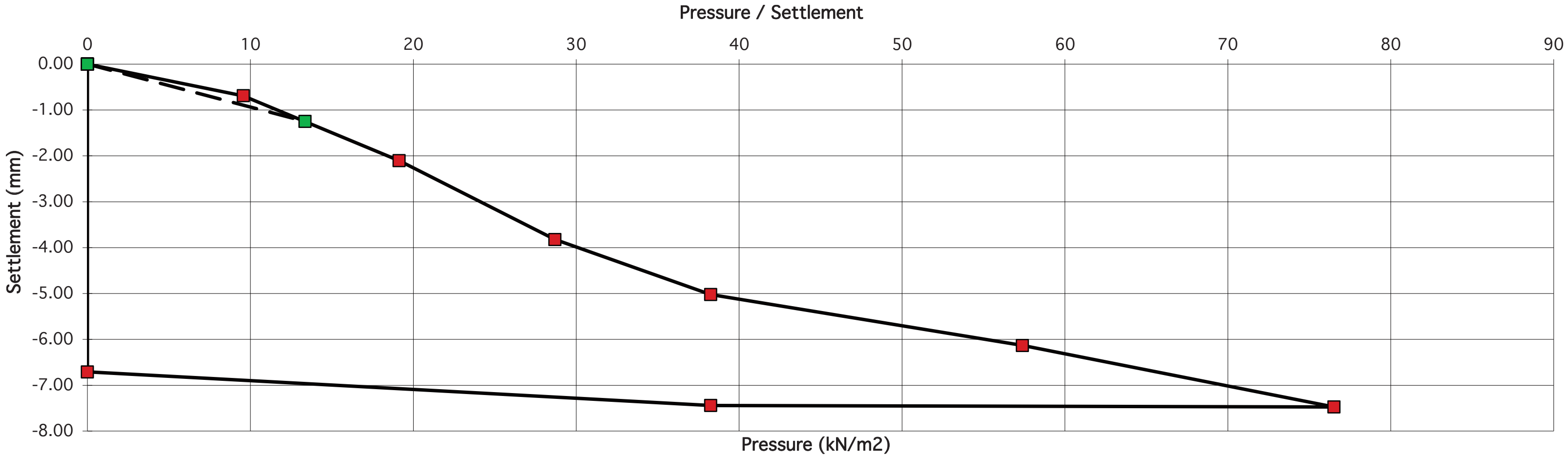
Applied Pressure/Settlement Curve

Reference No.	R139821
Contract	24330 Halverstown
Test No.	PBT02(Load)
Location	See Site Map
Depth	0.60
Client	DOBA
Plate Diameter:	450 mm
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician	M.Brown
Authorised by	
Date	19/10/2022

Description of soil under test
(natural soil, placed fill, sub-base)

Grey mottled orange gravelly silty SAND

Sample Ref No.
Depth m bgl



Gradient at 1.25 mm settlement intersection = 11
Modulus of subgrade reaction = 7 MPa/m
Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 0.3 %

PLATE TEST REPORT SHEET (F3.1)

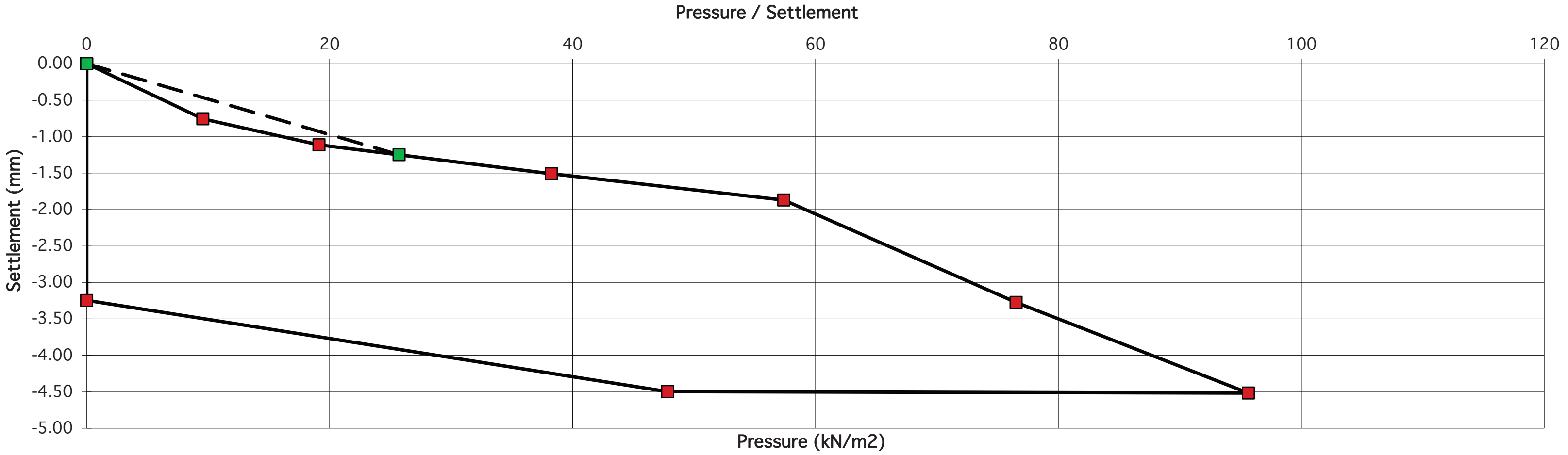
Applied Pressure/Settlement Curve

Reference No.	R139821
Contract	24330 Halverstown
Test No.	PBT02 (Reload)
Location	See Site Map
Depth	0.60
Client	DOBA
Plate Diameter:	450 mm
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician	M.Brown
Authorised by	
Date	19/10/2022

Description of soil under test
(natural soil, placed fill, sub-base)

Grey mottled orange gravelly silty SAND

Sample Ref No.
Depth m bgl



Gradient at 1.25 mm settlement intersection = 21
Modulus of subgrade reaction = 13 MPa/m
Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 0.8 %

PLATE TEST REPORT SHEET (F3.1)

Applied Pressure/Settlement Curve

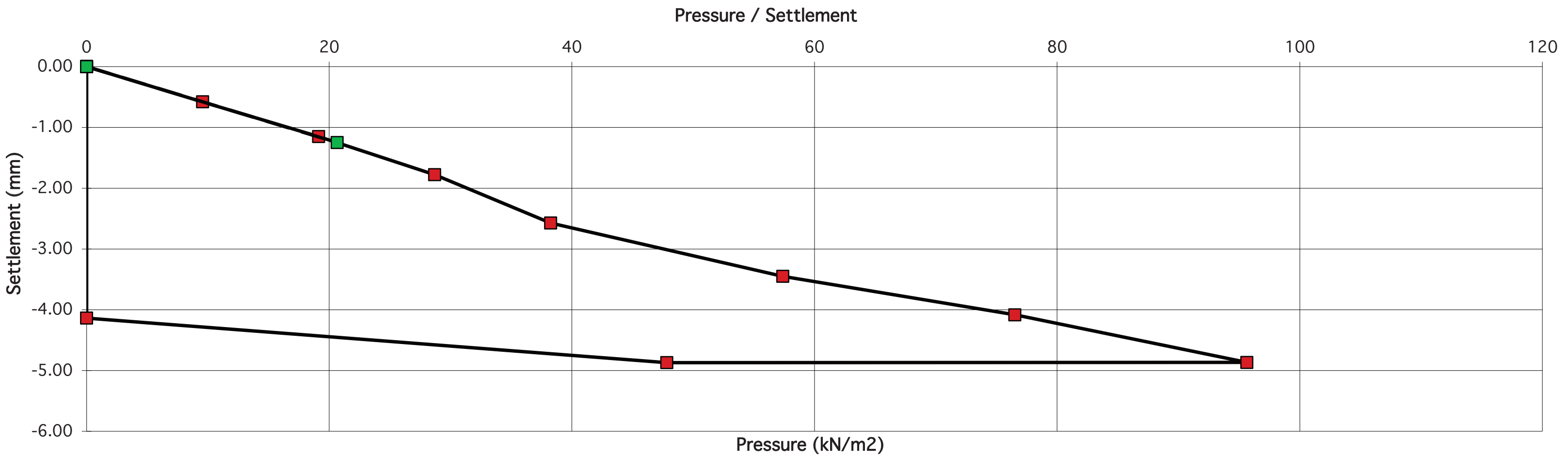
Reference No.	R139822
Contract	24330 Halverstown
Test No.	PBT03 (Load)
Location	See Site Map
Depth	0.50
Client	DOBA
Plate Diameter:	450 mm
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician	M.Brown
Authorised by	
Date	19/10/2022

Description of soil under test
(natural soil, placed fill, sub-base)

Grey mottled orange silty sandy CLAY.

Sample Ref No.

Depth m bgl



Gradient at 1.25 mm settlement intersection = 17
Modulus of subgrade reaction = 11 MPa/m
Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 0.6 %

PLATE TEST REPORT SHEET (F3.1)

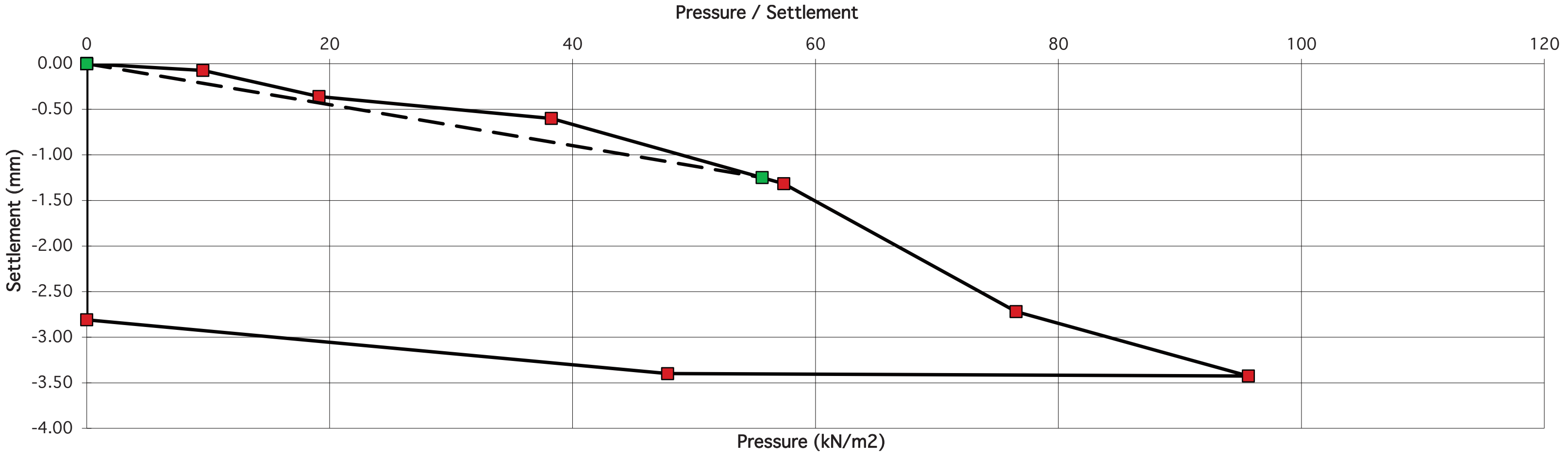
Applied Pressure/Settlement Curve

Reference No.	R139822
Contract	24330 Halverstown
Test No.	PBT03 (Reload)
Location	See Site Map
Depth	0.50
Client	DOBA
Plate Diameter:	450 mm
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician	M.Brown
Authorised by	
Date	19/10/2022

Description of soil under test
(natural soil, placed fill, sub-base)

Grey mottled orange silty sandy CLAY.

Sample Ref No.
Depth m bgl



Gradient at 1.25 mm settlement intersection = 44
Modulus of subgrade reaction = 29 MPa/m
Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 3.2 %

PLATE TEST REPORT SHEET (F3.1)

Applied Pressure/Settlement Curve

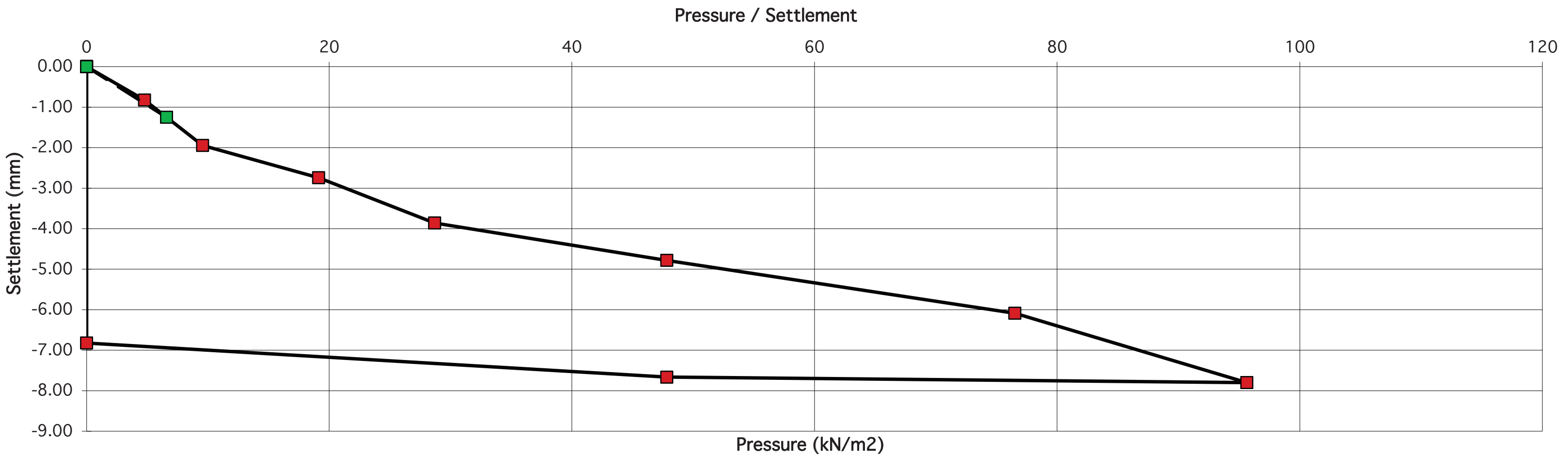
Reference No.	R139823
Contract	24330 Halverstown
Test No.	PBT04 (Load)
Location	See Site Map
Depth	0.40
Client	DOBA
Plate Diameter:	450 mm
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician	M.Brown
Authorised by	
Date	04/10/2022

Description of soil under test
(natural soil, placed fill, sub-base)

Grey gravelly silty CLAY with medium cobbles.

Sample Ref No.

Depth m bgl



Gradient at 1.25 mm settlement intersection = 5

Modulus of subgrade reaction = 3 MPa/m

Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 0.1 %

PLATE TEST REPORT SHEET (F3.1)

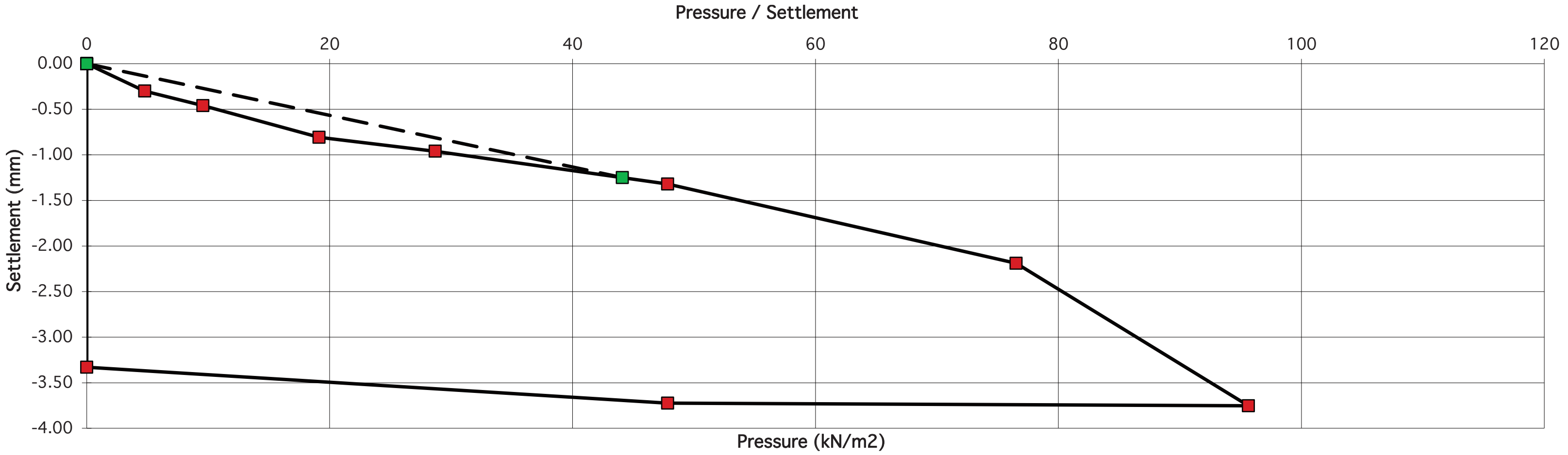
Applied Pressure/Settlement Curve

Reference No.	R139823
Contract	24330 Halverstown
Test No.	PBT04 (Reload)
Location	See Site Map
Depth	0.40
Client	DOBA
Plate Diameter:	450 mm
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician	M.Brown
Authorised by	
Date	04/10/2022

Description of soil under test
(natural soil, placed fill, sub-base)

Grey gravelly silty CLAY with medium cobbles.

