

Ground Investigation Report

Shaftesbury Theatre, London

Client: Orbital Equipment

Project Number: G184804

Date of Issue: 05/12/2019

Project Title	Shaftesbury Theatre, Lor	ndon	Project Ref	G184804
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Approved By				AU
Issue No	Status	Date		Approved By
001	FINAL	02/01/2019		MTM
002	FINAL with additions	06/01/2019		AJ



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1. Introduction

1.1. Appointment

Strata Geotechnics was appointed on 13/11/2018 by Orbital Equipment. The Appointment was to carry out a factual Ground Investigation Report of the site known as Shaftesbury Theatre, London. Strata Geotechnics were later requested by Avison Young to provide bearing pressures at specific depths.

1.2. Site Location

The site of the Ground investigation is Shaftesbury Theatre, London WC2H 8DP. The site is located at central grid reference 530115E, 181354N on the corner of Bloomsbury Street and High Holborn.

A site location plan is included in Appendix A.

1.3. Site Description and Proposed Development

The site is currently occupied by the Shaftesbury Theatre, a 1911 theatre for drama and musicals.

The purpose of the ground investigation is to provide information on the ground conditions so further work can be completed for the renovation of the existing building – to include an extension to the basement space.

1.4. Scope of the Investigation

The Ground Investigation was carried out between 24/11/18 and 02/12/18 on weekend-shifts and comprised three boreholes to a maximum depth of up to 30.10m bgl drilled by cable percussion techniques, the purpose of which was to provide information for design of foundations.

In-situ Standard Penetration Tests (SPTs) were conducted within the boreholes to ascertain 'N' values of the various lithologies encountered. This test acts as a proxy to ascertain the strength of the material encountered. SPT 'N' values detailed in this report have not been corrected for overburden pressure or hammer energy efficiency. Disturbed (D) samples were recovered at specified depths and at every stratum change for descriptive purposes.

The exploratory hole logs are presented in Appendix B.

No laboratory testing has been requested. Any samples retained on the premises of Strata Geotechnics will be kept for a period of six weeks from the date of issue of the Final Report until week commencing 11/02/2019 after which they will be disposed of. Should any laboratory tests be required, please contact Strata Geotechnics prior to the above disposal date.



2. Limitations of Study

Strata Geotechnics are a wholly owned subsidiary of Van Elle Limited (VEL).

This report is for the sole use and benefit of Orbital Equipment and Avison Young in accordance with their brief and should not be relied upon or used by other parties without explicit prior written agreement from VEL. VEL disclaim any responsibility to the client and others in respect of any matters outside the above scope.

The investigation has been carried out to our understanding of current legislation and best practice; designed to produce information adequate for the appraisal of potential site conditions in relation to the proposed future use of the site. This investigation generally adhered to the guidelines outlined in both BS5930:2015, Code of Practice for Site Investigations and BS1377:1990, Testing of Soils for Civil Engineering Purposes.

New information, legislation, local authority planning conditions or changes to best practice may necessitate further fieldworks and revision/reissue of the ground investigation report after the date of this report issue. Further assessment, investigation, construction activities over time may reveal conditions that were not found during the period of these investigations and, therefore, could not have been taken into account in the preparation of the report. VEL reserves the right to amend their conclusions and recommendations in the light of further information that may become available.

Intrusive investigations can only investigate ground beneath a small proportion of the total site area. Attention is drawn to the fact that the findings are based on data obtained from the borehole samples and in-situ testing. Where comments are made based on information obtained from third parties, VEL assumes that all third party information is true and correct. No independent action has been undertaken to validate the findings of third party information, unless specifically stated. The possibility of variation in ground conditions around the borehole should not be overlooked. As such these do not necessarily address all aspects of the ground behaviour on site. Any opinion or diagram of a possible configuration of strata beyond the borehole or extrapolated to greater depth is conjectural and given for guidance only no responsibility is accepted as to its accuracy. No liability can be accepted for such variations.

This investigation was undertaken in good faith with regards to the request and requirements of Orbital Equipmentand Avison Young at the time of quotation, it does not constitute a full interpretative report with regards to the geotechnical or environmental status of the site. There may be other sources of information not included in this report that hold data relevant to the site that could materially affect the conclusions made in this report.



It is possible therefore that the intrusive investigation undertaken by VEL, whilst fully appropriate, may not have encountered all significant subsurface conditions. Consequently, no liability can be accepted for conditions not revealed by the exploratory holes.



3. Results of the Ground Investigation

3.1. Ground Conditions

The published geological records available from the British Geological Survey shows that the Site is situated upon superficial deposits of Sand and Gravel from the Quaternary period. The underlying solid bedrock geology is listed as the London Clay Formation, which comprises Clay, Silt and Sand from the Palaeogene period.

MADE GROUND was encountered in all three of the boreholes during drilling from the base of the pre-excavated inspection-pit to a maximum depth of up to 3.50m bgl comprising generally sandy gravelly CLAY; the gravel is fine to medium, sub-angular to angular of predominantly brick.

Beneath the MADE GROUND, from a depth of 2.70m bgl medium dense and dense yellowish brown, gravelly SAND was encountered, which was noted to be becoming clayey with increasing depth. The SAND was noted to depth of between 4.50 to 5.00m bgl.

