



**IAN FARMER
ASSOCIATES**

CURTINS

**EMBASSY VILLAGE (ADDITIONAL)
EGERTON STREET
MANCHESTER
M15 4NU**

**FACTUAL REPORT ON
GROUND INVESTIGATION**

Contract: 2230942

Date: March 2023

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**FACTUAL REPORT ON
GROUND INVESTIGATION**

carried out at

**EMBASSY VILLAGE (ADDITIONAL)
EGERTON STREET
MANCHESTER
M15 4NU**

Prepared for

CURTINS
Merchant Exchange
17-19 Whitworth Street West
Manchester
M1 5WG

Contract No: 2230942

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1.0 INTRODUCTION

- 1.1 It is understood that the proposed development comprises multiple residential buildings situated under the arches of the railway.
- 1.2 On the instructions of Curtins Consulting Engineers, a ground investigation was undertaken to determine ground and groundwater conditions at the site.
- 1.3 This report has been prepared for the sole use of the Client for the purpose described and no extended duty of care to any third party is implied or offered. Third parties using any information contained within this report do so at their own risk.
- 1.4 Any comments given in this report and the opinions expressed herein are based on the information received, the conditions encountered during site works, and on the results of tests made in the field and laboratory. However, there may be conditions prevailing at the site which have not been disclosed by the investigation and which have not been taken into account in the report.
- 1.5 Groundwater observations may be made at the time the site work was carried out or during subsequent monitoring. It should be noted that groundwater levels may vary outside the limits of these observations due to seasonal or other effects.

2.0 THE SITE

2.1 Site Location

- 2.1.1 The site is situated off Egerton Street, approximately 1km to the southwest of Manchester city centre.
- 2.1.2 The site may be located by National Grid Reference SJ 827 975.
- 2.1.3 A site location plan is included in Appendix 1, Figure A1.1.

2.2 Site Description

- 2.2.1 The site is generally rectangular, approximately 40m by 120m orientated northeast-southwest lengthways taking up an area of approximately 0.45 hectares.
- 2.2.2 The site slopes downwards from the northeast at the junction to the A57(M) (Egerton Street) towards the centre of the site. The remainder of the site is generally level under the arches.
- 2.2.3 To the south, the site is bordered by the Bridgewater Canal. To the north, the site is bordered by a tributary river to the River Irwell. To the west, is a body of water feeding the river from the canal. To the east is the A57(M) (Egerton Street).
- 2.2.4 Access is from the eastern portion of the site via a small road off the A57(M) northbound.
- 2.2.5 The site is host to supporting arches for two railways with a series of small buildings under the arches. The walls and buildings are built from brick and the ground is a combination of concrete, cobbles, sandstone flags, sand and silt.
- 2.2.6 A site plan is included in Appendix 1 as Figure A1.2.

3.0 SITE WORK

- 3.1 The site work was carried out between the 22nd and 23rd of February 2023.
- 3.2 The locations of exploratory holes were indicated by Curtins.
- 3.3 The site works were carried out on the basis of the practices set out in and BS 5930 (ref. 4.1), BS EN ISO 14688-1 (ref. 4.2), BS EN ISO 14689-1 (ref. 4.3) and BS 10175 (ref. 4.4).
- 3.4 Exploratory holes were undertaken as follows:

Exploratory Hole Type	Quantity	Hole Reference	Depths (mbgl)	Notes
Cable Percussive Borehole with Rotary Follow-on	1	BH01	13.10	Rotary follow-on 8.10 to 13.10 m. Terminated at a target depth of 5m below rockhead.
Cable Percussive Boreholes	1	BH02	5.45	Terminated at 5.45 m on client instruction.
Window Sample Boreholes	1	WS01	3.45	Borehole concrete cored from ground level to 2.80 m. Terminated at 3.45 m due to SPT refusal.
Trial Pits – Hand Excavated	2	T01 and T02	1.20 and 0.40	T01 terminated at target depth of 1.20 m T02 terminated at 0.40 m on instruction from client.