Sample Ref No.
Depth m bgl



Gradient at 1.25 mm settlement intersection = 35
Modulus of subgrade reaction = 23 MPa/m
Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10	2.2 %

PLATE TEST REPORT SHEET (F3.1)

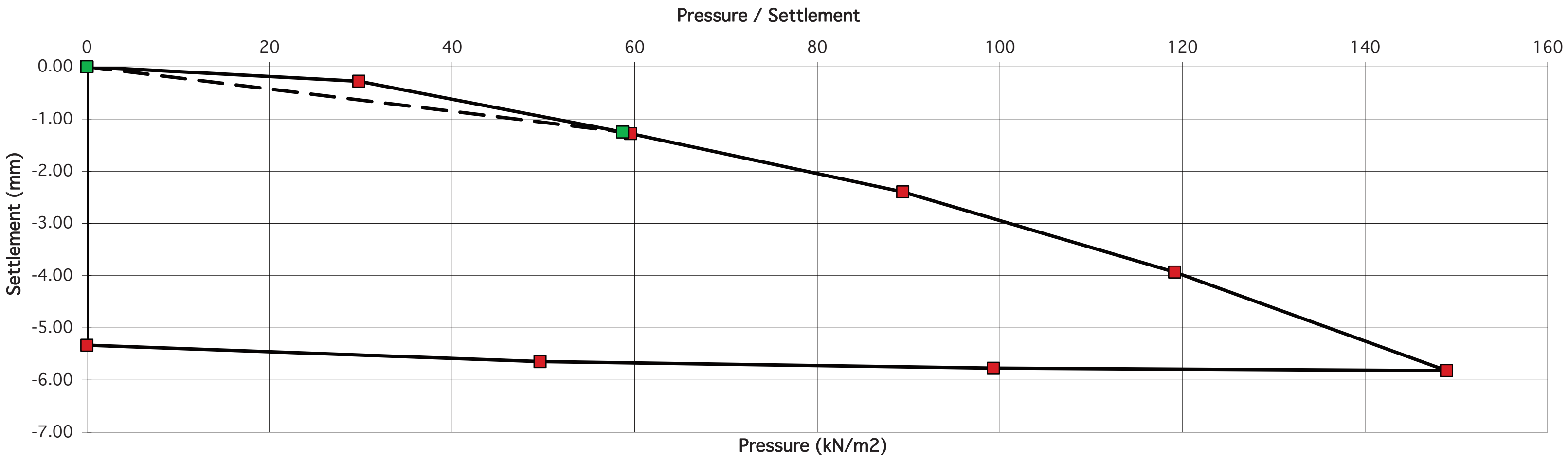
Applied Pressure/Settlement Curve

Reference No.	R139824
Contract	24330 Halverstown
Test No.	PBT05 (Load)
Location	See Site Map
Depth	0.40
Client	DOBA
Plate Diameter:	450 mm
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician	M.Brown
Authorised by	
Date	03/10/2022

Description of soil under test
(natural soil, placed fill, sub-base)

Grey gravelly sandy CLAY

Sample Ref No.
Depth m bgl



Gradient at 1.25 mm settlement intersection = 47
Modulus of subgrade reaction = 30 MPa/m
Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 3.5 %

PLATE TEST REPORT SHEET (F3.1)

Applied Pressure/Settlement Curve

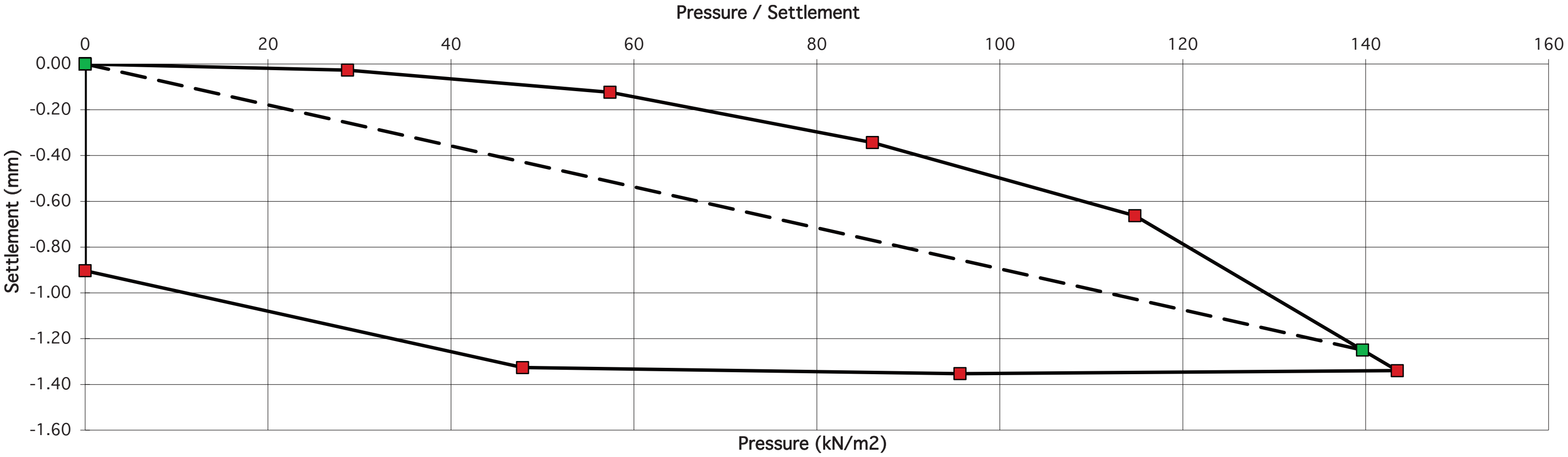
Reference No.	R139824
Contract	24330 Halverstown
Test No.	PBT05 (Reload)
Location	See Site Map
Depth	0.40
Client	DOBA
Plate Diameter:	450 mm
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician	M.Brown
Authorised by	
Date	03/10/2022

Description of soil under test
(natural soil, placed fill, sub-base)

Grey gravelly sandy CLAY

Sample Ref No.

Depth m bgl



Gradient at 1.25 mm settlement intersection = 112

Modulus of subgrade reaction = 72 MPa/m

Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 15.9 %

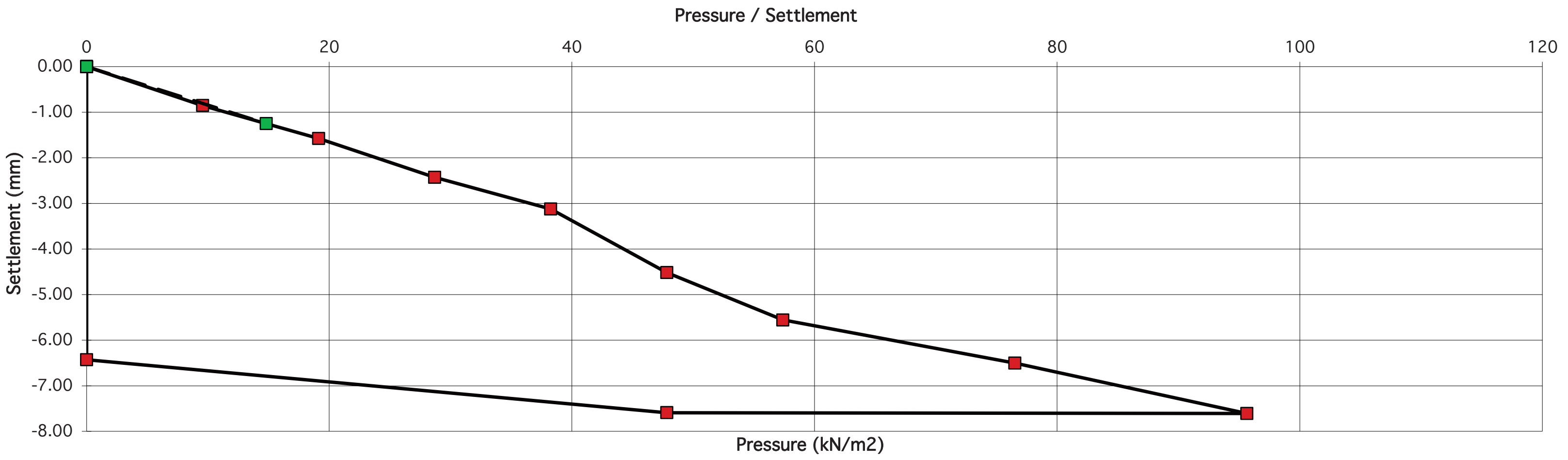
PLATE TEST REPORT SHEET (F3.1)

Applied Pressure/Settlement Curve

Reference No. R139825
Contract 24330 Halverstown
Test No. PBT06 (Load)
Location See Site Map
Depth 0.40
Client DOBA
Plate Diameter: 450 mm
Test Method BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician M.Brown
Authorised by
Date 18/10/2022

Description of soil under test
(natural soil, placed fill, sub-base)
Grey sandy gravelly clayey SILT.

Sample Ref No.
Depth m bgl



Gradient at 1.25 mm settlement intersection = 12
Modulus of subgrade reaction = 8 MPa/m
Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 0.3 %

PLATE TEST REPORT SHEET (F3.1)

Applied Pressure/Settlement Curve

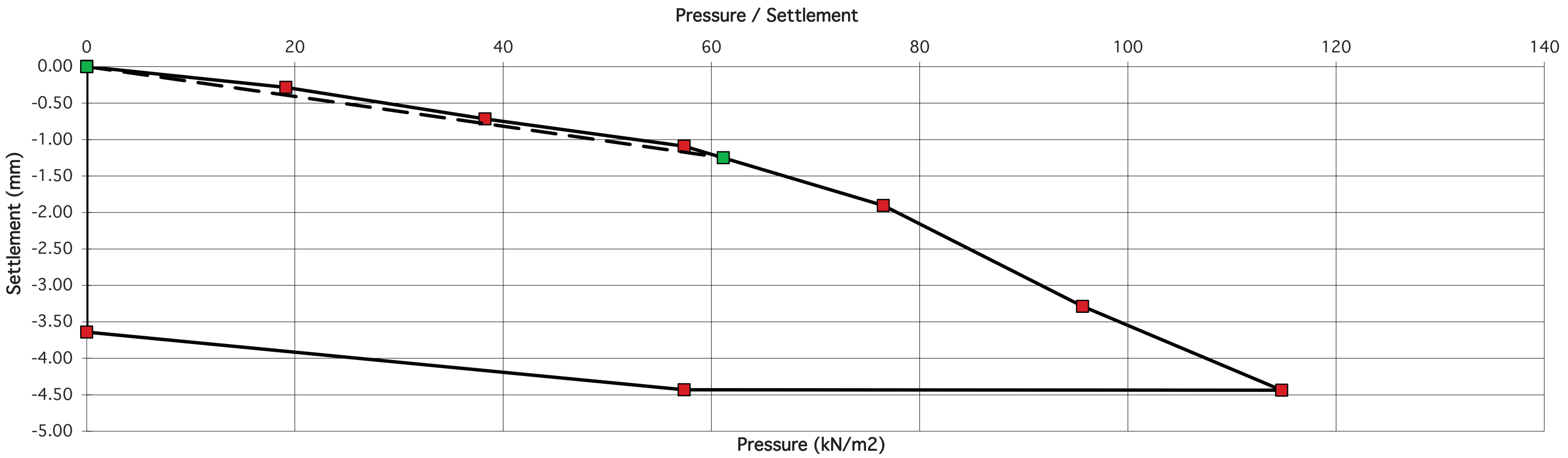
Reference No.	R139825
Contract	24330 Halverstown
Test No.	PBT06 (Reload)
Location	See Site Map
Depth	0.40
Client	DOBA
Plate Diameter:	450 mm
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician	M.Brown
Authorised by	
Date	18/10/2022

Description of soil under test
(natural soil, placed fill, sub-base)

Grey sandy gravelly clayey SILT.

Sample Ref No.

Depth m bgl



Gradient at 1.25 mm settlement intersection = 49
Modulus of subgrade reaction = 31 MPa/m
Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 3.8 %

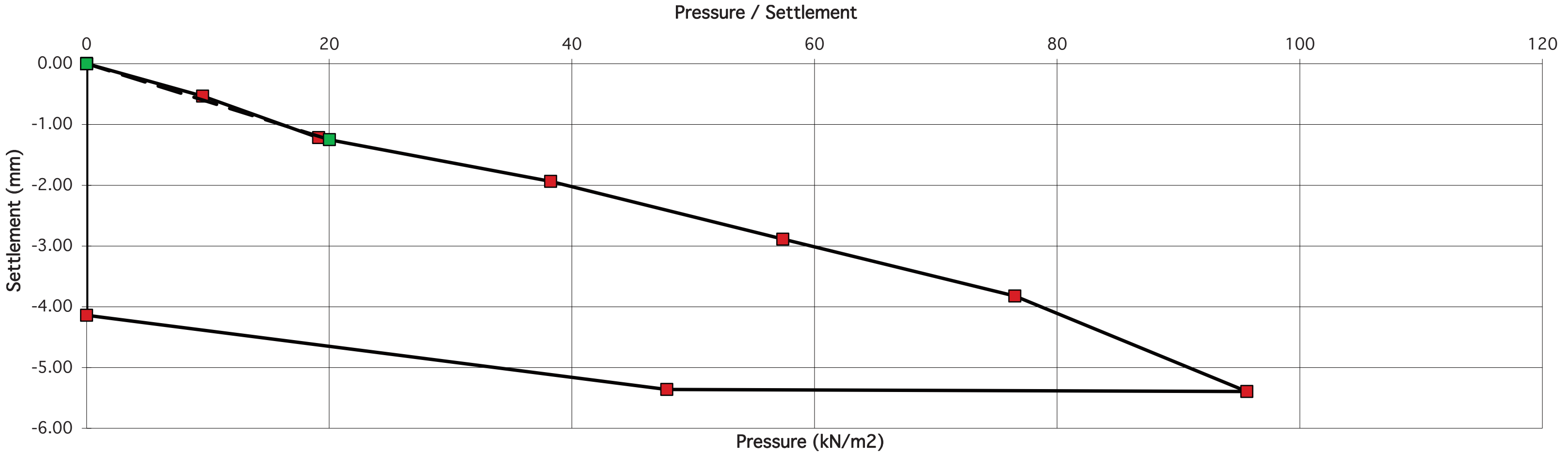
PLATE TEST REPORT SHEET (F3.1)

Applied Pressure/Settlement Curve

Reference No. R139826
Contract 24330 Halverstown
Test No. PBT07 (Load)
Location See Site Map
Depth 0.60
Client DOBA
Plate Diameter: 450 mm
Test Method BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician M.Brown
Authorised by
Date 18/10/2022

Description of soil under test
(natural soil, placed fill, sub-base)
Brown sandy gravelly SILT.