Stiff to very stiff silty CLAY was encountered from 4.50m bgl down to the maximum drilled depth of 30.10m bgl in BH2B and 15.40m in BH1 and BH2A.

The encountered soil profile corroborates the expected geology.

Please refer to the exploratory hole log in Appendix B for a more detailed account of the conditions encountered during the investigation.

3.2. Groundwater

Groundwater was not encountered during drilling; however, at the start-of-shift on 01/12/18 a standing water level (SWL) of 15.20m bgl was noted. Changes in groundwater level may occur for a number of reasons, including seasonal effects and variations in drainage. The long-term groundwater elevation may increase or decrease at some time in the future.



4. Ground Bearing Pressure Assessment

Strata Geotechnics were requested to provide safe bearing pressures for a basement ground bearing slab at 3.0m and 3.5m below ground level within the dense gravel band above the London Clay below (starting from between 4.5 and 5.0m bgl over the three boreholes). If the gravel were extending to a significant depth beneath the basement, a high bearing capacity would be possible however the zone of influence/pressure bulb extending from the proposed wide ground bearing slab means the bearing pressure relies on the properties of the London Clay below rather than the gravel above.

An undrained shear strength of 80kPa has been considered reasonable for the upper zone of the London Clay. Using drained analysis equation 8.32 from Craig 2004 gives the safe bearing capacity (factor of safety of 3) of a basement founded at 3.0m of 3.5m as 120kPa. Groundwater was not encountered in the boreholes and as such groundwater has been considered as much deeper than the zone of influence below the foundation (i.e. greater than twice the width of the foundation). Should this change in the future a lesser bearing capacity may need to be considered. Basement/retaining wall design and the structural raft design have not been considered and should be considered by a competent and experienced professional.

5. References

- British Geological Survey (BGS formerly the Institute of Geological Sciences (IGS)) www.bgs.ac.uk and BGS Geoindex: http://mapapps2.bgs.ac.uk/geoindex/home.html.
- BS5930:2015 Code of Practice for Site Investigations.
- BS1377:1990, Methods for Testing of Soils for Civil Engineering Purposes.