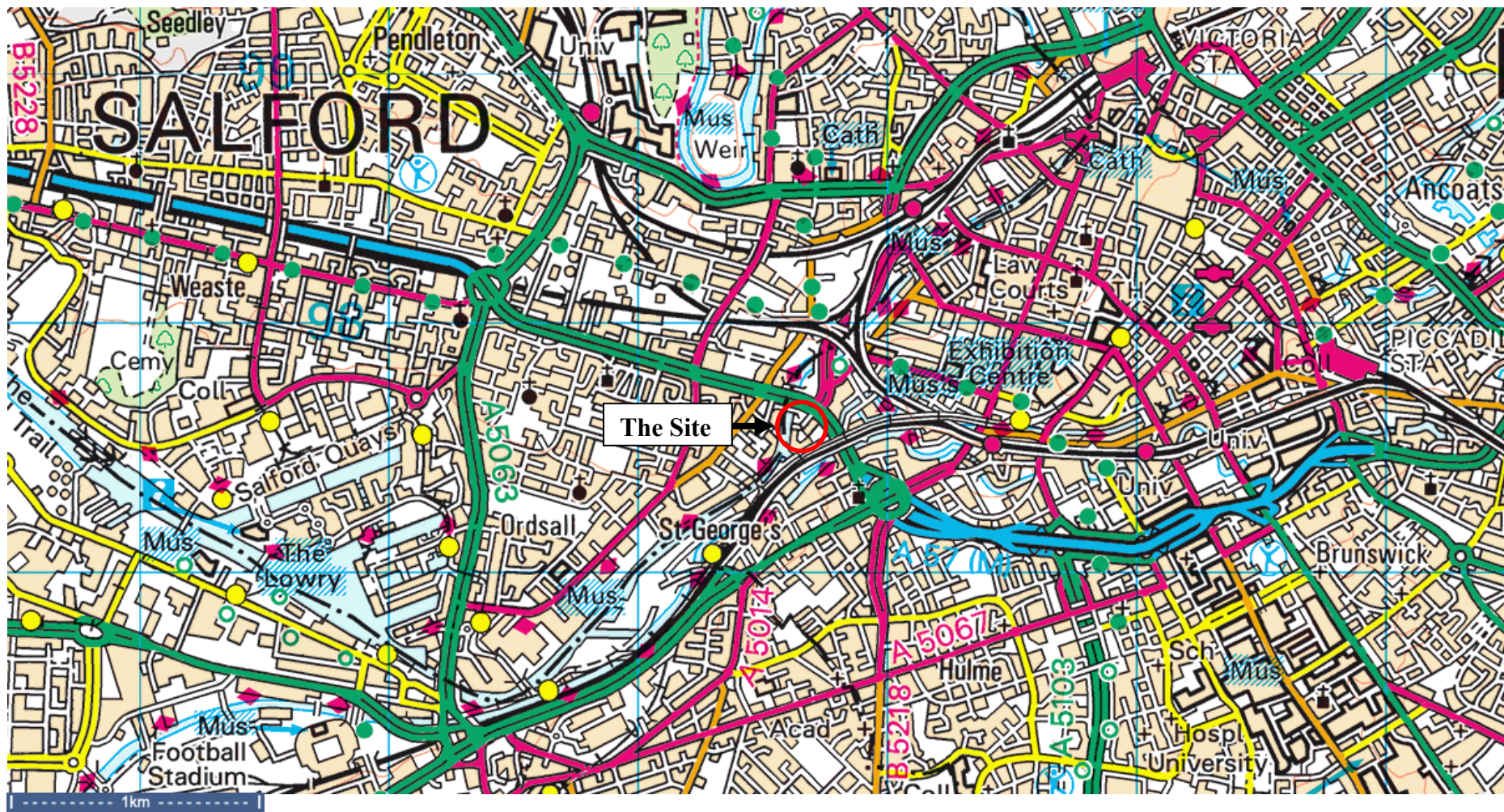
- 3.5 A site plan showing the positions of the exploratory holes is presented in Appendix 1 as Figure A1.2.
- 3.6 The depths of exploratory holes, descriptions of strata encountered and comments on groundwater conditions are presented on the records in Appendix 2.
- 3.7 Each exploratory hole location was surveyed using ground penetrating radar (GPR) and a Cable Avoidance Tool (CAT) prior to any physical excavation.
- 3.8 At the location of boreholes an inspection pit was excavated by hand to a depth of 1.20m below ground level to check for buried services.
- 3.9 Representative disturbed and undisturbed samples were taken at the depths shown on the exploratory hole records. Samples for environmental purposes were collected in appropriate containers and kept in cool boxes for daily despatch to the analytical laboratory.
- 3.10 A photographic record of trial pits is given in Appendix 2.
- 3.11 Rotary coring was carried out incorporating a semi-rigid plastic liner to obtain core at a nominal diameter of 92 mm. A photographic record of rock core is given in Appendix 2.

-
- 3.12 Standard penetration tests (SPT) (ref. 4.5) were carried out in boreholes in the various strata to assess the relative density or consistency. The values of penetration resistance are presented on the borehole records. Energy ratio calibration certification for SPT hammers used on site are presented in Appendix 2.
- 3.13 No monitoring standpipes or piezometers were installed.
- 3.14 The ground levels and co-ordinates reported on the records for WS01 and T01 were determined by survey to OS datum and National Grid by GPS methods.
- 3.15 The co-ordinates reported on the records for BH01, BH02 and T02 were determined using HoleBASE mapping tool as the positions were unable to be surveyed on site.

4.0 REFERENCES

- 4.1 BS 5930:2015+A1:2020, Code of practice for ground investigations
- 4.2 BS EN ISO 14688-1:2018, Geotechnical investigation and testing. Identification and classification of soil. Identification and description
- 4.3 BS EN ISO 14689-1:2018, Geotechnical investigation and testing. Identification, description and classification of rock. Part 1: Identification and description
- 4.4 BS 10175:2011+A2:2017, Investigation of potentially contaminated sites. Code of practice
- 4.5 BS EN ISO 22476-3:2005+A1:2011, Geotechnical investigation and testing. Field testing. Standard penetration test

APPENDIX 1
DRAWINGS



PROJECT: Embassy Village	
FIGURE No. A1.1.	SCALE: As above
TITLE: Site Location Plan	
	



- Legend Key
- Locations By Type - Em...
 - Locations By Type - CP
 - ▼ Locations By Type - WLS
 - Locations By Type - TP

Project:	
Embassy Village	
Client:	
Curtins Consulting Ltd	
Title:	
Exploratory Hole Location Plan	
Project ID:	Scale:
2230942	1:2500
Figure Number:	Revision:
Fig. A1.2	(00)



APPENDIX 2

SITE WORK

APPENDIX 2

GENERAL NOTES ON SITE WORKS

A2.1 SITE WORK

A2.1.1 Rotary Drilling

For exploration within rock rotary drilling methods are employed, where the drill bit is rotated on the bottom of the borehole. This method is occasionally used for drilling within soils. The drilling fluid is transferred from the surface through hollow drilling rods to the bit cooling and lubricating. Drilling fluids commonly comprise clean water, air, foam, mud or polymers which aid the transportation of drill cuttings to the surface and maximise core recovery.

There are two basic types of rotary drilling:

- Open hole where the drill bit cuts all the material within the diameter of the borehole. This technique is sometimes used in soils and weak rocks as a rapid and economical means of making holes for taking soil samples, carrying out insitu soil tests, installing instruments and probing for voids such as mine workings or solution cavities. The only samples recovered are the poor quality drill cuttings.
- Core drilling where an annular bit fixed to the bottom of the core barrel cuts a core, which is recovered within the innermost tube of the core barrel. Coring is normally carried out by triple tube core barrels. At the end of the core run the core barrel assembly is brought to the surface. The core is prevented from dropping out of the barrel by a core catcher made of spring steel. The non-rotating inner barrel contains a removable sample tube or liner. At the end of each coring run the liner is extracted from the barrel and stored in a core box, where it can be photographed, described and tested.