Sample Ref No.
Depth m bgl



Gradient at 1.25 mm settlement intersection = 16
Modulus of subgrade reaction = 10 MPa/m
Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 0.5 %

PLATE TEST REPORT SHEET (F3.1)

Applied Pressure/Settlement Curve

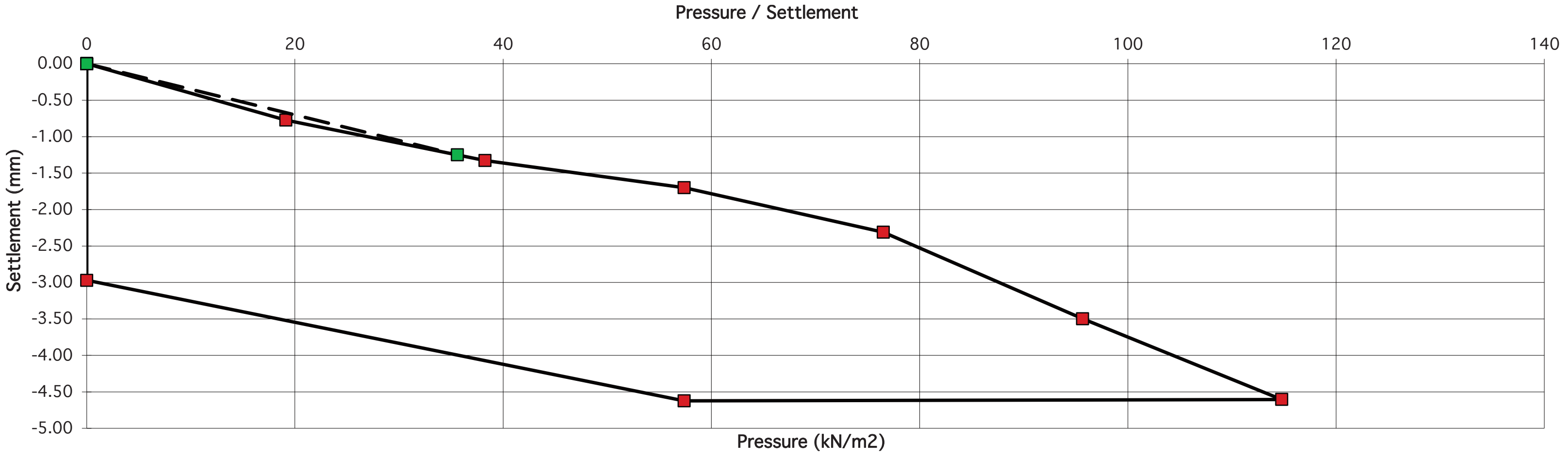
Reference No.	R139826
Contract	24330 Halverstown
Test No.	PBT07 (Reload)
Location	See Site Map
Depth	0.60
Client	DOBA
Plate Diameter:	450 mm
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician	M.Brown
Authorised by	
Date	18/10/2022

Description of soil under test
(natural soil, placed fill, sub-base)

Brown sandy gravelly SILT.

Sample Ref No.

Depth m bgl



Gradient at 1.25 mm settlement intersection = 28
Modulus of subgrade reaction = 18 MPa/m
Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 1.5 %

PLATE TEST REPORT SHEET (F3.1)

Applied Pressure/Settlement Curve

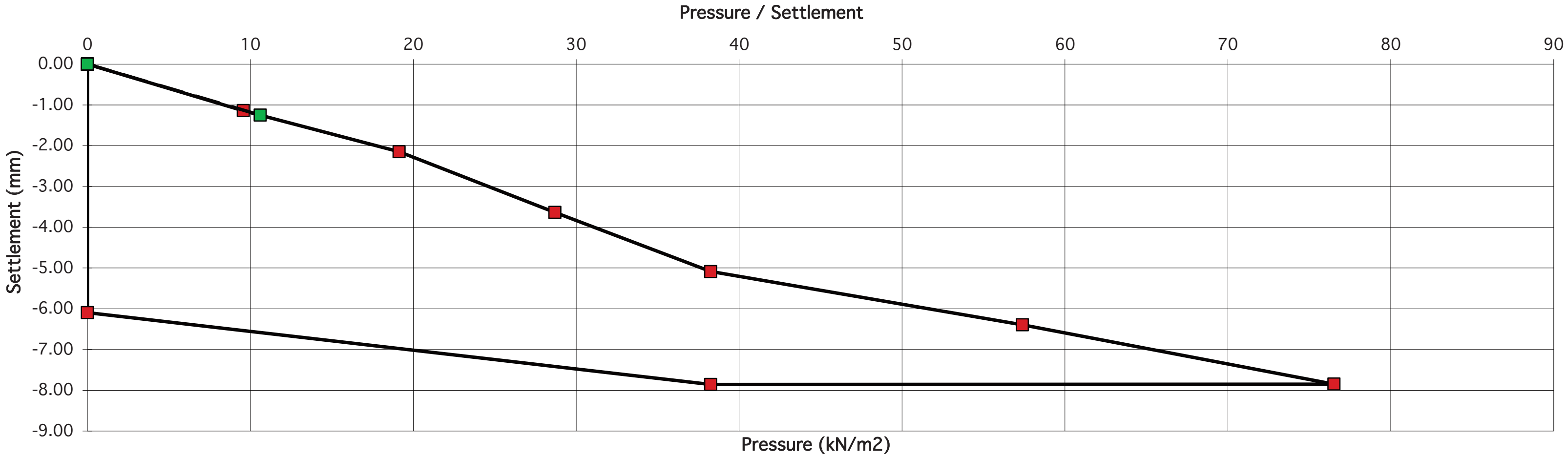
Reference No.	R139827
Contract	24330 Halverstown
Test No.	PBT08 (Load)
Location	See Site Map
Depth	0.50
Client	DOBA
Plate Diameter:	450 mm
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician	M.Brown
Authorised by	
Date	18/10/2022

Description of soil under test
(natural soil, placed fill, sub-base)

Brown sandy slightly gravelly silty CLAY.

Sample Ref No.

Depth m bgl



Gradient at 1.25 mm settlement intersection = 8
Modulus of subgrade reaction = 5 MPa/m
Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 0.2 %

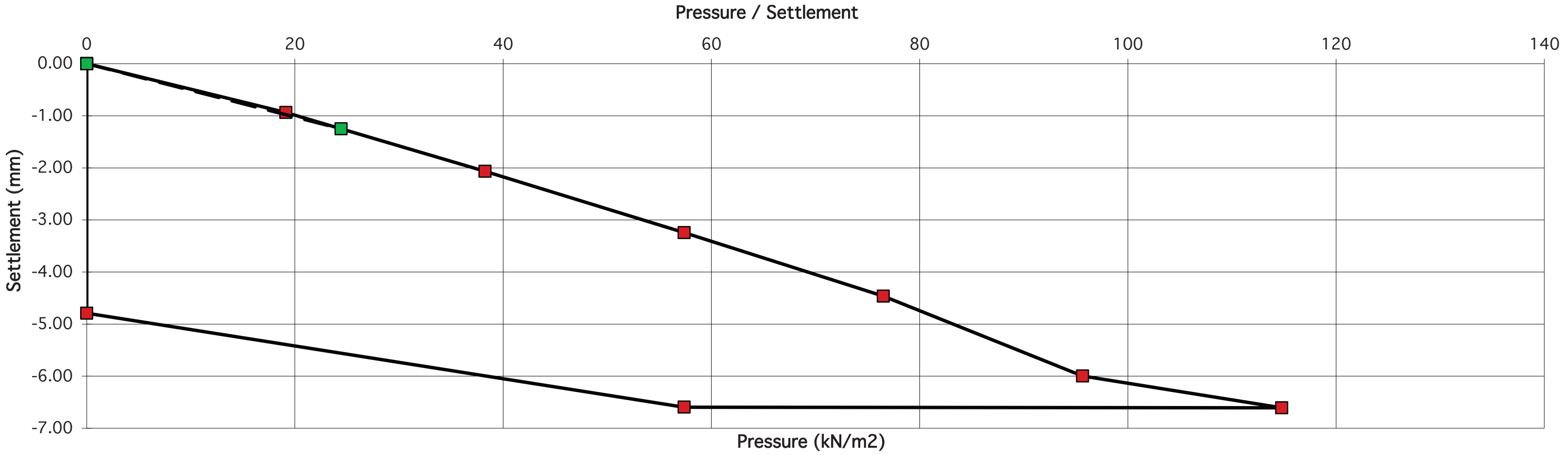
PLATE TEST REPORT SHEET (F3.1)

Applied Pressure/Settlement Curve

Reference No. R139827
Contract 24330 Halverstown
Test No. PBT08 (Reload)
Location See Site Map
Depth 0.50
Client DOBA
Plate Diameter: 450 mm
Test Method BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician M.Brown
Authorised by
Date 18/10/2022

Description of soil under test
(natural soil, placed fill, sub-base)
Brown sandy slightly gravelly silty CLAY.

Sample Ref No.
Depth m bgl



Gradient at 1.25 mm settlement intersection = 20
Modulus of subgrade reaction = 13 MPa/m
Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 0.8 %

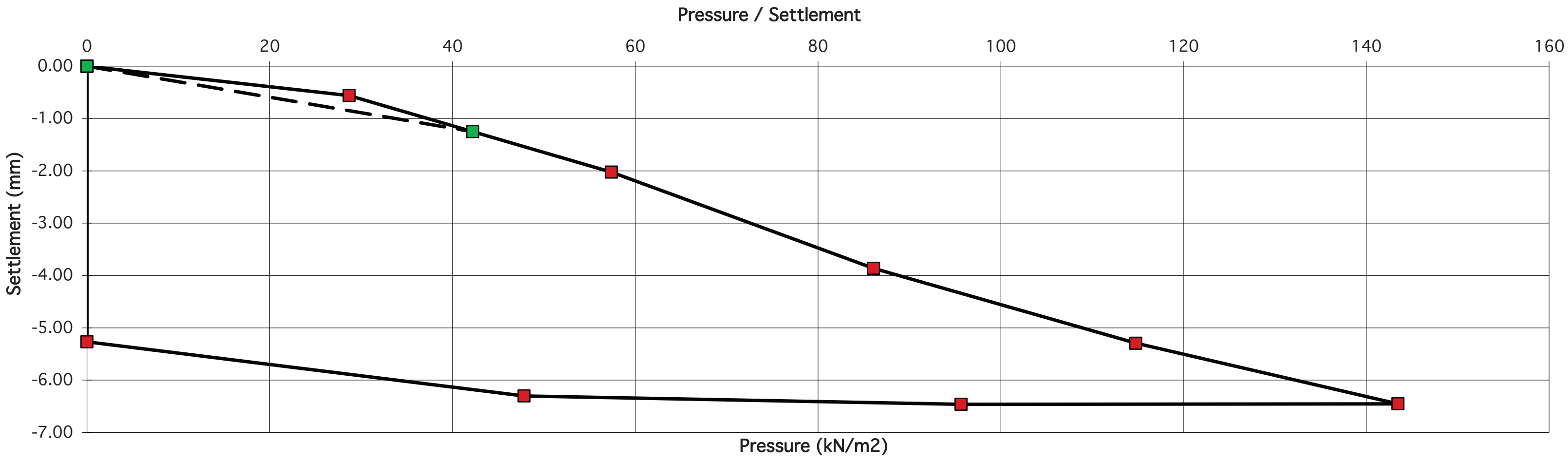
PLATE TEST REPORT SHEET (F3.1)

Applied Pressure/Settlement Curve

Reference No. R139828
Contract 24330 Halverstown
Test No. PBT09 (Load)
Location See Site Map
Depth 0.40
Client DOBA
Plate Diameter: 450 mm
Test Method BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician M.Brown
Authorised by
Date 06/10/2022

Description of soil under test
(natural soil, placed fill, sub-base)
Grey gravelly sandy SILT

Sample Ref No.
Depth m bgl



Gradient at 1.25 mm settlement intersection = 34
Modulus of subgrade reaction = 22 MPa/m
Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 2.0 %

PLATE TEST REPORT SHEET (F3.1)

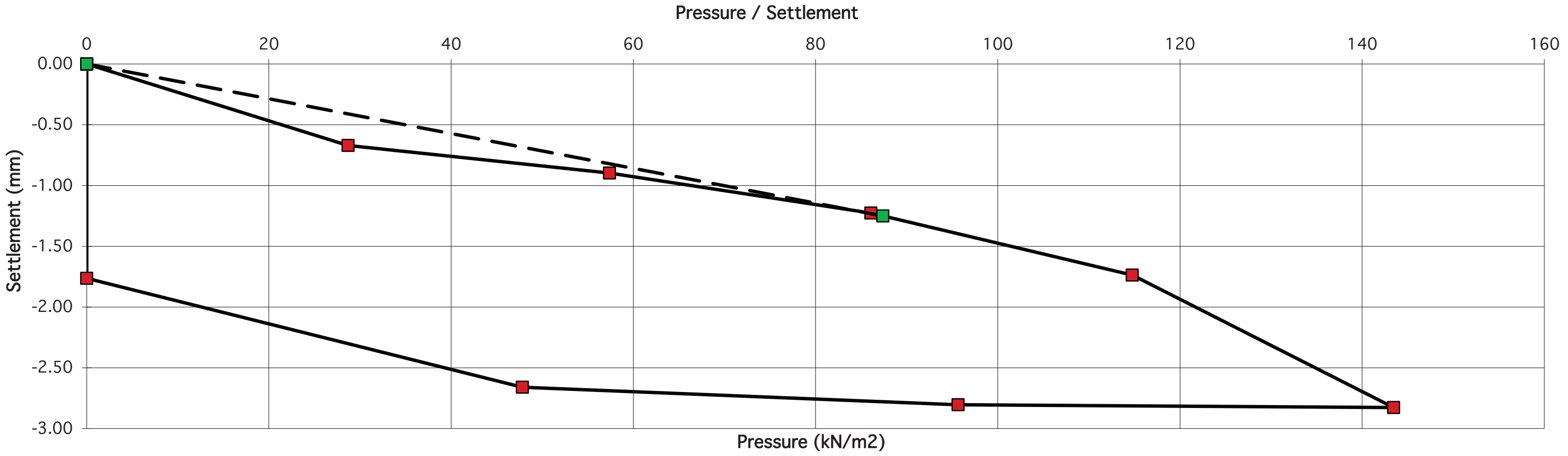
Applied Pressure/Settlement Curve

Reference No.	R139828
Contract	24330 Halverstown
Test No.	PBT09 (Reload)
Location	See Site Map
Depth	0.40
Client	DOBA
Plate Diameter:	450 mm
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician	M.Brown
Authorised by	
Date	06/10/2022

Description of soil under test
(natural soil, placed fill, sub-base)

Grey gravelly sandy SILT

Sample Ref No.
Depth m bgl



Gradient at 1.25 mm settlement intersection = 70
Modulus of subgrade reaction = 45 MPa/m
Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 7.1 %

PLATE TEST REPORT SHEET (F3.1)

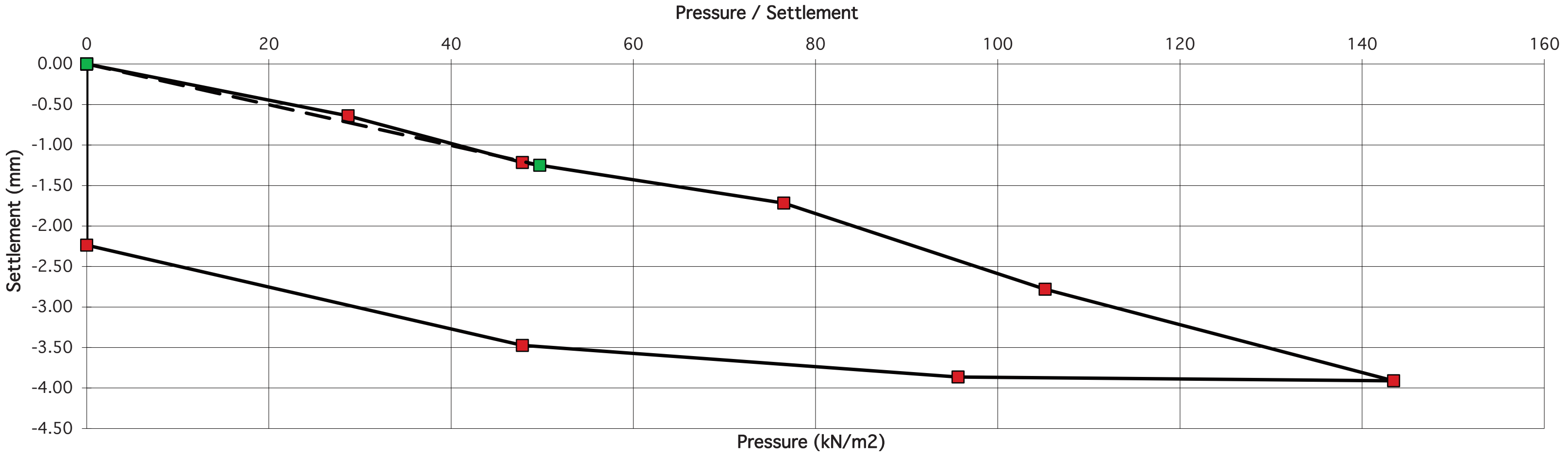
Applied Pressure/Settlement Curve

Reference No.	R139829
Contract	24330 Halverstown
Test No.	PBT10 (Load)
Location	See Site Map
Depth	0.50
Client	DOBA
Plate Diameter:	450 mm
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician	M.Brown
Authorised by	
Date	06/10/2022