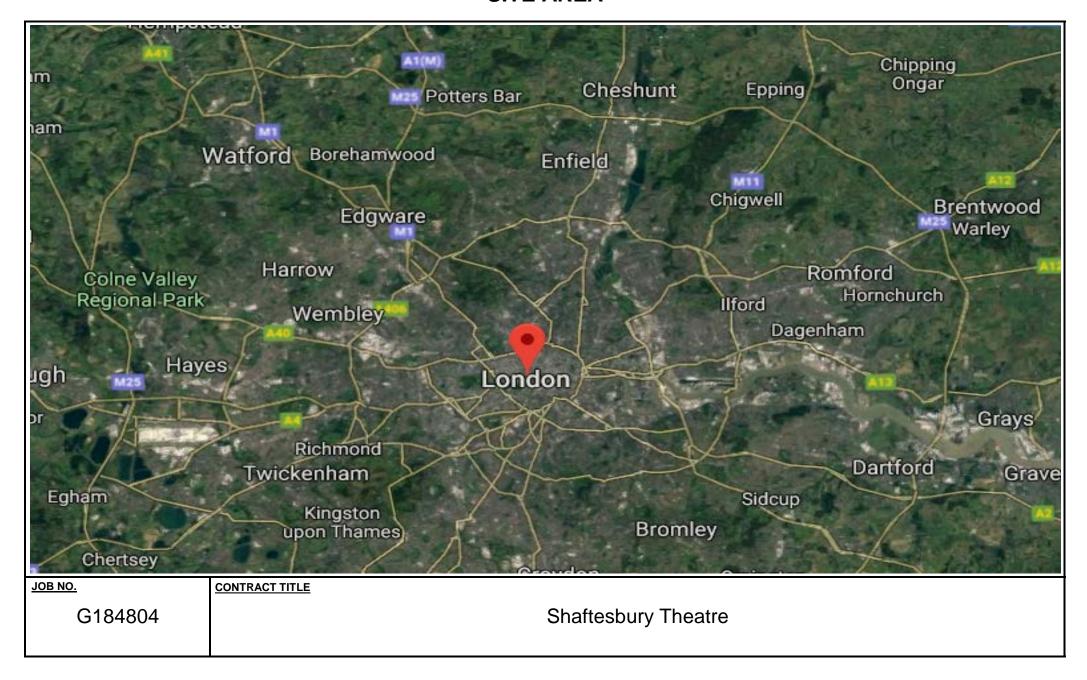


APPENDICES

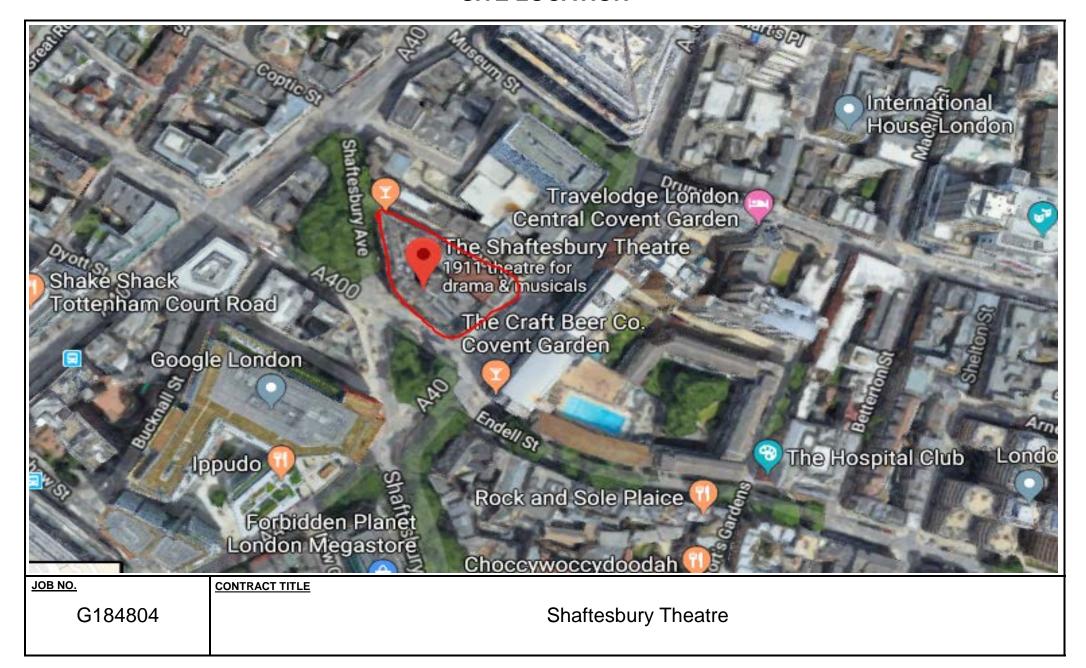


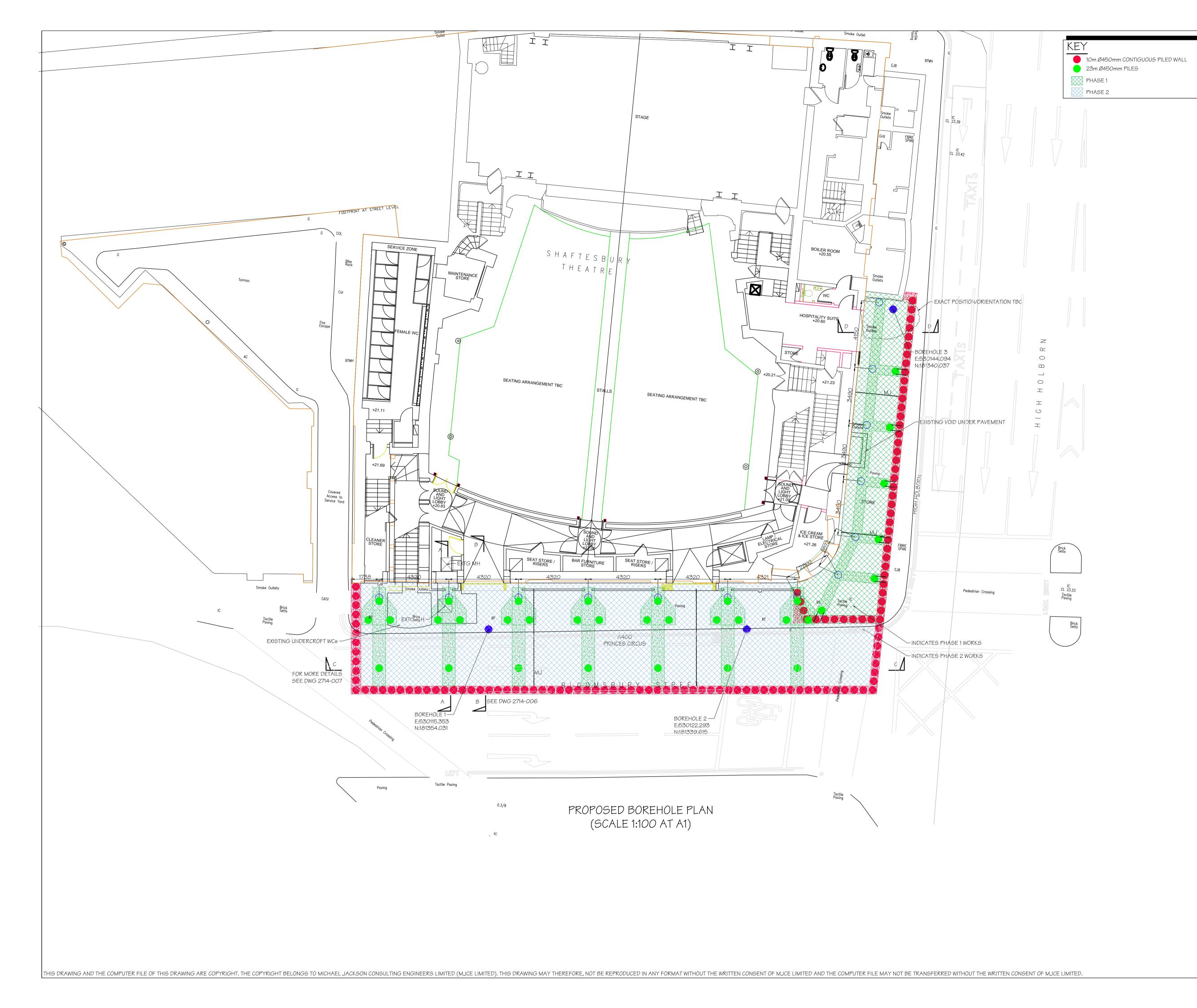
Appendix A: Drawings

SITE AREA



SITE LOCATION





DO NOT SCALE THIS DRAWING.