A2.1.2 Light Cable Percussion Boring

For routine soil exploration to depths in excess of 3m, the light cable percussion rig is generally employed for boring through soils and weak rocks. It consists of a powered winch and tripod frame, with running wheels that are permanently attached so that the rig may be towed behind a suitable vehicle. The rig is towed into position and set up using its own winching system.

The locations of services are checked to make sure the borehole is not situated unacceptably near any services. Regardless of the proximity of services, a CAT scan is undertaken at the borehole location and a trial hole dug to 1.20m by hand.

Boreholes are advanced in soil by the percussive action of the cable tool. The force of the cylindrical tool as it is dropped a short distance cuts a plug of cohesive soil that is removed by the tool.

In non-cohesive soils, the borehole is advanced by a 'shell', otherwise known as a 'bailer' or 'sand pump', which incorporates a clack valve. Material is transferred into the shell and retained by the clack valve. The water level in a borehole is maintained above that in the surrounding granular soil to allow for temporary reductions in the head of water as the shell is withdrawn from the borehole. Water should flow from the borehole into the surrounding soil at all times to prevent 'piping' and loosening the soil at the base of the hole. The casing is always advanced with the borehole in granular soil so that material is drawn from the base rather than the borehole sides.

Obstructions to boring are overcome by fitting a serrated chiselling ring to the base of the percussion tool. For large obstructions, a heavy chisel with a hardened cutting edge may have to be used.

Disturbed samples are taken in polythene bags, jars or tubs that are sealed against air or water loss.

Undisturbed samples are generally taken in cohesive materials at changes in strata and at one metre intervals to 5 metres then at 1.5 metre intervals to the full depths of the borehole. The general purpose open-tube sampler is suitable for firm to stiff clays, but is often used to retrieve disturbed samples of weak rocks, soft or hard clay and also clayey sand or silts. This has been adopted for routine use, and usually consists of a 100mm internal diameter tube (U100), which is capable of taking soil samples up to 450mm in length. The undisturbed samples are sealed at each end using micro-crystalline wax to prevent drying.

Standard penetration tests are generally carried out in non-cohesive soils but also in stiff clays and soft rocks at frequencies similar to that of undisturbed sampling.

A2.1.3 Drive-in Window Sampler

The drive-in window sampler consists of a series of cylindrical sample tubes, generally varying in diameter from 80mm to 35mm. A cutting shoe is fitted to the bottom of each tube, while a window, representing about a quarter of the circumference, is cut along the length of the tube.

The largest diameter tube is driven into the ground using a small vibrating breaker. The sample tube is extracted by means of a ratchet or hydraulic extraction system.

The borehole is extended by using progressively smaller diameter tubes.

Soil samples are extracted through the window of the tube.

A2.1.4 Trial Pits

Shallow trial pits are generally dug by mechanical excavator, however, in difficult access locations or adjacent to structures, such pits may be hand dug. Pits are best used where the ground will stand unsupported and generally, the maximum depth of machine dug pits is 4m to 5m. Where personnel are required to enter pits, it is essential that side support is provided. Entry by personnel into unsupported pits deeper than 1.2m is not allowed for health and safety reasons.

Trial pits allow the in-situ condition of the ground to be examined both laterally and vertically and also allow discontinuities to be recorded. The field record should give the orientation of the pit with details of which face was logged, assessment of stability of sides of pit and groundwater as well as the strata encountered. Photographs of the pit may also be taken.

In-situ testing, such as hand penetrometer, hand vane, Macintosh probe, or similar, can be undertaken in the sides or base of pits while both disturbed and undisturbed samples may be recovered.

It is generally advisable to backfill the pits as soon as possible, open pits should not be left unattended.

A2.2 IN-SITU TESTS

A2.2.1 Standard Penetration Test

The Standard Penetration Test is carried out in accordance with the proposals recommended in (ref 4.5).

The standard penetration test, **SPT**, covers the determination of the resistance of soils to the penetration of a split barrel sampler. A 50mm diameter split barrel sampler is driven 450mm into the soil using a 65kg hammer with a 760mm drop. The penetration resistance is expressed as the number of blows required to obtain 300mm penetration below an initial seating drive of 150mm through any disturbed ground at the bottom of the borehole. The number of blows to achieve the standard penetration of 300mm is reported as the 'N' value.

The test is generally carried out in fine soils, however, it may also be carried out in coarse granular soils, weak rocks and glacial tills using the same procedure as for the SPT but with a 50mm diameter, 60° apex solid cone replacing the split spoon sampler, **CPT**.

When attempting the standard penetration test in very dense material or weathered rocks it may be necessary to terminate the test before completion to prevent damage to the equipment. In these circumstances it is important to distinguish how the blow count relates to the penetration of the sampler. This may be achieved in the following manner:

- Where the seating drive has been completed, the test drive is terminated if 50 blows are reached before the full penetration of 300mm is achieved. The penetration for 50 blows is recorded and an approximate N value obtained by linear extrapolation of the number of blows for the partial test drive.
- If the seating drive of 150mm is not achieved within the first 25 blows, the penetration after 25 blows is recorded and the test drive then commenced.
- For tests in soft rocks, the test drive should be terminated after 100 blows where the penetration of 300mm has not been achieved.