Description of soil under test
(natural soil, placed fill, sub-base)

Grey gravelly sandy SILT

Sample Ref No.
Depth m bgl



Gradient at 1.25 mm settlement intersection = 40
Modulus of subgrade reaction = 26 MPa/m
Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 2.7 %

PLATE TEST REPORT SHEET (F3.1)

Applied Pressure/Settlement Curve

Reference No.	R139829
Contract	24330 Halverstown
Test No.	PBT10 (Reload)
Location	See Site Map
Depth	0.50
Client	DOBA
Plate Diameter:	450 mm
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician	M.Brown
Authorised by	
Date	06/10/2022

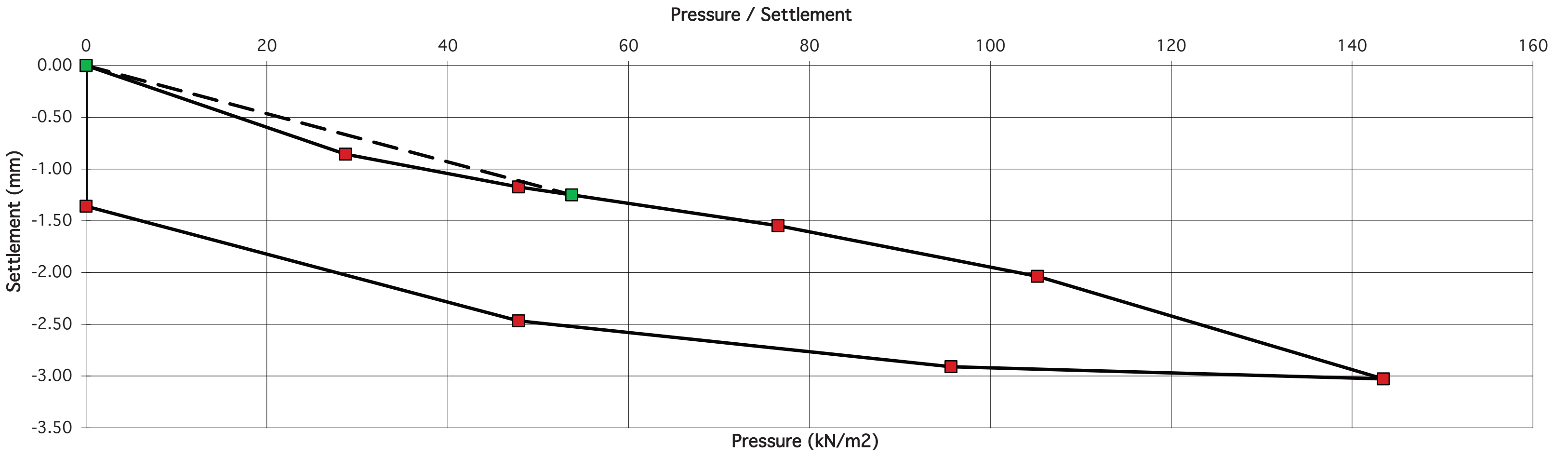
Description of soil under test
(natural soil, placed fill, sub-base)

Grey gravelly sandy SILT

Sample Ref No.
Depth m bgl

IGSL

ISO 17025 INAB ACCREDITED TESTING DETAILED IN SCOPE REG NO.1331



Gradient at 1.25 mm settlement intersection = 43
Modulus of subgrade reaction = 28 MPa/m
Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 3.0 %

PLATE TEST REPORT SHEET (F3.1)

Applied Pressure/Settlement Curve

Reference No.	R139830
Contract	24330 Halverstown
Test No.	PBT11 (Load)
Location	See Site Map
Depth	0.50
Client	DOBA
Plate Diameter:	450 mm
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician	M.Brown
Authorised by	
Date	17/10/2022

Description of soil under test
(natural soil, placed fill, sub-base)

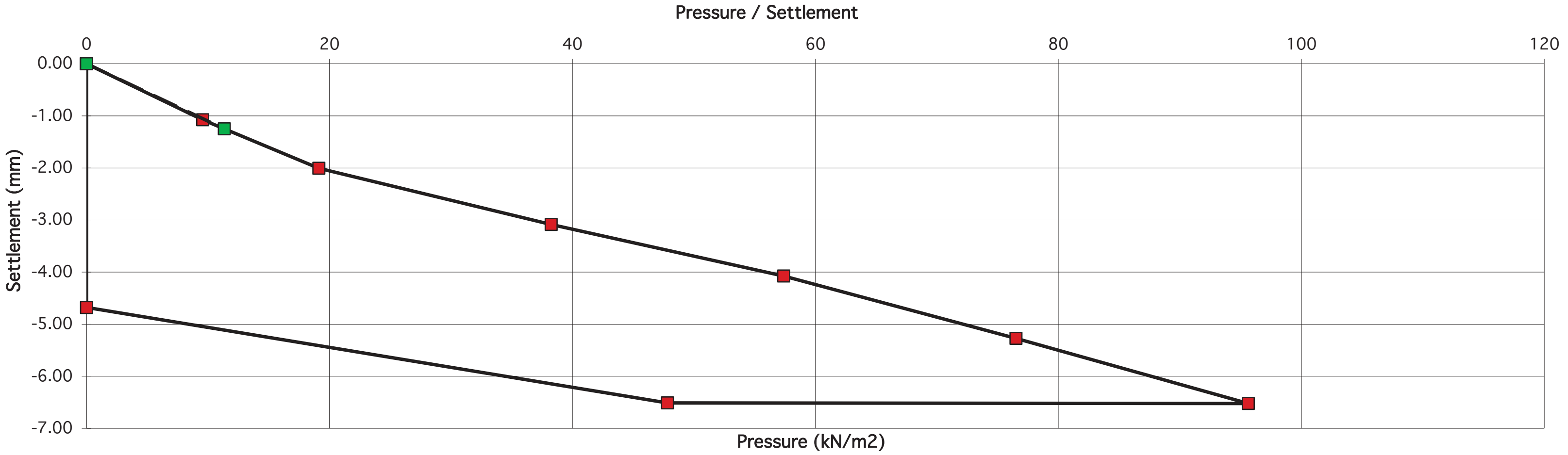
Brown sandy silty CLAY.

Sample Ref No.

Depth m bgl

IGSL Ltd.

ISO 17025 INAB ACCREDITED TESTING
DETAILED IN SCOPE REG NO.133T



Gradient at 1.25 mm settlement intersection = 9
Modulus of subgrade reaction = 6 MPa/m
Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 0.2 %

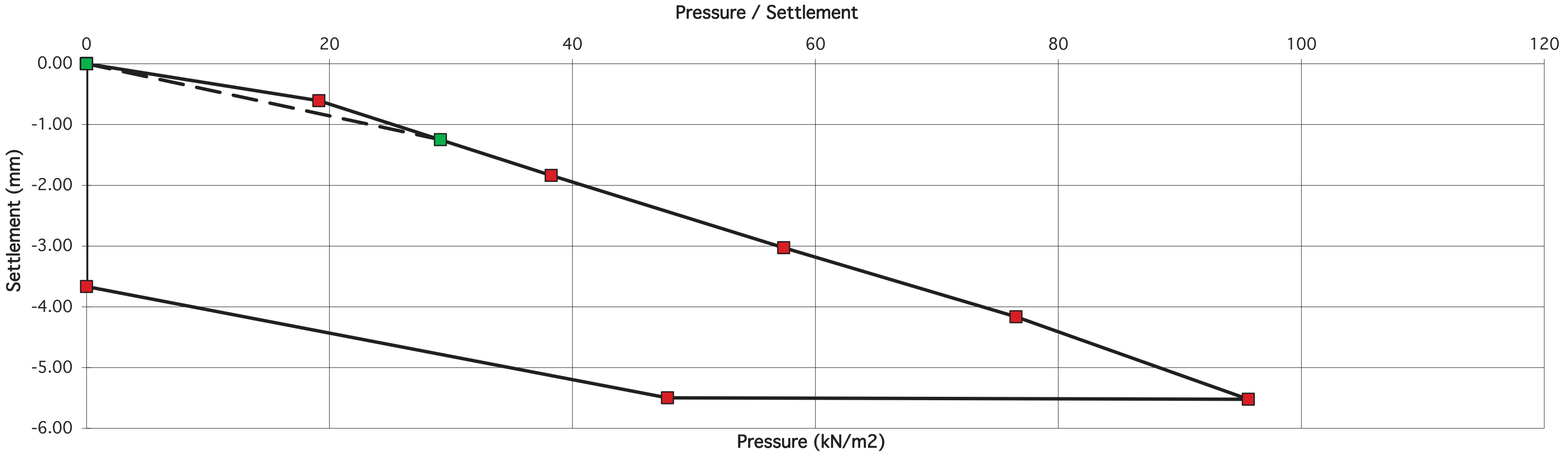
PLATE TEST REPORT SHEET (F3.1)

Applied Pressure/Settlement Curve

Reference No. R139830
Contract 24330 Halverstown
Test No. PBT11 (Reload)
Location See Site Map
Depth 0.50
Client DOBA
Plate Diameter: 450 mm
Test Method BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician M.Brown
Authorised by
Date 17/10/2022

Description of soil under test
(natural soil, placed fill, sub-base)
Brown sandy silty CLAY.

Sample Ref No.
Depth m bgl



Gradient at 1.25 mm settlement intersection = 23
Modulus of subgrade reaction = 15 MPa/m
Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 1.1 %

PLATE TEST REPORT SHEET (F3.1)

Applied Pressure/Settlement Curve

Reference No.	R139831
Contract	24330 Halverstown
Test No.	PBT12 (Load)
Location	See Site Map
Depth	0.50
Client	DOBA
Plate Diameter:	450 mm
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician	M.Brown
Authorised by	
Date	17/10/2022

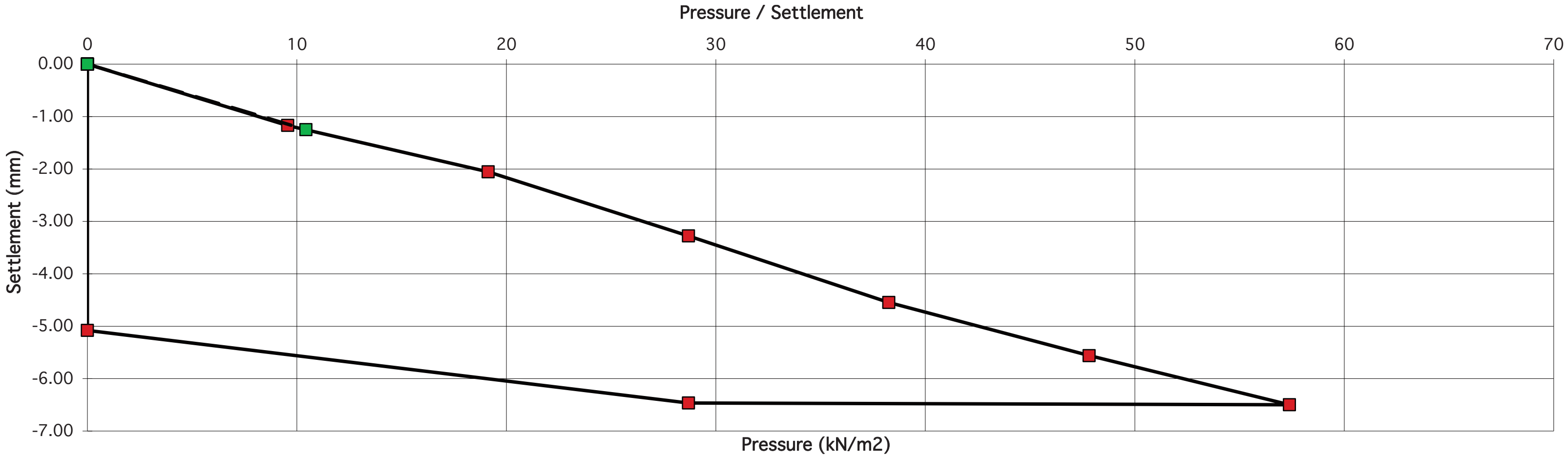
Description of soil under test
(natural soil, placed fill, sub-base)

Brown sandy silty CLAY.

Sample Ref No.
Depth m bgl

IGSL

INAB ISO 17025 ACCREDITED TESTING DETAILED IN SCOPE REG NO.1331



Gradient at 1.25 mm settlement intersection = 8
Modulus of subgrade reaction = 5 MPa/m
Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 0.2 %

PLATE TEST REPORT SHEET (F3.1)

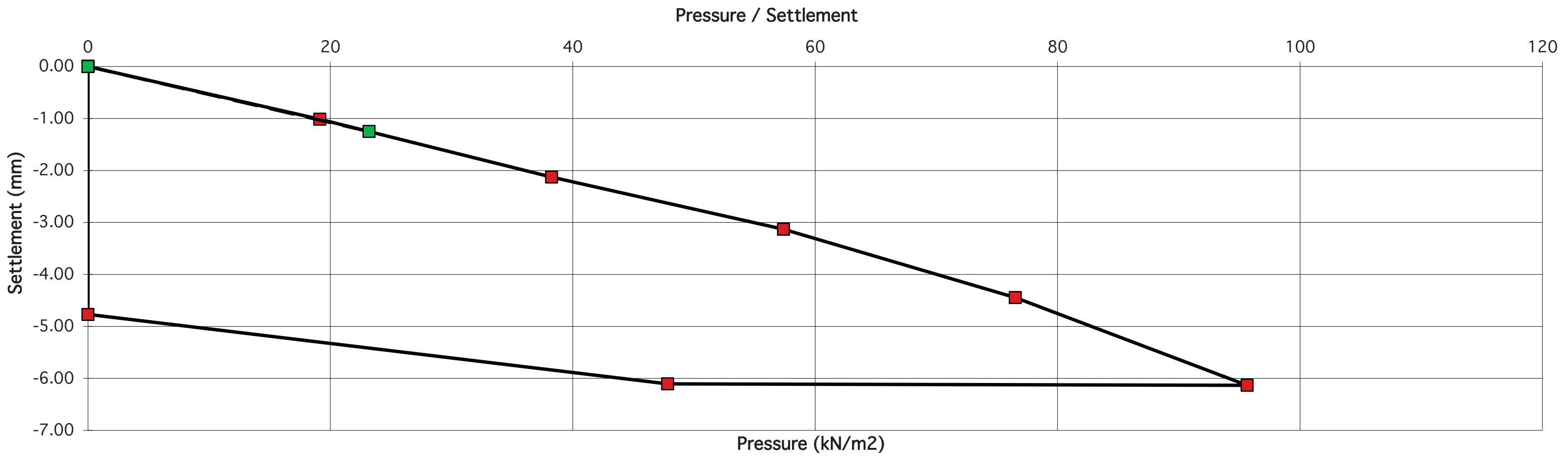
Applied Pressure/Settlement Curve

Reference No.	R139831
Contract	24330 Halverstown
Test No.	PBT12 (Reload)
Location	See Site Map
Depth	0.50
Client	DOBA
Plate Diameter:	450 mm
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician	M.Brown
Authorised by	
Date	17/10/2022

Description of soil under test
(natural soil, placed fill, sub-base)

Brown sandy silty CLAY.