ORIGINAL DRAWING SIZE A1

Notes

GENERAL

- G1. ALL DIMENSIONS SHOWN ARE IN mm UNLESS NOTED OTHERWISE.
- G2. ALL DIMENSIONS SHOWN ARE APPROXIMATELY ONLY AND MUST BE CHECKED AND CONFIRMED BY THE CONTRACTOR VIA A FULL DIMENSIONAL SURVEY OF THE AREA OF THE WORKS PRIOR TO UNDERTAKING OF THE WORKS. THE ENGINEER MUST BE NOTIFIED IMMEDIATELY SHOULD ANY DISCREPANCIES BECOME APPARENT.
- G3. ALL DETAILS AND DIMENSIONS SHOWN RELATING TO THE EXISTING STRUCTURE ARE SCHEMATIC AND APPROXIMATE ONLY, BASED UPON NO EXPOSURE PRIOR TO COMMENCEMENT OF THE PREPARATION OF THESE DETAILS.
- G4. THE DEPTH AND LOCATION OF ANY SERVICES HAS NOT BEEN ESTABLISHED. THE CONTRACTOR IS RESPONSIBLE FOR LOCATING AND PROTECTING THEM.
- G5. ALL WORKMANSHIP AND MATERIALS TO COMPLY WITH THE CURRENT BUILDING REGULATIONS AND RELEVANT CURRENT BRITISH STANDARDS.
- G6. THE CONTRACTOR SHALL ALLOW FOR ALL WORK NECESSARY TO OBTAIN FULL APPROVAL AND SATISFACTION OF THE BUILDING INSPECTOR.
- G7. THE CONTRACTOR SHALL COMPLY WITH ALL REQUIREMENTS OF THE CURRENT HEALTH & SAFETY AT WORK ACT AND CONSTRUCTION REGULATIONS.
- G8. THE CONTRACTOR IS RESPONSIBLE FOR ENSURING THAT HIS OPERATIONS DO NOT IN ANY WAY IMPAIR THE SAFETY OR CONDITION OF THE EXISTING STRUCTURE OR ADJACENT STRUCTURES. HE IS TO PROVIDE ANY TEMPORARY SUPPORTS, SHORING, ETC REQUIRED FOR THIS PURPOSE AND HE IS TO CAREFULLY INSPECT THE CONDITION OF THE STRUCTURES BOTH BEFORE AND DURING THE EXECUTION OF THE WORK. THE ENGINEER IS TO BE NOTIFIED IMMEDIATELY SHOULD ANY DAMAGE OCCUR
- G9. ALL PROPRIETARY PRODUCTS TO BE USED IN STRICT ACCORDANCE WITH MANUFACTURERS INSTRUCTIONS AND RECOMMENDATIONS

THESE DRAWINGS HAVE BEEN PREPARED SOLELY AS A DRAFT SCHEME TO ASSIST THE QS IN COSTING THE RC AND STEELWORK ONLY.

THE SCHEME IS BASED ON A SECTION THROUGH PROVIDED BY BENNETTS ASSOCIATES. THE HEIGHTS AND LEVELS OF THE FOUNDATIONS ARE INDICATIVE ONLY BASED ON NO EXPOSURE WORK.

THE FOUNDATIONS SHOULD BE EXPOSED TO ALLOW THE SCHEME TO BE VALIDATED OR REVISED ACCORDINGLY.

IT IS ANTICIPATED THE STALLS FLOOR WILL NEED TO BE LOWERED TO PROVIDE THE ADDITIONAL HEADROOM REQUIRED TO ACCESS BENEATH THE BEAMS.

PRELIMINARY ISSUE

Rev Date Description By

Michael Jackson Consultin

Shaftesbury Theatre

SHAFTESBURY THEATRE

Pro

PROPOSED BASEMENT

Drawing Title

PROPOSED BOREHOLE LOCATION PLAN

Scale Date Drawn Checked Passed AS SHOWN NOV 2017 SAM

DRG. No.