The N-value obtained from the Standard Penetration Test may be used to assess the relative density of sands and gravels as follows:

Term	SPT N-Value : Blows/300mm Penetration
Very Loose	0 - 4
Loose	4 - 10
Medium Dense	10 - 30
Dense	30 - 50
Very Dense	Over 50

A2.3 SAMPLES

U(x)	represents undisturbed 100mm diameter sample with (x) being the number of blows required to obtain sample.
U NR	indicates undisturbed sample not recovered
ES	represents environmental sample
B	represents bulk disturbed samples
D	represents small disturbed sample
W	represents water sample
<u>∇</u>	represents water strike
<u>▼</u>	represents level to which water rose

A2.4 DESCRIPTION OF SOIL AND ROCK

A2.4.1 Soil

The procedures and principles given in BS EN ISO 14688-1:2018 (Ref. 4.2) and BS 5930:2015 (Ref. 4.1) have been used in the soil descriptions contained within this report.

A2.4.2 Rock

The procedures and principles given in BS EN ISO 14689-1:2018 (Ref. 4.3) and BS 5930:2015 (Ref. 4.1) have been used in the soil descriptions contained within this report.

A2.4.3 Fracture State

Various criteria may be used for quantitative description of the Fracture State of rock cores. The standard terms are presented in as BS 5930:2015 (Ref. 4.1) as follows.

TCR (%)	ratio of core recovered (solid and non intact) to length of core run.
SCR (%)	ratio of solid core recovered to length of core run.
RQD (%)	ratio of solid core pieces longer than 100mm to length of core run.
Fracture Index	a count of the number or spacing of fractures over an arbitrary length of core of similar intensity of fracturing. Commonly reported as either Fracture Index (FI, number of fractures per metre) or as Fracture Spacing (I_f mm).
NR	denotes no recovery of core.
NI	denotes non-intact core: intensely fractured and not of sufficient quality to allow an assessment of fracture spacing to be made.



SPT Calibration Report

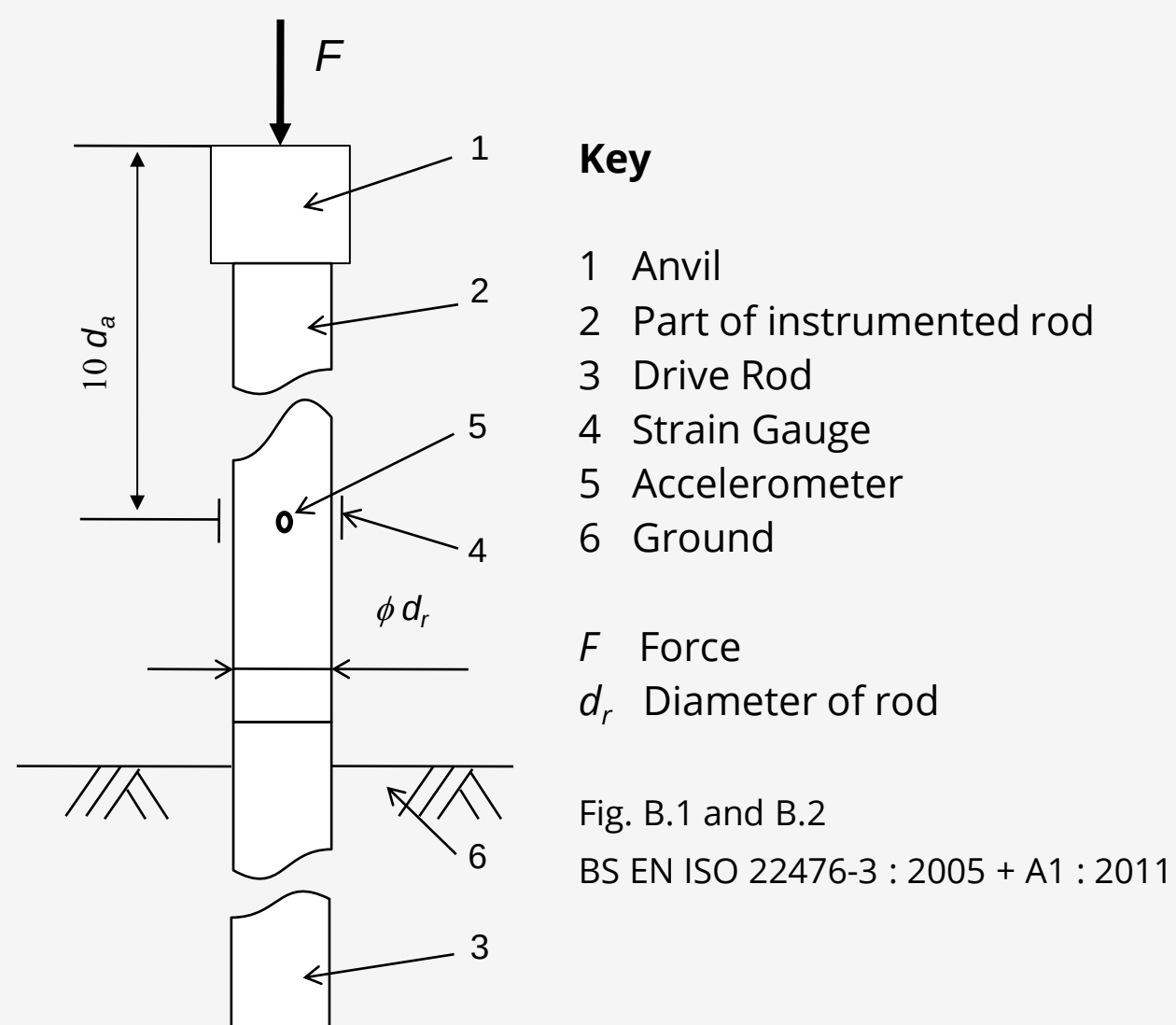
Hammer Energy Measurement Report

Type of Hammer SPT HAMMER
Test No EQU2814
Client GEODRILL

Test Depth (m) 9.80
Mass of hammer $m = 63.5\text{kg}$
Falling height $h = 0.76\text{m}$
 $E_{\text{theor}} = m \times g \times h = 473\text{J}$