Sample Ref No.
Depth m bgl



Gradient at 1.25 mm settlement intersection = 19
Modulus of subgrade reaction = 12 MPa/m
Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 0.7 %

PLATE TEST REPORT SHEET (F3.1)

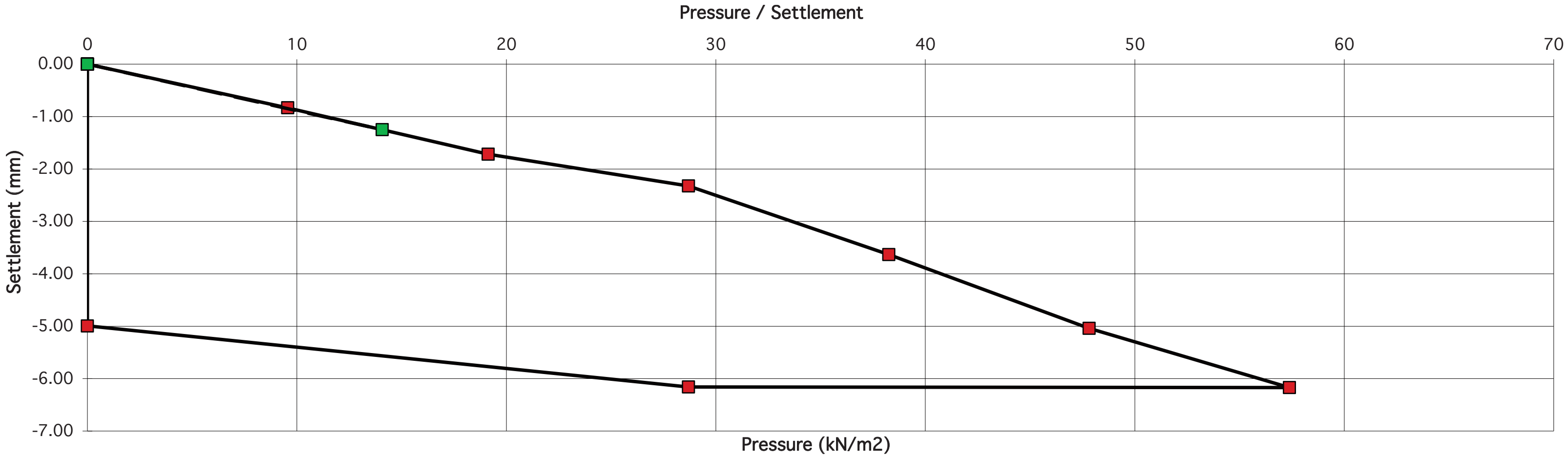
Applied Pressure/Settlement Curve

Reference No.	R139832
Contract	24330 Halverstown
Test No.	PBT13 (Load)
Location	See Site Map
Depth	0.50
Client	DOBA
Plate Diameter:	450 mm
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician	M.Brown
Authorised by	
Date	12/10/2022

Description of soil under test
(natural soil, placed fill, sub-base)

Brown sandy silty CLAY.

Sample Ref No.
Depth m bgl



Gradient at 1.25 mm settlement intersection = 11
Modulus of subgrade reaction = 7 MPa/m
Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 0.3 %

PLATE TEST REPORT SHEET (F3.1)

Applied Pressure/Settlement Curve

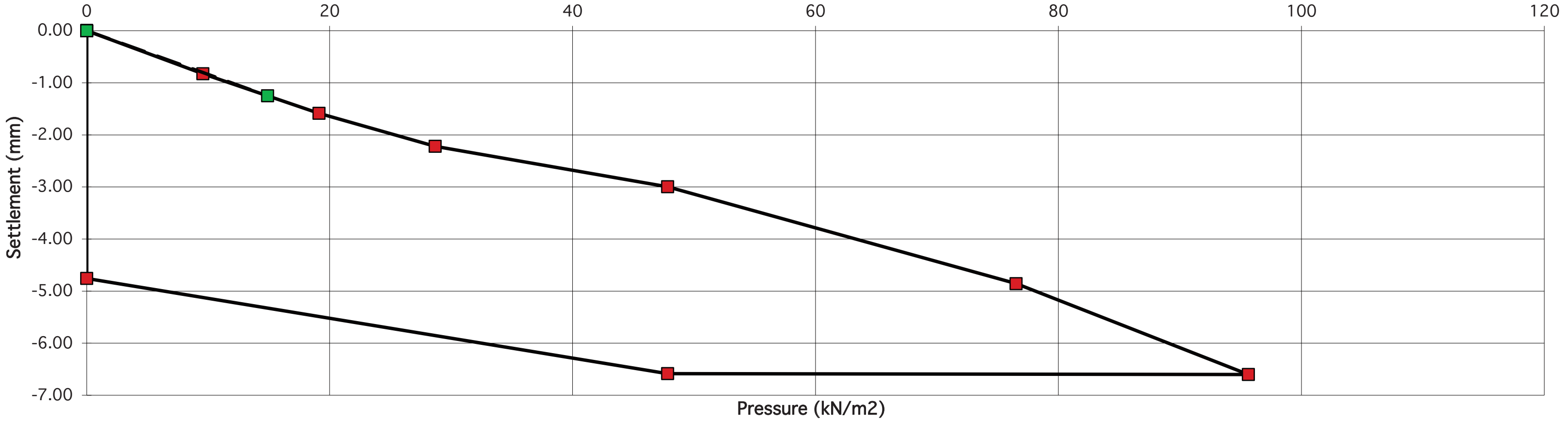
Reference No.	R139832
Contract	24330 Halverstown
Test No.	PBT13 (Reload)
Location	See Site Map
Depth	0.50
Client	DOBA
Plate Diameter:	450 mm
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician	M.Brown
Authorised by	
Date	12/10/2022

Description of soil under test
(natural soil, placed fill, sub-base)

Brown sandy silty CLAY.

Sample Ref No.
Depth m bgl

Pressure / Settlement



Gradient at 1.25 mm settlement intersection = 12
Modulus of subgrade reaction = 8 MPa/m
Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 0.3 %

PLATE TEST REPORT SHEET (F3.1)

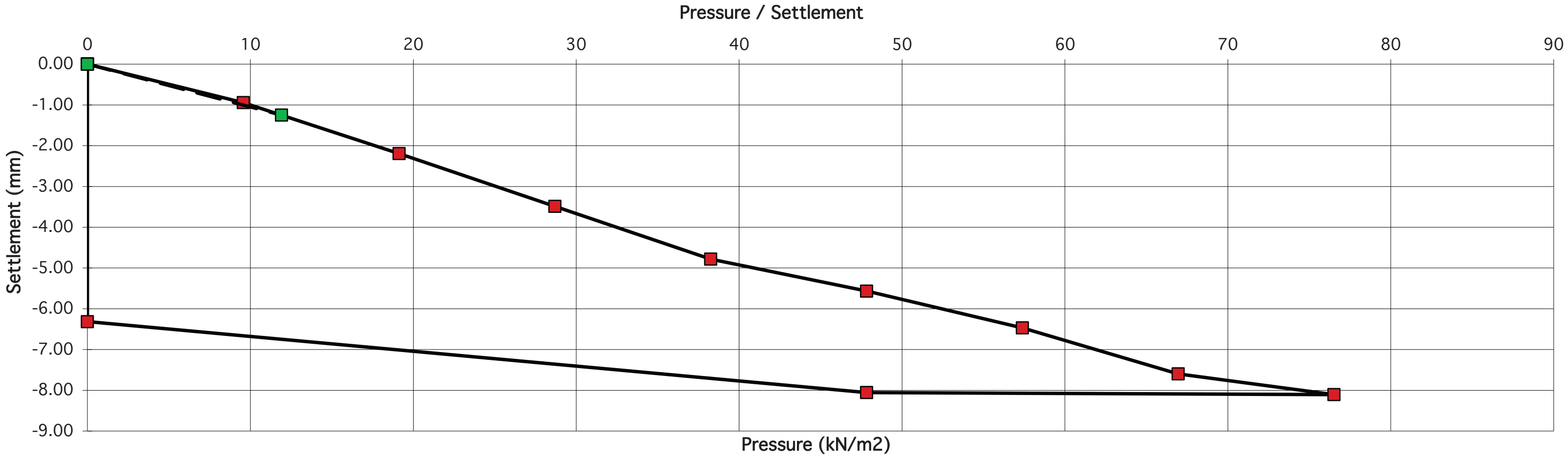
Applied Pressure/Settlement Curve

Reference No.	R139833
Contract	24330 Halverstown
Test No.	PBT14 (Load)
Location	See Site Map
Depth	0.40
Client	DOBA
Plate Diameter:	450 mm
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician	M.Brown
Authorised by	
Date	12/10/2022

Description of soil under test
(natural soil, placed fill, sub-base)

Brown sandy gravelly CLAY.

Sample Ref No.
Depth m bgl



Gradient at 1.25 mm settlement intersection = 10
Modulus of subgrade reaction = 6 MPa/m
Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 0.2 %

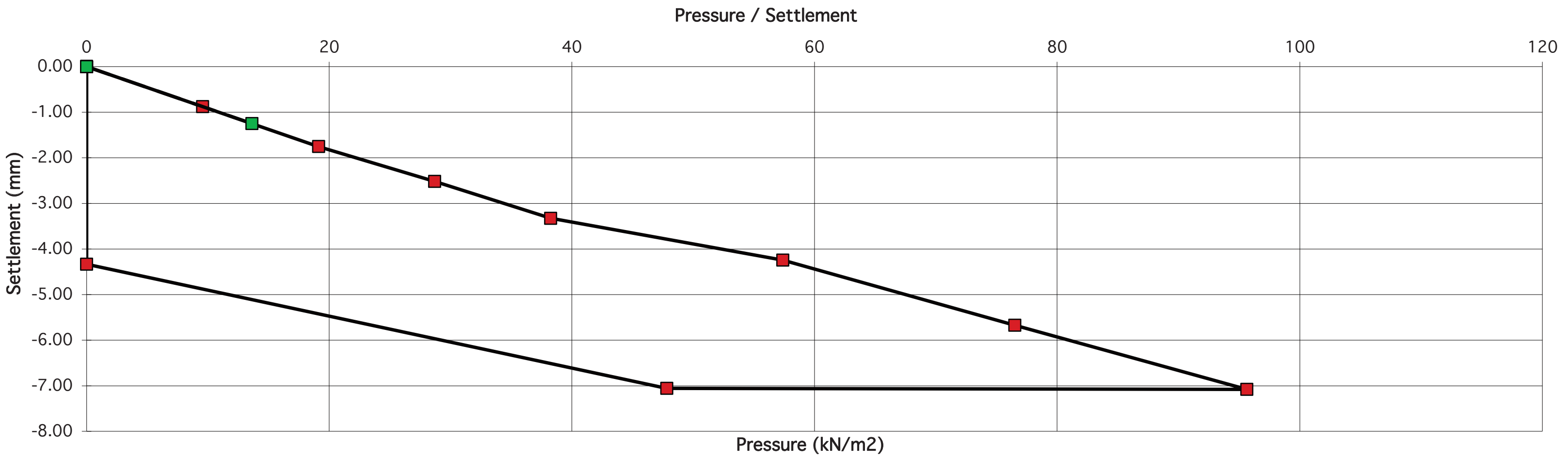
PLATE TEST REPORT SHEET (F3.1)

Applied Pressure/Settlement Curve

Reference No. R139833
Contract 24330 Halverstown
Test No. PBT14 (Reload)
Location See Site Map
Depth 0.40
Client DOBA
Plate Diameter: 450 mm
Test Method BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician M.Brown
Authorised by
Date 12/10/2022

Description of soil under test
(natural soil, placed fill, sub-base)
Brown sandy gravelly CLAY.

Sample Ref No.
Depth m bgl



Gradient at 1.25 mm settlement intersection = 11
Modulus of subgrade reaction = 7 MPa/m
Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 0.3 %

PLATE TEST REPORT SHEET (F3.1)

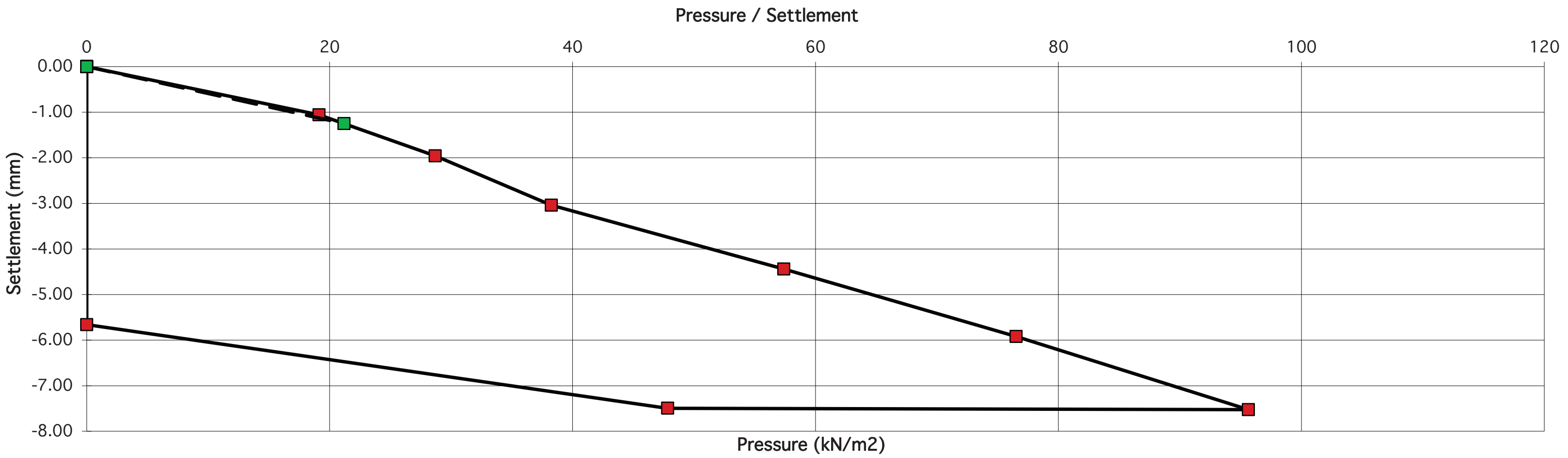
Applied Pressure/Settlement Curve

Reference No.	R139834
Contract	24330 Halverstown
Test No.	PBT15 (Load)
Location	See Site Map
Depth	0.50
Client	DOBA
Plate Diameter:	450 mm
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician	M.Brown
Authorised by	
Date	12/10/2022

Description of soil under test
(natural soil, placed fill, sub-base)

Brown sandy gravelly CLAY.

Sample Ref No.
Depth m bgl



Gradient at 1.25 mm settlement intersection = 17
Modulus of subgrade reaction = 11 MPa/m
Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 0.6 %

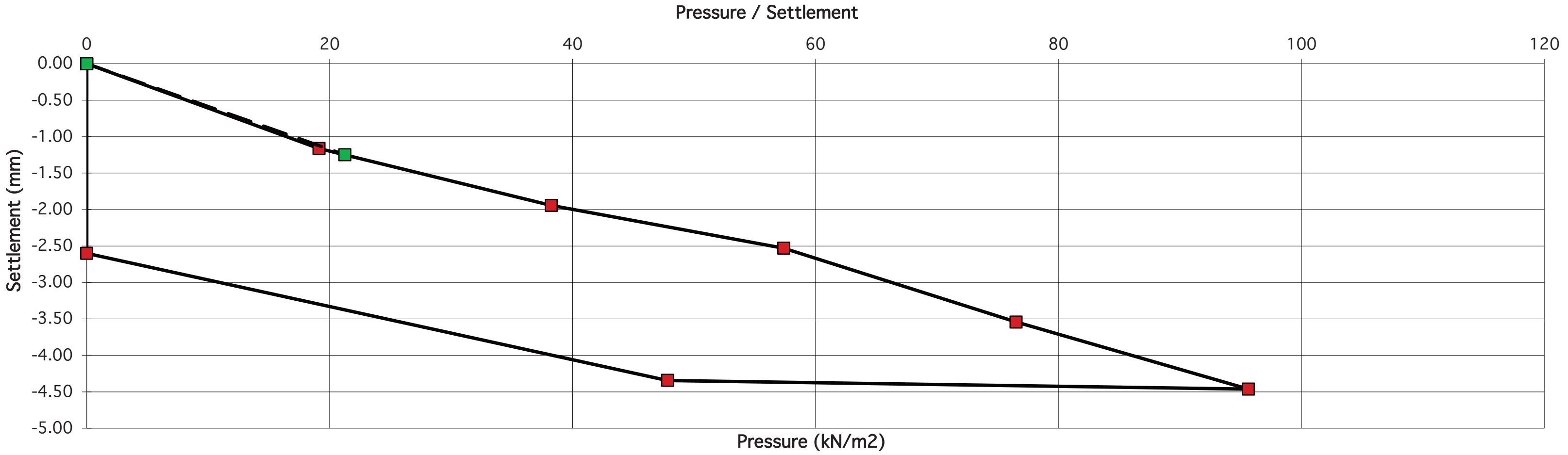
PLATE TEST REPORT SHEET (F3.1)

Applied Pressure/Settlement Curve

Reference No. R139834
Contract 24330 Halverstown
Test No. PBT15 (Reload)
Location See Site Map
Depth 0.50
Client DOBA
Plate Diameter: 450 mm
Test Method BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician M.Brown
Authorised by
Date 12/10/2022

Description of soil under test
(natural soil, placed fill, sub-base)
Brown sandy gravelly CLAY.