2714 - 209 P1

	STR	ATA
//// <i>(Mannie</i>	EOTE	CHNICS

Date Reported: 05/12/2019

Summit Close, Kirkby-in-Ashfield, 01773 304056

SPT N Value By Elevation

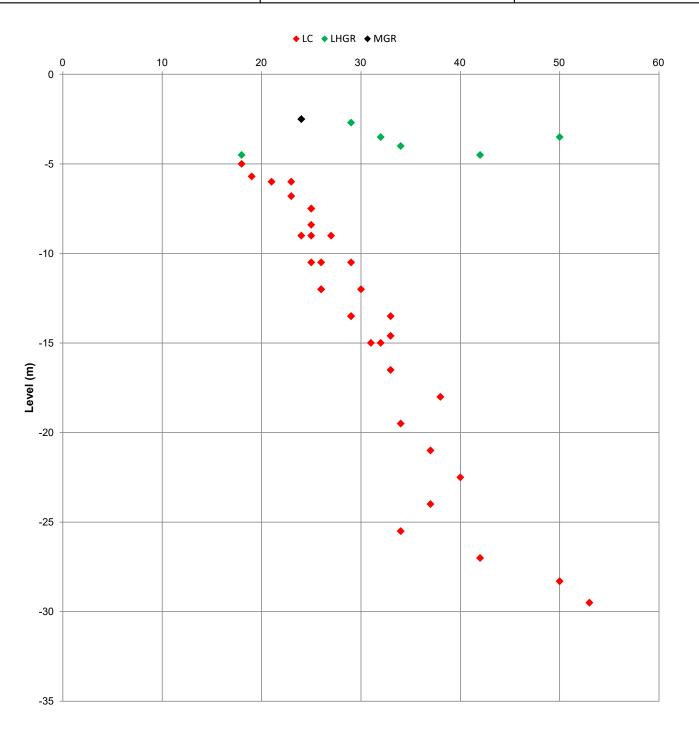
Data Status:

Borehole No.

0

Project ID: 184804 Project Title: Shaftsbury Theatre Final Depth: 0

Client: Orbital Equipment Location: Date Drilled:





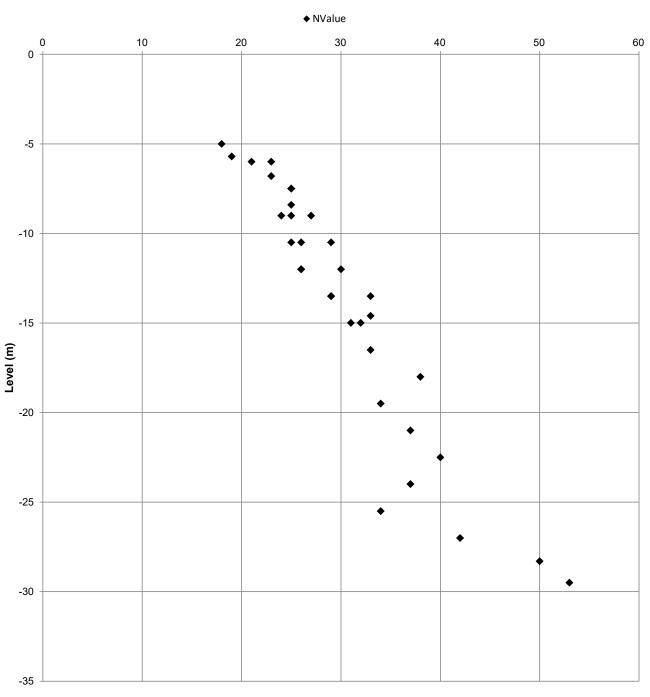
Summit Close, Kirkby-in-Ashfield, 01773 304056

SPT N Value By Elevation

London Clay

Project ID: 184804 Project Title: Shaftsbury Theatre Final Depth: 30.1

Client: Orbital Equipment Location: Date Drilled: 01/12/18



Date Reported: 05/12/2019

Data Status:



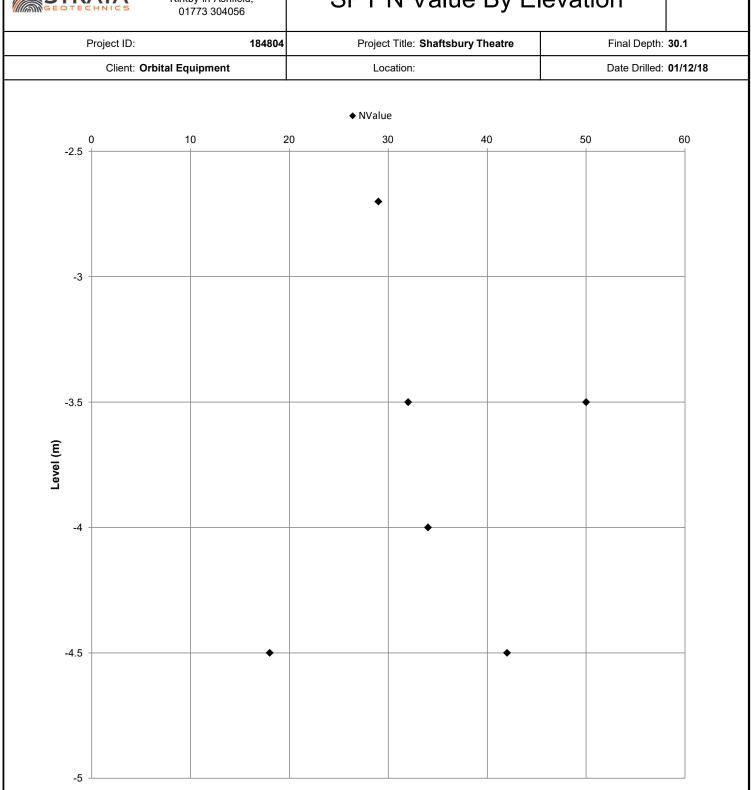
Date Reported: 05/12/2019

Summit Close, Kirkby-in-Ashfield, 01773 304056

SPT N Value By Elevation

Data Status:

Gravel





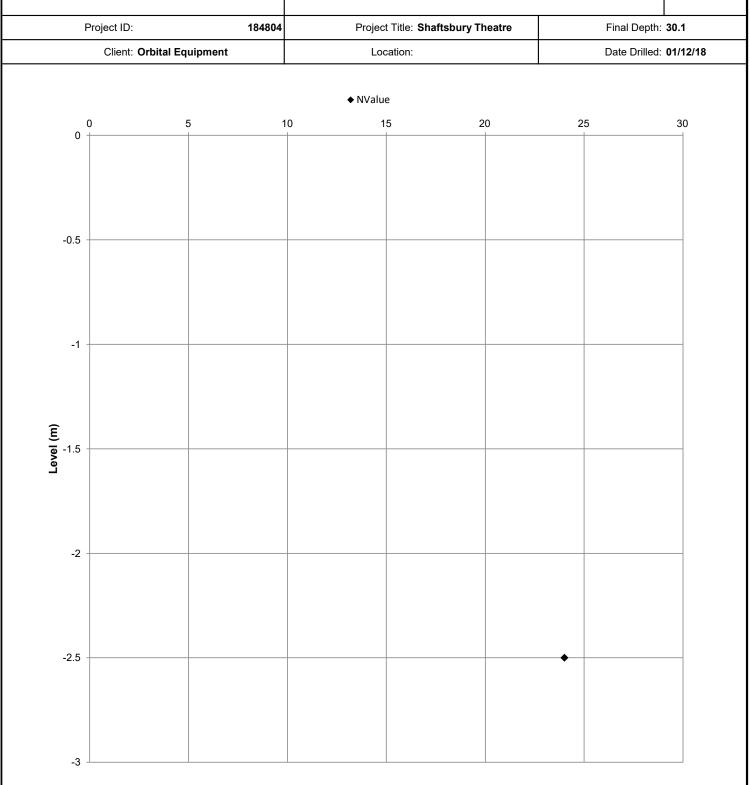
Date Reported: 05/12/2019

Summit Close, Kirkby-in-Ashfield, 01773 304056

SPT N Value By Elevation

Data Status:

Made Ground





Appendix B: Exploratory Hole Records



LEGEND

U Undisturbed driven tube sample, 100mm nominal diameter unless noted

UT Undisturbed thin wall tube sample, 100mm nominal diameter unless noted

P Undisturbed pushed piston sample, 100mm nominal diameter unless noted

TW Thin wall tube (pushed)

CBR mould sample

BLK Block sample

D Small disturbed sample

B Disturbed bulk sample

SB Small disturbed bulk sample, <5kg total weight

SD Standard Penetration Test liner sample

ES Soil sample for environmental testing

W Water sample

L Liner, dynamic sample

C Core sample

Test results

N Standard penetration test, split spoon sampler

N Standard penetration test, solid cone

K Field permeability test, kFH indicates falling head, kPl indicates packer injection

V Field vane test [natural (n) remoulded (r)]

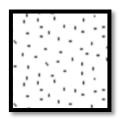
I_a or I_d Point load strength quoted for axial (a) and diameter (d)

CS Core sample for laboratory testing

PP Pocket Penetrometer



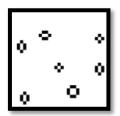
Backfill



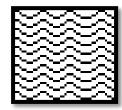
Sand



Grout



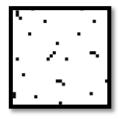
Gravel



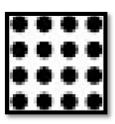
Arisings



Bentonite pellets



Concrete



Cement Bentonite pellets

Contract Name: Client: Borehole ID: Orbital Equipment Shaftsbury Theatre 1 Contract Number: Checked: Date Started: Date Completed: Logged: Status: 184804 24/11/2018 24/11/2018 CW MTM **FINAL** Sheet 1 of 2 Cable Percussion Easting: Northing: Ground Level: Plant Used: Print Date: Scale: Dando 2000 Borehole Log 530115.4 181354.0 11/12/2018 1:50