Characteristics of the instrumented rod

Diameter $d_r = 0.052\text{ m}$
Length of instrumented rod 0.558 m
Area $A = 11.61\text{ cm}^2$
Modulus $E_a = 206843\text{ MPa}$



DATE OF TEST VALID UNTIL HAMMER ID

26/04/2021

26/04/2022

GEO 4

$E_{\text{meas}} = 0.281\text{ kN-m}$

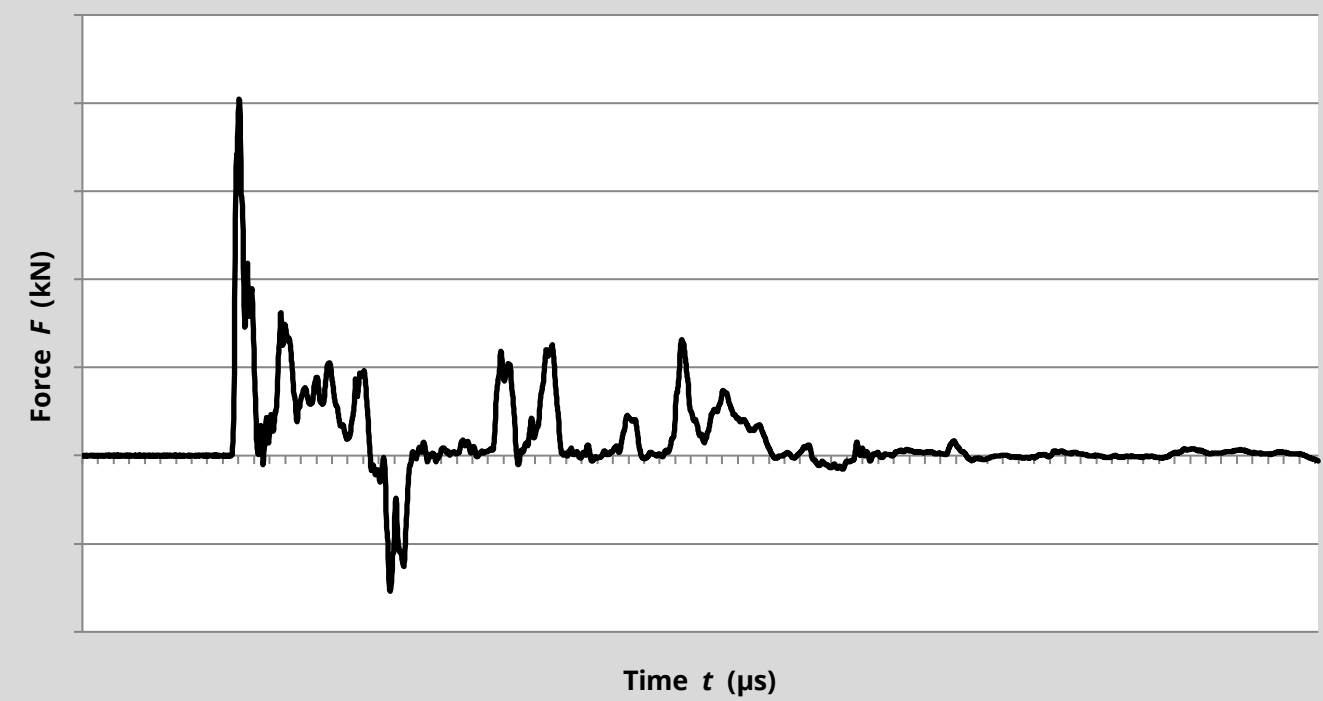
$E_{\text{theor}} = 0.473\text{ kN-m}$

Comments

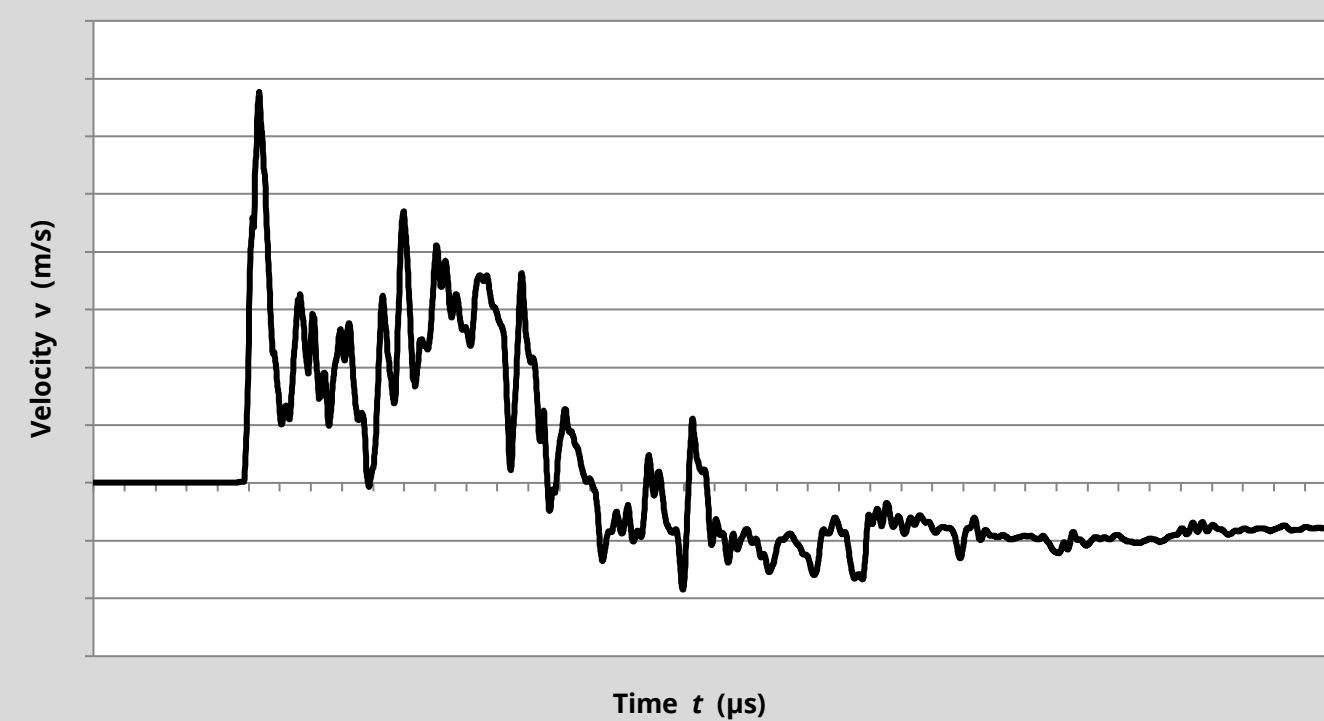
$$\text{Energy Ratio (Er)} = \frac{E_{\text{meas}}}{E_{\text{theor}}}$$