Sample Ref No.
Depth m bgl



Gradient at 1.25 mm settlement intersection = 17
Modulus of subgrade reaction = 11 MPa/m
Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 0.6 %

PLATE TEST REPORT SHEET (F3.1)

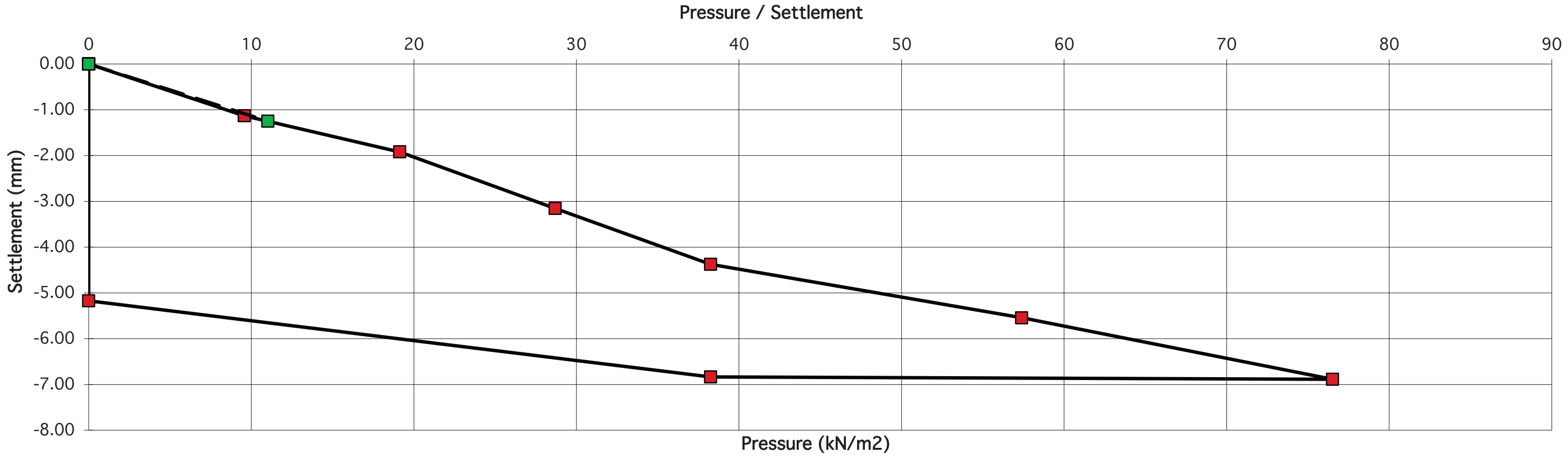
Applied Pressure/Settlement Curve

Reference No.	R139835
Contract	24330 Halverstown
Test No.	PBT16 (Load)
Location	See Site Map
Depth	0.60
Client	DOBA
Plate Diameter:	450 mm
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician	M.Brown
Authorised by	
Date	17/10/2022

Description of soil under test
(natural soil, placed fill, sub-base)

Brown sandy gravelly CLAY.

Sample Ref No.
Depth m bgl



Gradient at 1.25 mm settlement intersection = 9
Modulus of subgrade reaction = 6 MPa/m
Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 0.2 %

PLATE TEST REPORT SHEET (F3.1)

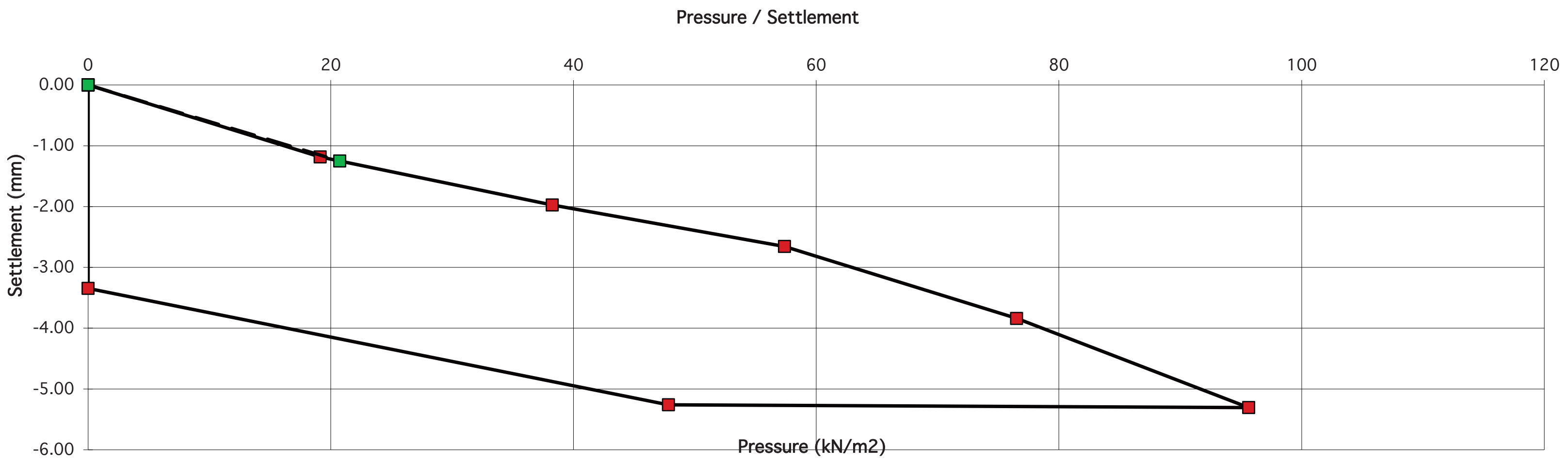
Applied Pressure/Settlement Curve

Reference No.	R139835
Contract	24330 Halverstown
Test No.	PBT16 (Reload)
Location	See Site Map
Depth	0.60
Client	DOBA
Plate Diameter:	450 mm
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician	M.Brown
Authorised by	
Date	17/10/2022

Description of soil under test
(natural soil, placed fill, sub-base)

Brown sandy gravelly CLAY.

Sample Ref No.
Depth m bgl



Gradient at 1.25 mm settlement intersection = 17
Modulus of subgrade reaction = 11 MPa/m
Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 0.6 %

PLATE TEST REPORT SHEET (F3.1)

Applied Pressure/Settlement Curve

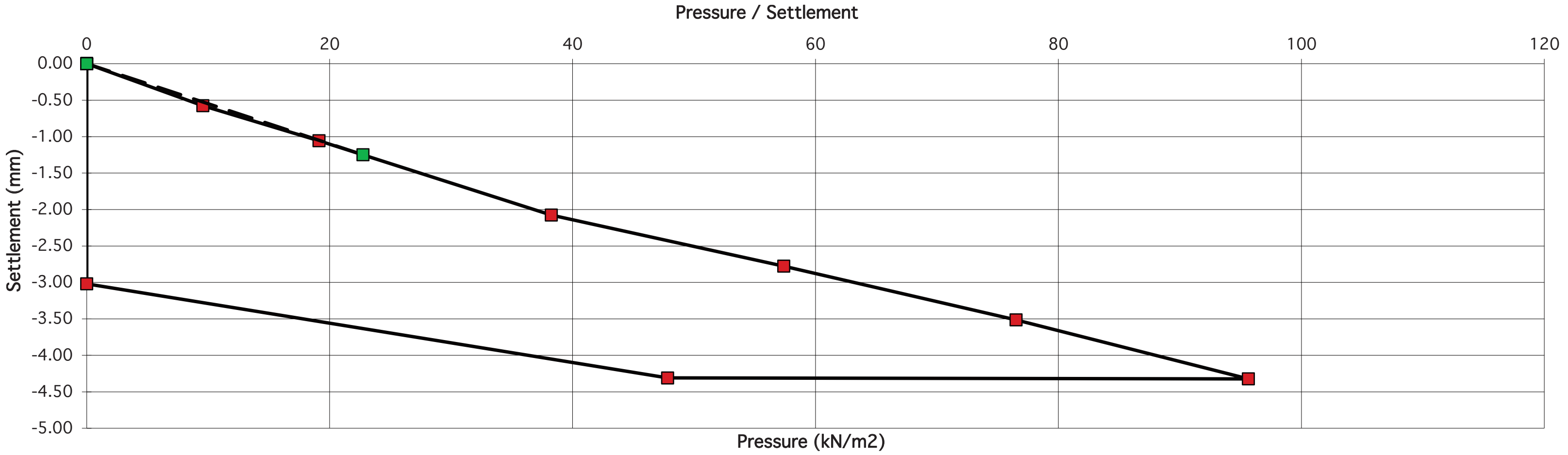
Reference No.	R139836
Contract	24330 Halverstown
Test No.	PBT17 (Load)
Location	See Site Map
Depth	0.40
Client	DOBA
Plate Diameter:	450 mm
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician	M.Brown
Authorised by	
Date	17/10/2022

Description of soil under test
(natural soil, placed fill, sub-base)

Brown sandy gravelly silty CLAY.

Sample Ref No.

Depth m bgl



Gradient at 1.25 mm settlement intersection = 18
Modulus of subgrade reaction = 12 MPa/m
Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 0.7 %

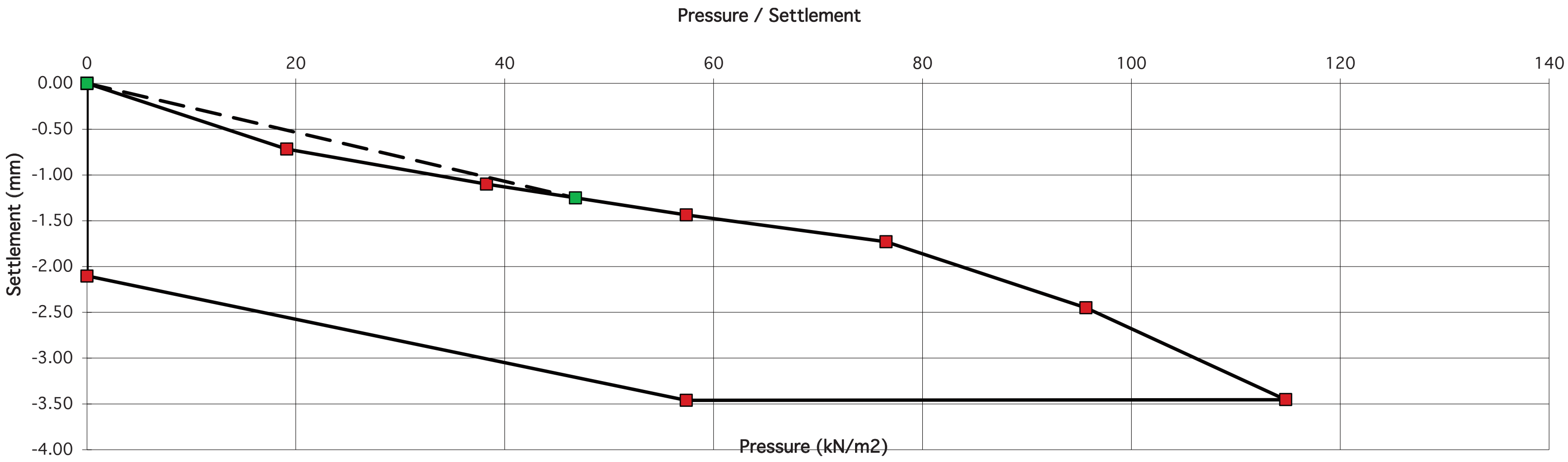
PLATE TEST REPORT SHEET (F3.1)

Applied Pressure/Settlement Curve

Reference No. R139836
Contract 24330 Halverstown
Test No. PBT17 (Reload)
Location See Site Map
Depth 0.40
Client DOBA
Plate Diameter: 450 mm
Test Method BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician M.Brown
Authorised by
Date 17/10/2022

Description of soil under test
(natural soil, placed fill, sub-base)
Brown sandy gravelly silty CLAY.

Sample Ref No.
Depth m bgl



Gradient at 1.25 mm settlement intersection = 37
Modulus of subgrade reaction = 24 MPa/m
Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 2.4 %

PLATE TEST REPORT SHEET (F3.1)

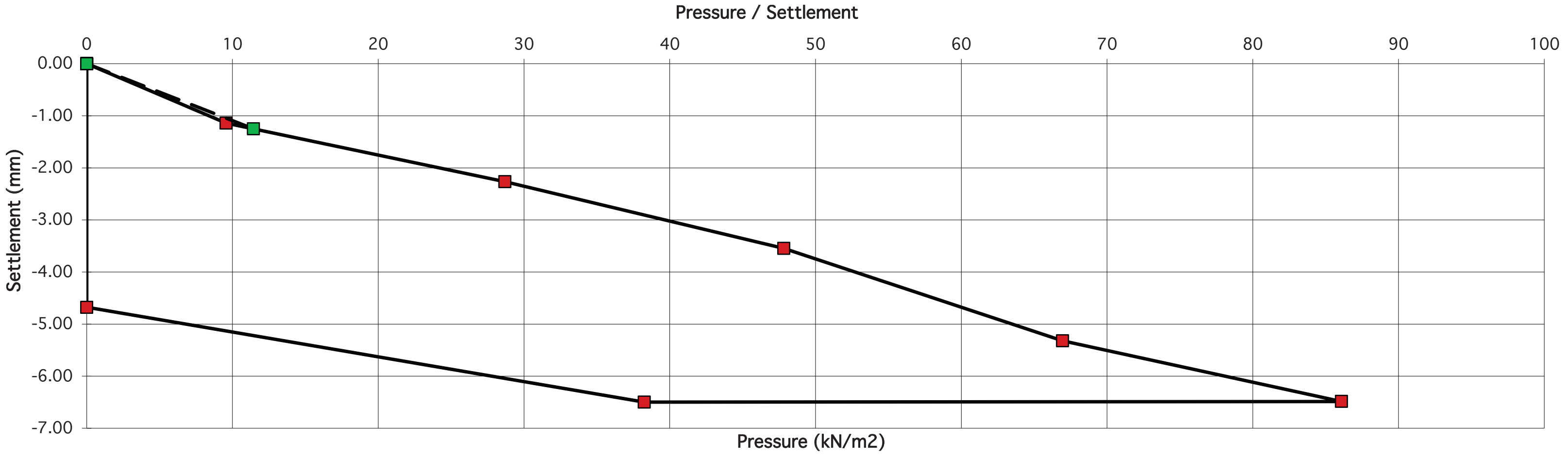
Applied Pressure/Settlement Curve

Reference No.	R139837
Contract	24330 Halverstown
Test No.	PBT18 (Load)
Location	See Site Map
Depth	0.50
Client	DOBA
Plate Diameter:	450 mm
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician	M.Brown
Authorised by	
Date	12/10/2022

Description of soil under test
(natural soil, placed fill, sub-base)

Brown sandy CLAY.