Weather: Clo	udy	Rig Crew: Stephen Thompson	Terr	nination:	Schedule	d depth reached SPT Hammer: AR366 Energy Ra	tio: 73	%	
	Samples &	n Situ Testing				Grour	ndwater		
Depth	Sample ID	Test Result	Level (mAOD)	Depth (m) (Thickness)	Legend	Strata Description		Water Strike	Backfill/ Installation
			(IIII/CD)	, ,	incorrect incorrect incor key key ke	Pre-excavated pit (by others).	-		
					incorrect incorrect incor		-		
					incorrect incorrect incor		_		
					incorrect incorrect incor		-		
					incorrect incorrect incor		Ŀ		
_				(2.00)	incorrect incorrect incor		- 1		
					incorrect incorrect incor		[
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-					incorrect incorrect incor		-		
					incorrect incorrect incor		-		
_				2.00	key key ke incorrect incorrect incor		2		
				2.00		MADE GROUND: Dark brown, soft to firm, sandy very gravelly CLAY. Sand is coarse. Gravel is sub-angular to			
						angular, fine to medium of mixed lithologies mainly brick	-		
2.50 - 2.60	D1			(1.00)			-		
							ļ.,		
-3.00 - 3.10	D2			3.00	p00000000	Dense, orangish brown, gravelly fine to coarse SAND. Gravel	_ 3		
						is angular to sub-angular, fine to coarse of mixed lithologies.	ļ		
_		SPT(C) 3.50m, N=50					ţ.		
		(4,9/12,12,12,14)					<u> </u>		
				(1.80)			-		
-4.00 - 4.10	D3			(1.60)			- 4		
							-		
-		SPT(C) 4.50m, N=42					-		
4.80 - 4.90	D4	(4,6/9,9,12,12)		4.80			1		
- 1.00	5.			1.00	××	Stiff to very stiff, orangish brown, silty sandy CLAY. Sand is	- - 5		
				(0.70)	X———X	fine.	- 3		
:				(,	×_ ××		-		
- 5.50 - 5.60	D5			5.50	$\overline{}$	Stiff to very stiff, dark grey silty CLAY.	+		
					^- <u>×</u>	Suit to very suit, dark grey sitty CLAT.	-		
					<u> </u>		1		
6.00 - 6.45	SD6	SPT(S) 6.00m, N=23			×		- 6		
		(2,4/4,5,6,8)			× ×				
					$\pm \times $		Ŀ		
					× ×		-		
					×x		-		
-7.00 - 7.10	D7				×_×_×		7		
					× ×		F		
							ļ .		
7.50 - 7.95	SD8	SPT(S) 7.50m, N=25 (4,4/5,6,7,7)			× ×		ļ .		
		(7,4/0,0,7,7)			×		ļ		
_					×_×_×		- - 8		
					$\frac{\times}{\times}$		- 0		
					E ×		F		
8.50 - 8.60	D9				<u>x</u> — <u> </u>		F		
					<u>×</u> ×		ļ.		
					×		ļ		
-9.00 - 9.45	SD10	SPT(S) 9.00m, N=24					- 9 -		
		(5,4/5,5,7,7)			^ <u></u> ×				
					×		<u> </u>		
					××		F		
					× ×		F		
_							10		
Start	L & End of	 Shift Observations	Boreho	l ole Diam	eter Cas	l ing Diameter Remarks:	1		<u> </u>
Date		epth (m) Casing (m) Water (n) Depth (m) Dia (r	nm) Depth	hand pit pre dug to 2m bgl. Backfilled with	arisina	ns No	
24-11-2018	04:40		15.00	15	0 6.0				rdinates

Start & End of Shift Observations

Borehole Diameter | Casing Diam

Contract Name: Borehole ID: Client: Shaftsbury Theatre Orbital Equipment 1 Logged: Checked: Contract Number: Date Started: Date Completed: Status: 184804 24/11/2018 24/11/2018 CW MTM **FINAL** Sheet 2 of 2 Cable Percussion Easting: Northing: Ground Level: Plant Used: Print Date: Scale: Borehole Log 530115.4 181354.0 Dando 2000 11/12/2018 1:50

Weather: Clo	udy	Rig Crew: Stepher	1	Term	nination:	Schedule	d depth reache	'd	SPT Hammer: AR366	Energy Ratio: 73	%	
	-	In Situ Testing		Strata Details							Groun	
Depth	Sample ID	Test Result		vel (OD)	Depth (m) (Thickness)	Legend		Strata	Description		Water Strike	Backfill/ Installation
10.00 - 10.10 - 10.50 - 10.95	D11	SPT(S) 10.50m, N=2 (4,5/5,7,7,7)				XX XX XX XX	Stiff to very st	iff, dark grey sil	ity CLAY.	- 11		
11.50 - 11.60 - 12.00 - 12.45	D13	SPT(S) 12.00m, N=2 (3,5/5,6,8,7)	6			X				- 12		
- 13.00 - 13.10 - 13.50 -	D15 SD16	SPT(S) 13.50m, N=2	9		(9.95)	× × × × × × × × × × × × × × × × × × ×				- - - - - 13		
13.95 - - - - 14.50 - 14.60	D17	(5,5/6,7,7,9)				X—————————————————————————————————————				- 14		
15.00 - 15.45 15.45	SD18	SPT(S) 15.00m, N=3 (5,5/7,7,8,9)	1		15.45	× × × × - ×		End of Bore	ehole at 15.450m	- 15 - 15 		
										- 16 - - - - - - - -		
- - - - - - -										- 17		
										- 18 - - - - - - - - - - - - - - - - - - -		
										- 19 - - - - - - - - - - - - - - - - - - -		
Start Date 24-11-2018 24-11-2018	& End of 3 Time De 04:40 18:00	Shift Observations epth (m) Casing (m) Wat 2.00 0.00	er (m) De	oreho epth (i 15.00	m) Dia (n	nm) Dept	00 150	Hand pit pre o	dug to 2m bgl. Back was encountered wi OS mapping.	filled with arising	js. No e. Co-o	rdinates

Installation
Top (m) Base (m) Type

Water Strikes

Remarks

Dia (mm) Strike (m) Casing (m) Sealed (m) Time (mins) Rose to (m)