59.36%
© COPYRIGHT 2021

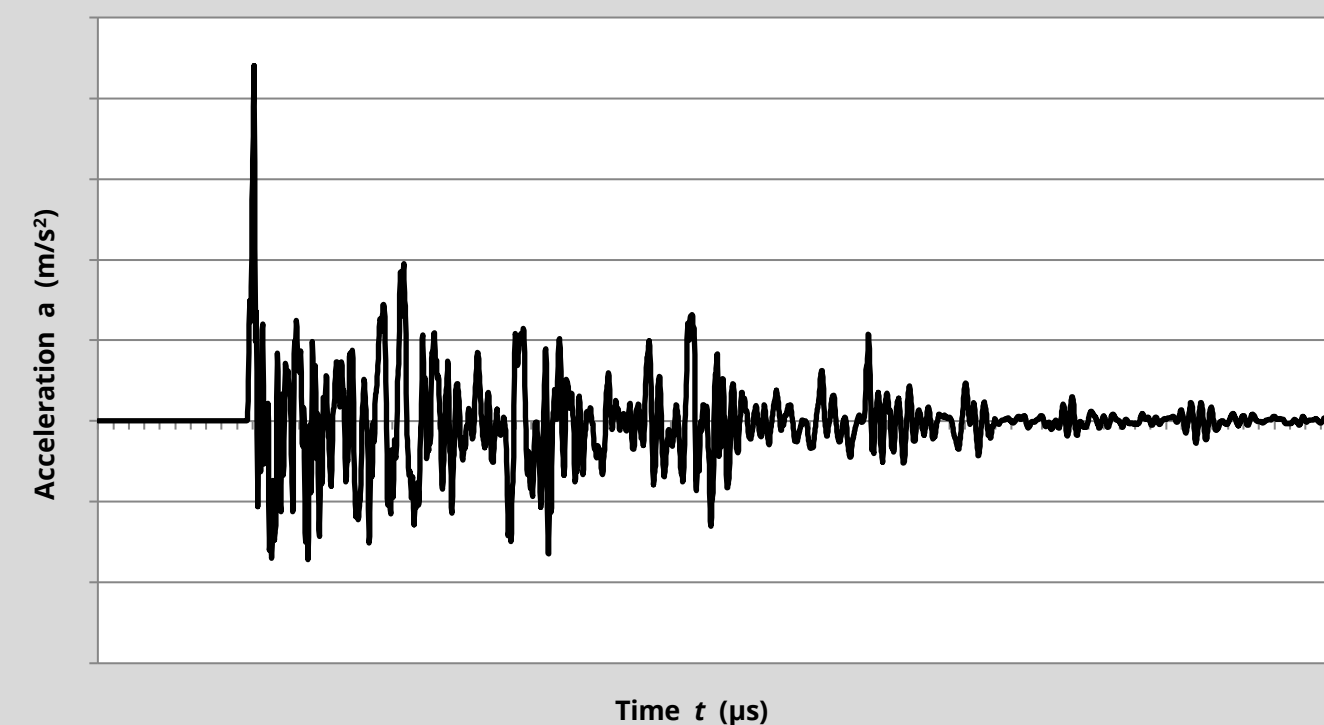
Force



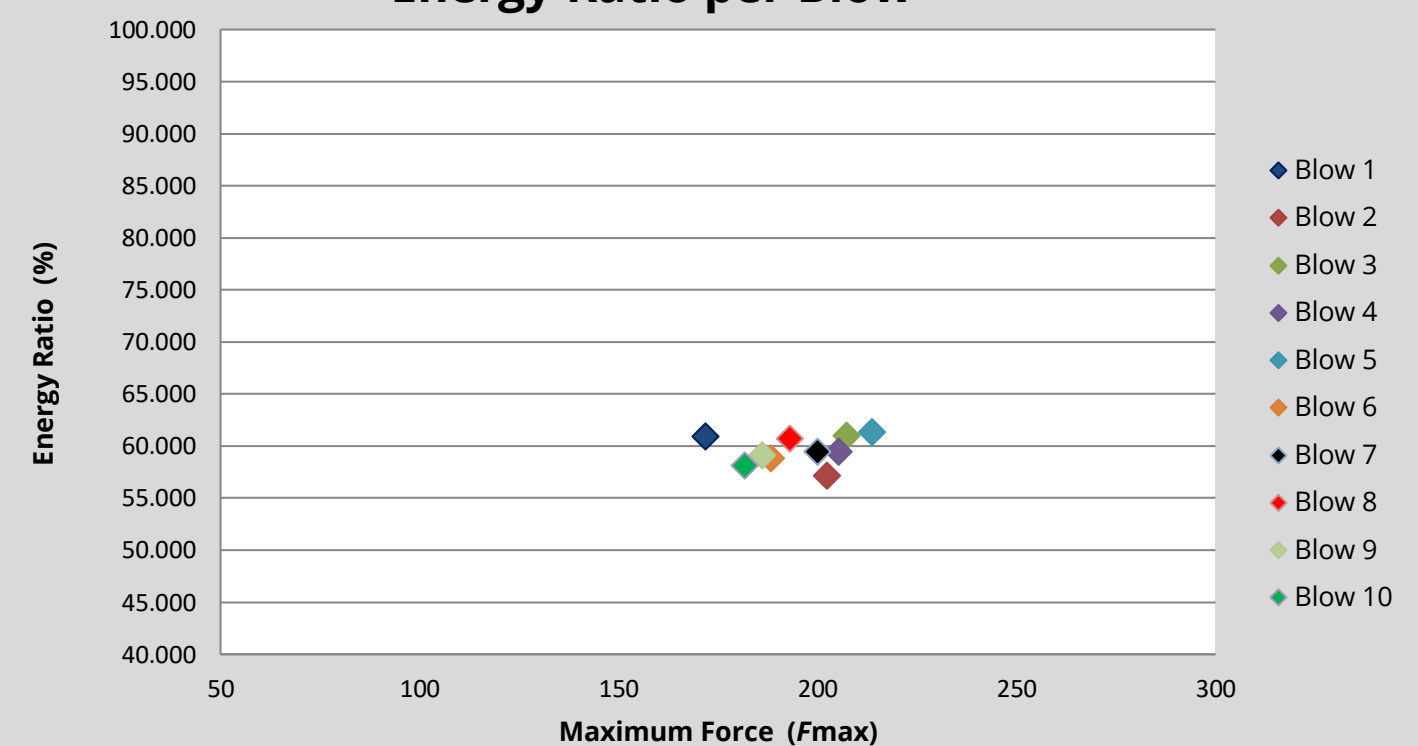
Particle Velocity



Acceleration



Energy Ratio per Blow



Equipe SPT Analyzer Operator

JML

Certificate prepared by

27/04/2021

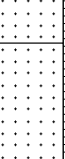
Certificate checked by

27/04/2021

Certificate date

27/04/2021

Plant used: Dando 2000/Comacchio 205	Project: Embassy Village			Location ID: BH01
Dates: 23/02/2023	Client: Curtins Consulting Ltd			
Location: 382667.73E 397467.05N	Ground level:	Logged by: AC/FH	Vertical scale: 1:50	Sheet 1 of 2 Project ID: 2230942

 IAN FARMER ASSOCIATES	Plant used: Dando 2000/Comacchio 205		Project: Embassy Village			Location ID: BH01									
	Dates: 23/02/2023		Client: Curtins Consulting Ltd												
Rotary Boring Log	Location: 382667.73E 397467.05N		Ground level:	Logged by: AC/FH	Vertical scale: 1:50	Sheet 2 of 2 Project ID: 2230942									
	Coring, Samples & In Situ Testing		Strata Details				Groundwater								
Depth	TCR/SCR/ RQD	FI	Samples & Test Result	Level (mOD)	Depth (m) (Thickness)	Strata Description	Legend	Water Strike	Backfill/ Installation						
10.10 - 11.60	93 84 70	3			10.33	Moderately weak, reddish brown, fine and medium grained SANDSTONE with occasional greenish grey discolouration spots and surface stained yellowish brown, approximately 1mm. <i>Between 9.50m and 9.70m: occasional partings, 0-15 degrees, very closely spaced, planar.</i>		11							
		15													
		0													
		AZCL													