Sample Ref No.
Depth m bgl



Gradient at 1.25 mm settlement intersection = 9
Modulus of subgrade reaction = 6 MPa/m
Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 0.2 %

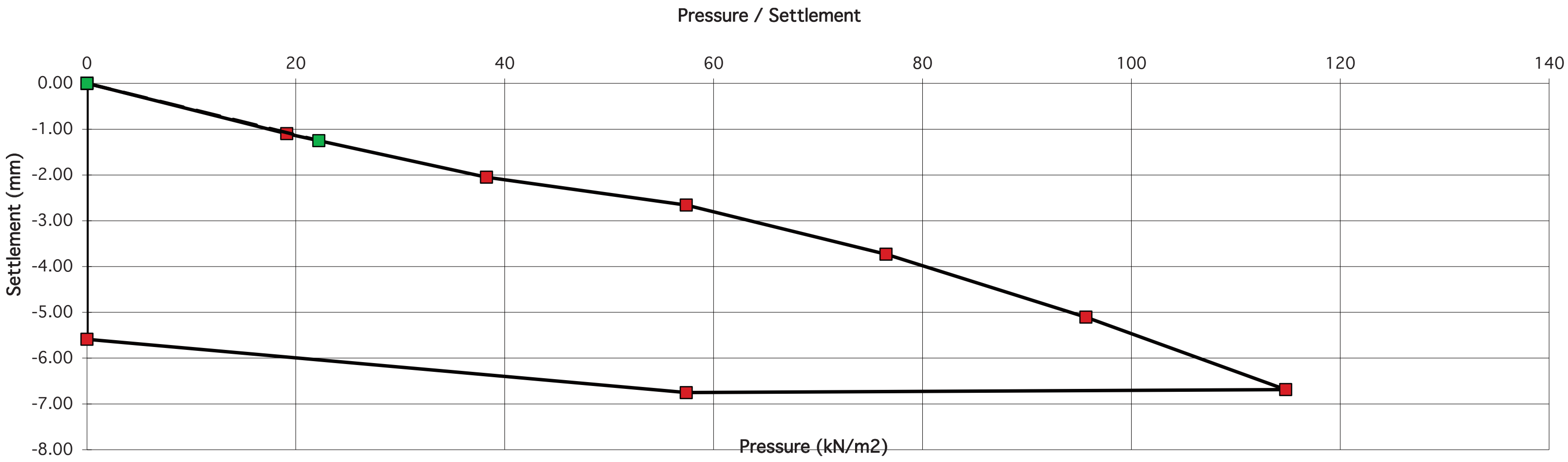
PLATE TEST REPORT SHEET (F3.1)

Applied Pressure/Settlement Curve

Reference No. R139837
Contract 24330 Halverstown
Test No. PBT18 (Reload)
Location See Site Map
Depth 0.50
Client DOBA
Plate Diameter: 450 mm
Test Method BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician M.Brown
Authorised by
Date 12/10/2022

Description of soil under test
(natural soil, placed fill, sub-base)
Brown sandy CLAY.

Sample Ref No.
Depth m bgl



Gradient at 1.25 mm settlement intersection = 18
Modulus of subgrade reaction = 11 MPa/m
Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 0.7 %

PLATE TEST REPORT SHEET (F3.1)

Applied Pressure/Settlement Curve

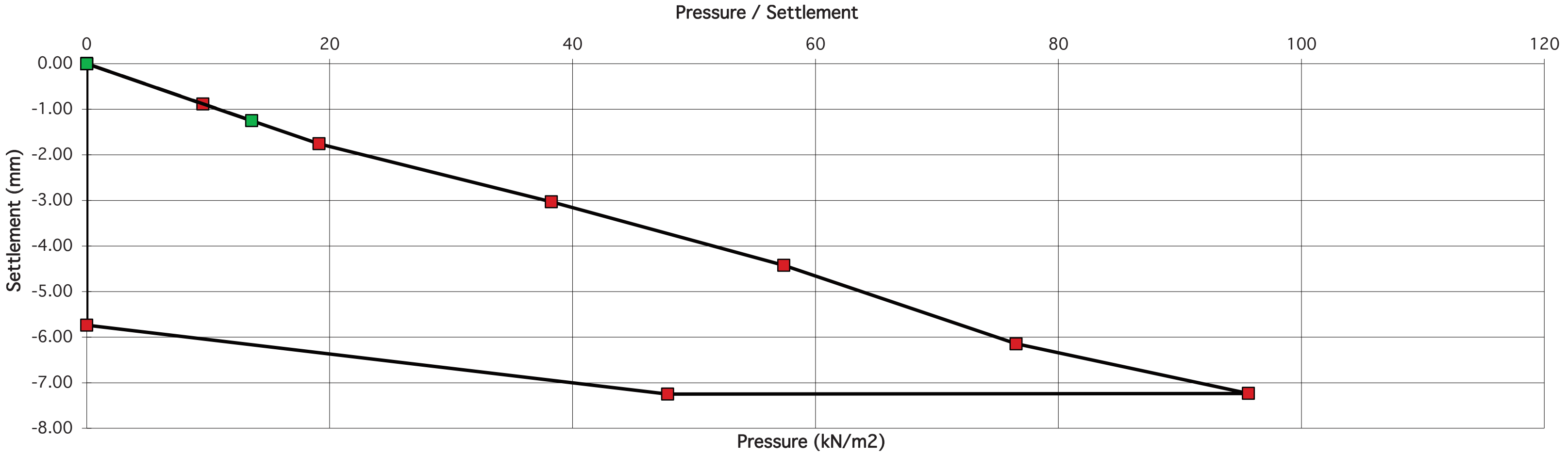
Reference No.	R139838
Contract	24330 Halverstown
Test No.	PBT19 (Load)
Location	See Site Map
Depth	0.60
Client	DOBA
Plate Diameter:	450 mm
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician	M.Brown
Authorised by	
Date	12/10/2022

Description of soil under test
(natural soil, placed fill, sub-base)

Brown sandy silty CLAY.

Sample Ref No.

Depth m bgl



Gradient at 1.25 mm settlement intersection = 11
Modulus of subgrade reaction = 7 MPa/m
Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 0.3 %

PLATE TEST REPORT SHEET (F3.1)

Applied Pressure/Settlement Curve

Reference No.	R139838
Contract	24330 Halverstown
Test No.	PBT19 (Reload)
Location	See Site Map
Depth	0.60
Client	DOBA
Plate Diameter:	450 mm
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician	M.Brown
Authorised by	
Date	12/10/2022

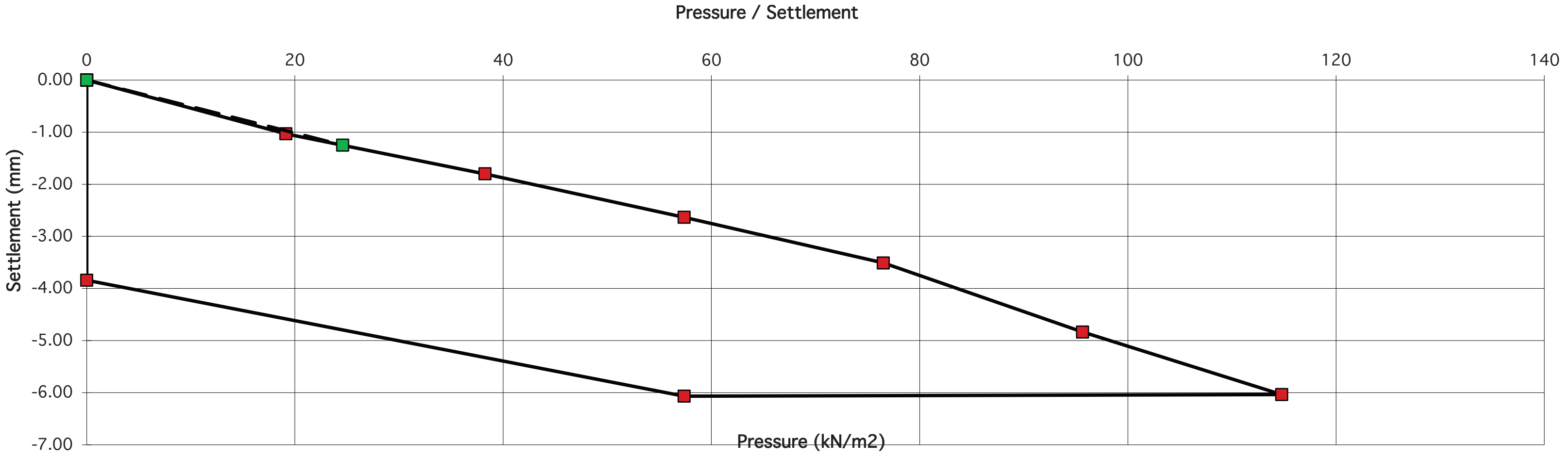
Description of soil under test
(natural soil, placed fill, sub-base)

Brown sandy silty CLAY.

Sample Ref No.
Depth m bgl

IGSL

INAB ISO 17025 ACCREDITED TESTING DETAILED IN SCOPE REG NO.133T



Gradient at 1.25 mm settlement intersection = 20
Modulus of subgrade reaction = 13 MPa/m
Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 0.8 %

PLATE TEST REPORT SHEET (F3.1)

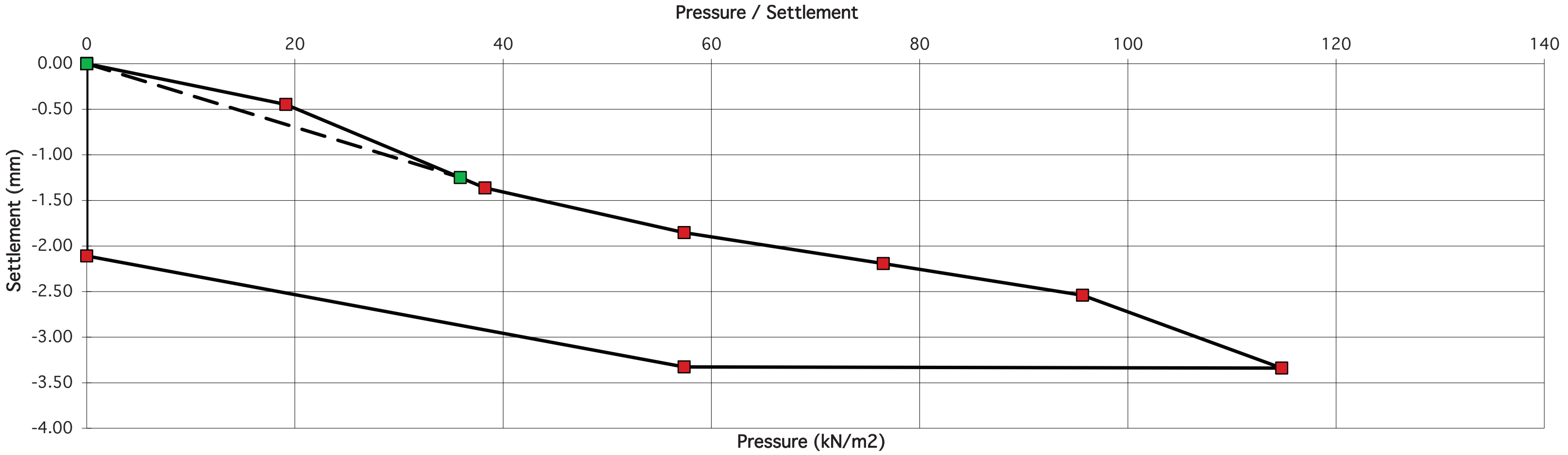
Applied Pressure/Settlement Curve

Reference No.	R139839
Contract	24330 Halverstown
Test No.	PBT20 (Load)
Location	See Site Map
Depth	0.40
Client	DOBA
Plate Diameter:	450 mm
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician	M.Brown
Authorised by	
Date	14/10/2022

Description of soil under test
(natural soil, placed fill, sub-base)

Brown sandy CLAY.

Sample Ref No.
Depth m bgl



Gradient at 1.25 mm settlement intersection = 29
Modulus of subgrade reaction = 18 MPa/m
Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 1.5 %

PLATE TEST REPORT SHEET (F3.1)

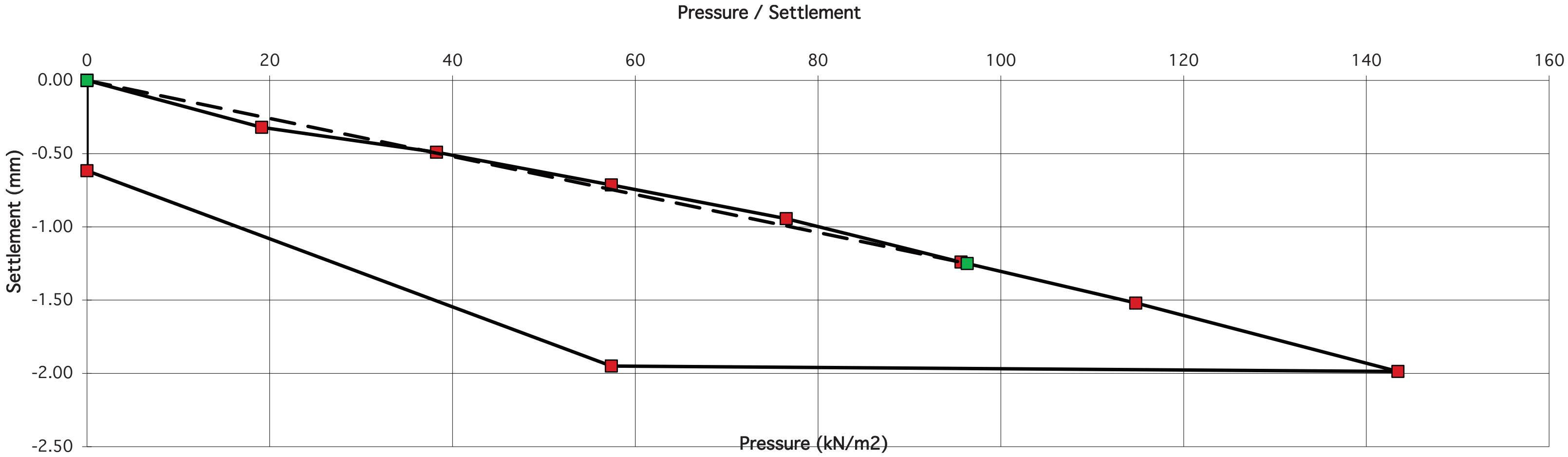
Applied Pressure/Settlement Curve

Reference No.	R139839
Contract	24330 Halverstown
Test No.	PBT20 (Reload)
Location	See Site Map
Depth	0.40
Client	DOBA
Plate Diameter:	450 mm
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician	M.Brown
Authorised by	
Date	14/10/2022

Description of soil under test
(natural soil, placed fill, sub-base)

Brown sandy CLAY.

Sample Ref No.
Depth m bgl



Gradient at 1.25 mm settlement intersection = 77
Modulus of subgrade reaction = 50 MPa/m
Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 8.3 %

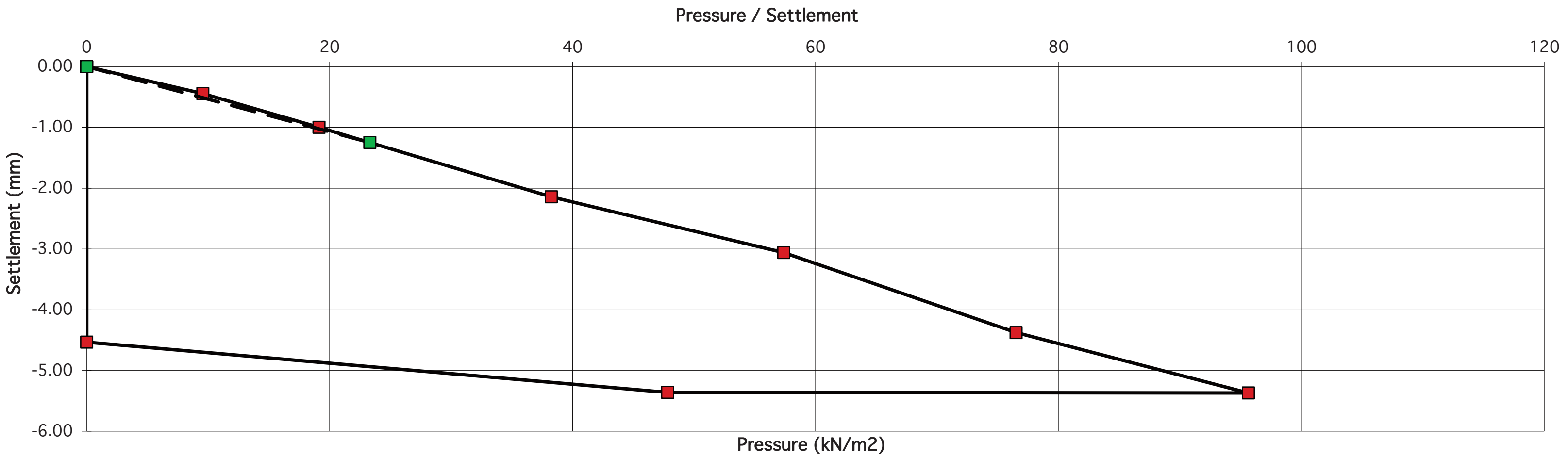
PLATE TEST REPORT SHEET (F3.1)

Applied Pressure/Settlement Curve

Reference No. R139840
Contract 24330 Halverstown
Test No. PBT21 (Load)
Location See Site Map
Depth 0.40
Client DOBA
Plate Diameter: 450 mm
Test Method BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician M.Brown
Authorised by
Date 14/10/2022

Description of soil under test
(natural soil, placed fill, sub-base)
Grey clayey silty SAND.