11.60 - 13.10	100 95 77	0			(2.17)	Weak, reddish brown, medium grained SANDSTONE with rare pebbles, subangular to rounded including mudstone. Discontinuities are 5 degrees, planar, smooth, clean. Weak, reddish brown, medium grained SANDSTONE with occasional subangular to subrounded gravel including mudstone and rare discolouration spots, greenish grey, 4-6mm. Discontinuities are 1) 0-12 degrees, very closely to closely spaced, planar smooth to rough, clean. 2) 0-5 degrees, closely to medium spaced, undulating with reddish brown silt coating. 3) 1No. fracture, 87 degrees, planar, smooth clean. <i>Below 10.90m: moderately weak. Between 11.84m and 13.10m: Discontinuities are 1) 18 -20 degrees, closely to medium spaced, planar smooth, clean. 2) 0-5 degrees, closely to medium spaced, undulating with reddish brown silt coating.</i>	12								
		7													
					12.50 (0.60)	Moderately weak, reddish brown with grey discolouration, medium grained SANDSTONE with rare subangular to rounded, fine and medium gravel including quartz. Discontinuities are 15-30 degrees, closely spaced, planar, smooth clean.		13							
					13.10	End of Borehole at 13.10m									
								14							
								15							
								16							
								17							
								18							
								19							
								20							
Flush Details			Borehole Diameter		Boring Progress			Remarks:							
Top (m)	Base (m)	Flush Type	Flush Return %	Depth (m)	Dia (mm)	Date	Time			Depth (m)	Cased (m)	Water (m)			
									SPT Hammer: GEO4 Energy Ratio: 59.36%						
				Casing Diameter		Water Strikes			Monitoring Installations						
				Depth (m)	Dia (mm)	Strike (m)	Cased (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks	Top (m)	Base (m)	Pipe Type	Dia (mm)
Checked by:		MHW	IFA RC												
Log status:		DRAFT	v01.01												