Sample Ref No.
Depth m bgl



Gradient at 1.25 mm settlement intersection = 19
Modulus of subgrade reaction = 12 MPa/m
Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 0.7 %

PLATE TEST REPORT SHEET (F3.1)

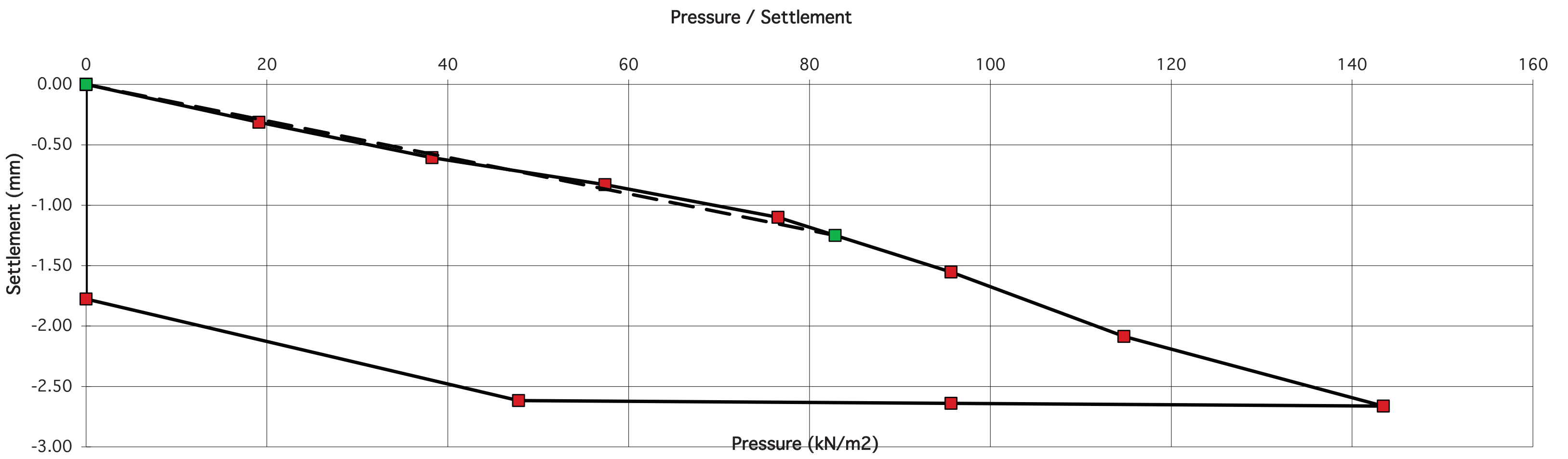
Applied Pressure/Settlement Curve

Reference No.	R139840
Contract	24330 Halverstown
Test No.	PBT21 (Reload)
Location	See Site Map
Depth	0.40
Client	DOBA
Plate Diameter:	450 mm
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician	M.Brown
Authorised by	
Date	14/10/2022

Description of soil under test
(natural soil, placed fill, sub-base)

Grey clayey silty SAND.

Sample Ref No.
Depth m bgl



Gradient at 1.25 mm settlement intersection = 66
Modulus of subgrade reaction = 43 MPa/m
Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 6.4 %

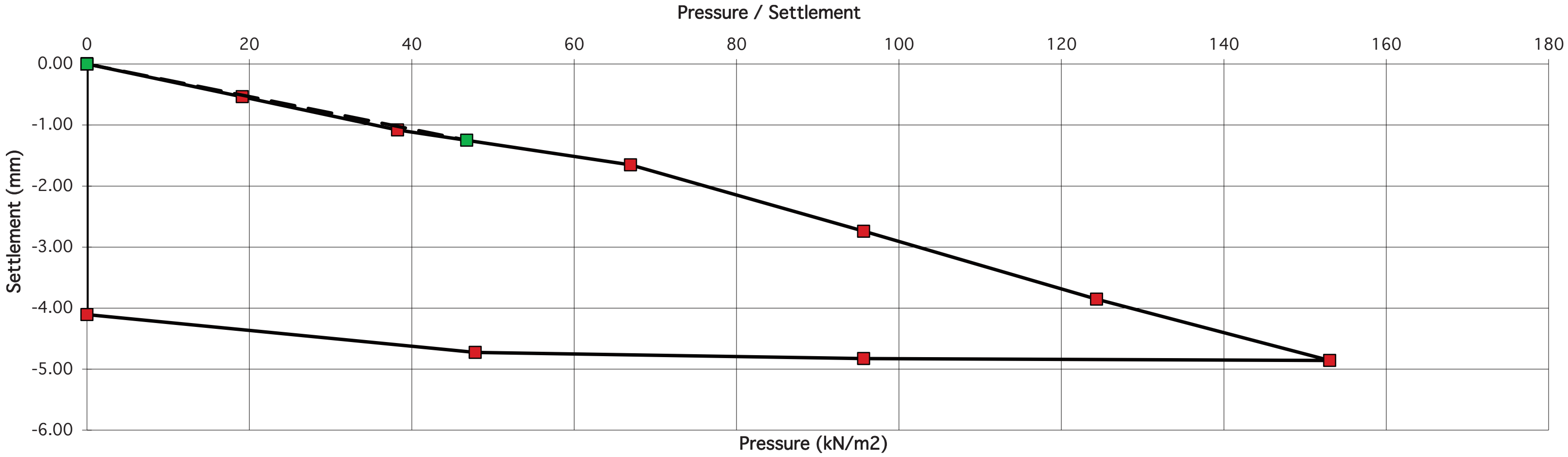
PLATE TEST REPORT SHEET (F3.1)

Applied Pressure/Settlement Curve

Reference No. R139841
Contract 24330 Halverstown
Test No. PBT22 (Load)
Location See Site Map
Depth 0.50
Client DOBA
Plate Diameter: 450 mm
Test Method BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician M.Brown
Authorised by
Date 13/10/2022

Description of soil under test
(natural soil, placed fill, sub-base)
Grey sandy gravelly SILT.

Sample Ref No.
Depth m bgl



Gradient at 1.25 mm settlement intersection = 37
Modulus of subgrade reaction = 24 MPa/m
Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 2.4 %

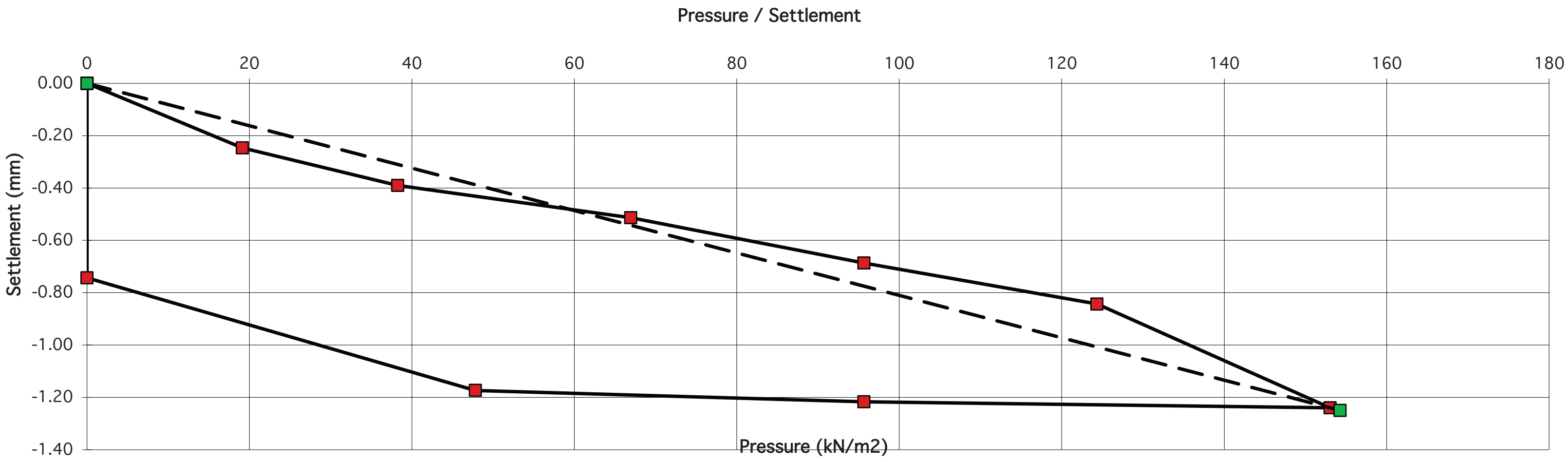
PLATE TEST REPORT SHEET (F3.1)

Applied Pressure/Settlement Curve

Reference No. R139841
Contract 24330 Halverstown
Test No. PBT21 (Reload)
Location See Site Map
Depth 0.50
Client DOBA
Plate Diameter: 450 mm
Test Method BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician M.Brown
Authorised by
Date 13/10/2022

Description of soil under test
(natural soil, placed fill, sub-base)
Grey sandy gravelly SILT.

Sample Ref No.
Depth m bgl



Gradient at 1.25 mm settlement intersection = 123
Modulus of subgrade reaction = 79 MPa/m
Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 18.9 %

PLATE TEST REPORT SHEET (F3.1)

Applied Pressure/Settlement Curve

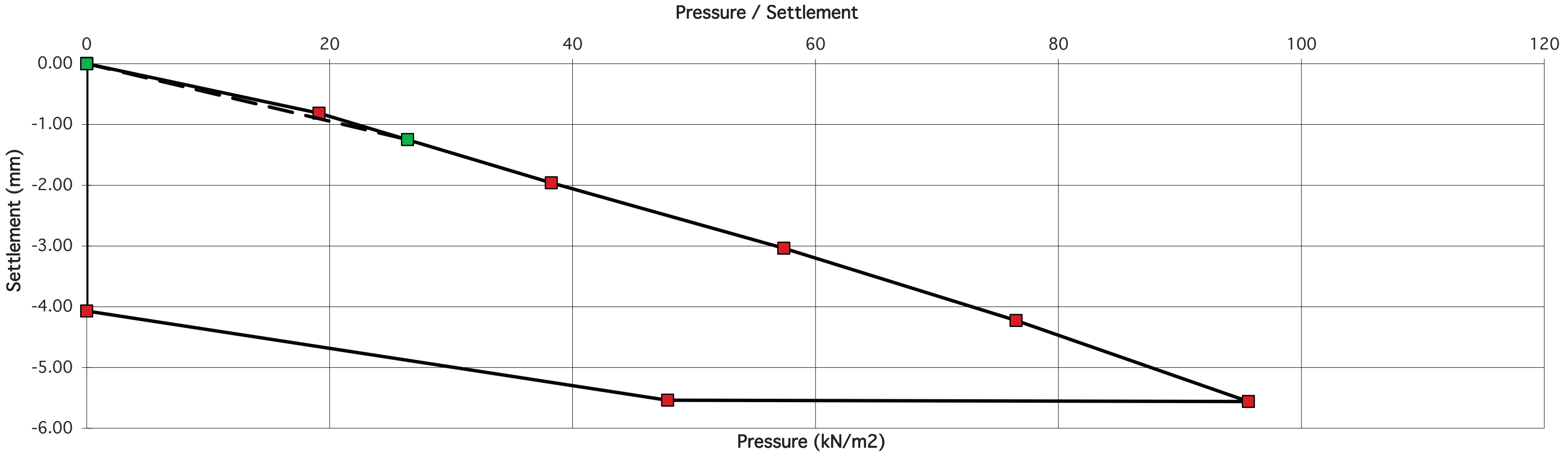
Reference No.	R139842
Contract	24330 Halverstown
Test No.	PBT23 (Load)
Location	See Site Map
Depth	0.50
Client	DOBA
Plate Diameter:	450 mm
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician	M.Brown
Authorised by	
Date	12/10/2022

Description of soil under test
(natural soil, placed fill, sub-base)

Brown sandy silty CLAY.

Sample Ref No.

Depth m bgl



Gradient at 1.25 mm settlement intersection = 21
Modulus of subgrade reaction = 14 MPa/m
Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 0.9 %

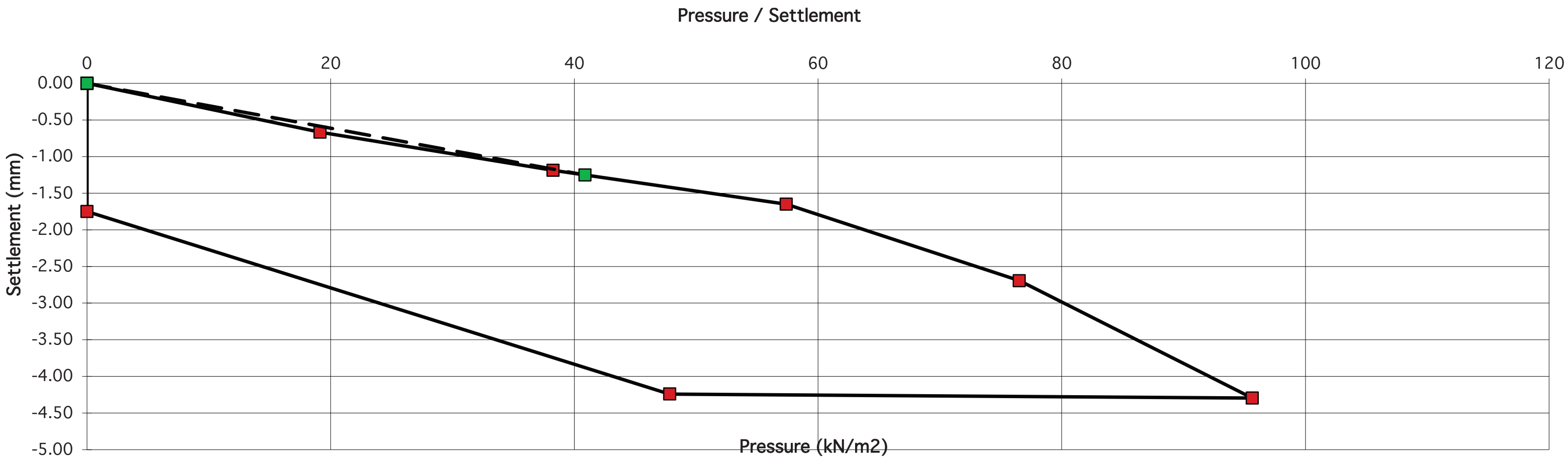
PLATE TEST REPORT SHEET (F3.1)

Applied Pressure/Settlement Curve

Reference No. R139842
Contract 24330 Halverstown
Test No. PBT23 (Reload)
Location See Site Map
Depth 0.50
Client DOBA
Plate Diameter: 450 mm
Test Method BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician M.Brown
Authorised by
Date 12/10/2022

Description of soil under test
(natural soil, placed fill, sub-base)
Brown sandy silty CLAY.

Sample Ref No.
Depth m bgl



Gradient at 1.25 mm settlement intersection = 33
Modulus of subgrade reaction = 21 MPa/m
Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 1.9 %

PB04 – 1 of 2

PB04 – 2 of 2

PB05 1 of 3

PB05 2 of 3

PB05 3 of 3

PB06 1 of 1

PB07 1 of 1

PB08 1 of 1

PB09 1 of 2

PB09 2 of 2

PB10 1 of 1

PB11 1 of 1

PB12 1 of 1

PB13 1 of 1

PB14 1 of 1

PB15 1 of 1

PB16 1 of 1

PB17 1 of 1

PB19 1 of 1

PB21 1 of 1

PB23 1 of 1