Core Photographs BH01



Core Photographs BH01



Core Photographs BH01



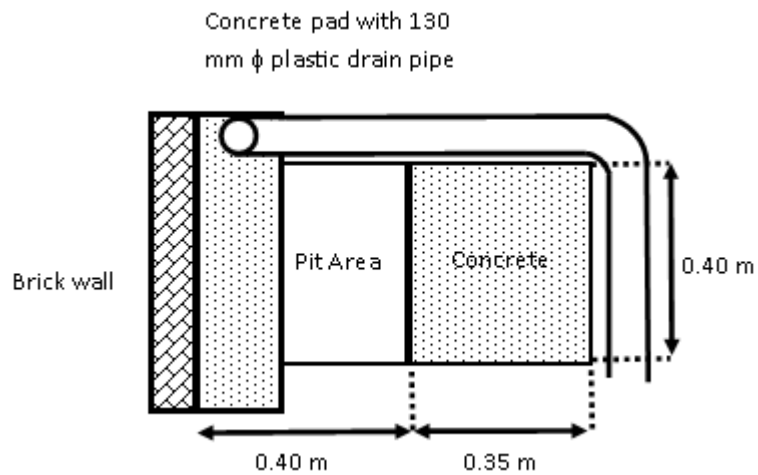
[illegible]

	Plant used: Hand tools and Competitor dart		Project: Embassy Village		Location ID: WS01								
	Dates: 22/02/2023		Client: Curtins Consulting Ltd										
Dynamic Sample Borehole Log		Location: 382771.94E 397482.56N		Ground level: 27.79mOD	Logged by: AC	Vertical scale: 1:50	Sheet 1 of 1 Project ID: 2230942						
Samples & In Situ Testing			Strata Details				Groundwater						
Depth	Sample ID	Test Result	Level (mOD)	Depth (m) (Thickness)	Strata Description	Legend	Water Strike	Backfill/ Installation					
3.00		SPT(C) N=59 (12,12/14,15,15,15)	27.59	0.20	MADE GROUND: Tarmacadam.		1						
			27.39	0.40	MADE GROUND: Light grey, sandy, silty, angular to subangular, fine to coarse GRAVEL including limestone and concrete. MADE GROUND: Strong grey and reddish brown CONCRETE 50-60% aggregates of angular to subrounded, fine to coarse gravel including brick and limestone.								
			(2.40)										
			24.99	2.80	MADE GROUND: Orangish brown, sandy, angular to subangular, fine to coarse GRAVEL including brick.				3				
			24.34	3.45	End of Borehole at 3.45m								
							4						
							5						
							6						
							7						
							8						
							9						
							10						
Dynamic Sample Recovery			Remarks:										
Top (m)	Base (m)	Dia (mm)	Recovery %	Remarks									
				Borehole concrete cored GL to 2.80m.									
				SPT Hammer: N/R, Energy Ratio: N/R									
				Water Strikes			Monitoring Installations						
				Strike (m)	Cased (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks	Top (m)	Base (m)	Pipe Type	Dia (mm)
Checked by:		MHW	IFA DS v01.01										
Log status:		DRAFT											

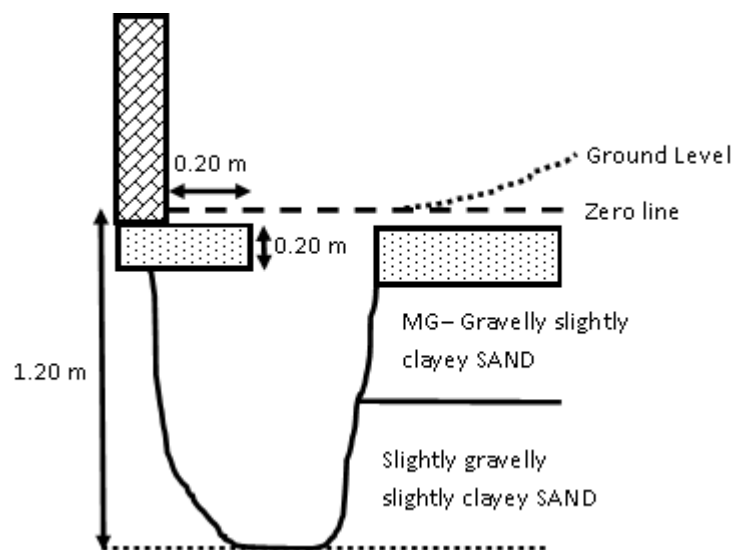
Termination:				Stability: Trial pit remained stable during excavation.	Remarks: No groundwater encountered. Please refer to sketch for further details.		
Dimensions (Length m x Width m): 0.40 x 0.40							
Water Strikes							
Strike (m)	Time (mins)	Rose to (m)	Remarks				
					Checked by:	MHW	IFA TP v01.01
					Status:	DRAFT	

Trial Pit Sketch T01

Plan view



Cross section



Trial Pit Photographs T01



T01 prior to breaking through the shallow concrete layer in the pit (0.10 - 0.30 m).
Terracotta colored pipe can be seen in the pit.

Trial Pit Photographs T01



Trial Pit Photographs T01



Trial Pit Photographs T01



 IAN FARMER ASSOCIATES	Plant used: Hand tools		Project: Embassy Village			Location ID: T02			
	Dates: 23/02/2023		Client: Curtins Consulting Ltd						
Trial Pit Log	Location: 382769.47E 397487.81N		Ground level:	Logged by: AC	Vertical scale: 1:25	Sheet 1 of 1 Contract ID: 2230942			
	Samples & In Situ Testing		Strata Details						
Depth	Sample ID	Test Result	Level (mOD)	Depth (m) (Thickness)	Strata Description	Legend	Scale	Water Strike	Backfill/ Installation
				0.10	MADE GROUND: Paving slab.		1		
				(0.30)	MADE GROUND: Concrete.				
				0.40	End of Trial Pit at 0.40m				
							2		
							3		
							4		
							5		
Termination:			Stability: Trial pit remained stable during excavation.			Remarks: No groundwater encountered. Please refer to sketch for further details. Unable to be surveyed in during GPR due to position on slope. Co-ordinates derived from HoleBASE mapping tool.			
Dimensions (Length m x Width m): 0.40 x 0.40									
Water Strikes									
Strike (m)	Time (mins)	Rose to (m)	Remarks						
						Checked by: MHW		IFA TP v01.01	
						Status: DRAFT			

Trial Pit Photographs T02



Trial Pit Photographs T02