Chiselling
From (m) To (m) Duration

Remarks

Contract Name: Client: Borehole ID: Shaftsbury Theatre Orbital Equipment 2A Contract Number: Date Started: Date Completed: Logged: Checked: Status: 184804 24/11/2018 24/11/2018 CW MTM **FINAL** Sheet 1 of 2 Easting: Northing: Ground Level: Plant Used: Print Date: Scale: Cable Percussion 530122.3 181339.6 Dando 4000 1:50

Borehole Log 11/12/2018 Weather: Fine Rig Crew: David Pond Termination: Scheduled depth reached SPT Hammer: AR1076 Energy Ratio: 74% Samples & In Situ Testing Strata Details Groundwater Backfill/ Installatio Strata Description Depth Sample ID Test Result Legend (mAOD) Pre-excavated pit (by others). key (2.00)2.00 MADE GROUND: Soft, brownish grey, sandy very gravelly CLAY. Sand is fine to coarse. Gravel is fine to medium, sub-2.20 D1 (0.70)angular of brick 2.60 D2 SPT(S) 2.70m, N=29 2.70 2.70 - 3.15 D3 Medium dense to dense, yellowish brown, gravelly fine to coarse SAND. Gravel is sub-angular to sub-rounded, fine to (3,5/6,7,8,8)3 medium of mixed lithologies. 3.20 D4 (1.80)-4.00 - 4.45 SD5 SPT(S) 4.00m, N=34 4 (5,5/7,8,8,11) 4.50 D6 4.50 Stiff, orangish brown, gravelly fissured CLAY. Gravel is subangular, medium to coarse of flint and chert. 4.90 D7 SPT(S) 5.00m, N=18 (1.00)5 5.00 - 5.45 SD8 (2,4/4,4,5,5)5.50 D9 5.50 Stiff, dark grey silty CLAY. 5.70 - 6.15 **SD10** SPT(S) 5.70m, N=19 (2,4/4,4,5,6)6 6.20 D11 6.80 - 7.25 SD12 SPT(S) 6.80m, N=23 (3,5/5,5,6,7)7.30 D13 8 SPT(S) 8.40m, N=25 8.40 - 8.85 SD14 (3,5/5,6,7,7) 8.90 D15 SPT(S) 9.00m, N=27 9 9.00 - 9.45 **SD16** (4,5/6,6,7,8) 9.50 D17 10 Start & End of Shift Observations Borehole Diameter | Casing Diameter | Remarks: Time | Depth (m) | Casing (m) | Water (m) | Depth (m) | Dia (mm) | Depth (m) | Dia (mm) | Hand pit pre dug to 2.2m bgl. Backfilled with arisings. No Date 24-11-2018 03:50 15.05 5.00 groundwater was encountered within the borehole. Co-ordinates 24-11-2018 16:00 2.20 0.00 inferred from OS mapping. Installation Water Strikes Chiselling From (m) To (m) Duration Remarks Top (m) Base (m) Type Dia (mm) Strike (m) Casing (m) Sealed (m) Time (mins) Rose to (m) Remarks

Client: Contract Name: Borehole ID: Shaftsbury Theatre Orbital Equipment 2A Contract Number: Date Started: Date Completed: Logged: Checked: Status: 184804 24/11/2018 24/11/2018 CW MTM **FINAL** Sheet 2 of 2 Easting: Northing: Ground Level: Plant Used: Print Date: Scale: Cable Percussion

Borehole Log 530122.3 181339.6 Dando 4000 11/12/2018 1:50 Weather: Fine Rig Crew: David Pond Termination: Scheduled depth reached SPT Hammer: AR1076 Energy Ratio: 74% Samples & In Situ Testing Strata Details Groundwater Level Backfill/ Depth Sample ID Test Result Legend Strata Description (mAOD) Stiff, dark grey silty CLAY. \times × SPT(S) 10.50m, N=29 (5,6/6,7,8,8) 10.50 -SD18 10.95 11.00 D19 11 12.00 -SD20 SPT(S) 12.00m, N=30 12 12.45 (6,6/7,7,7,9) 12.50 D21 (9.55) 13 SPT(S) 13.50m, N=33 13.50 -SD22 13.95 (7,7/7,8,9,9)14.00 D23 14 14.60 -SD24 SPT(S) 14.60m, N=33 15.05 (7.8/8.8.8.9)15 15.05 End of Borehole at 15.050m 16 17 18 19 20 Start & End of Shift Observations Borehole Diameter | Casing Diameter | Remarks: Time Depth (m) Casing (m) Water (m) Depth (m) Dia (mm) Depth (m) Dia (mm) Hand pit pre dug to 2.2m bgl. Backfilled with arisings. No Date 24-11-2018 03:50 15.05 140 5.00 150 groundwater was encountered within the borehole. Co-ordinates 24-11-2018 2.20 0.00 16:00 inferred from OS mapping. Water Strikes Installation Chiselling From (m) To (m) Duration Remarks Top (m) Base (m) Type Dia (mm) Strike (m) Casing (m) Sealed (m) Time (mins) Rose to (m) Remarks

Contract Name: Client: Borehole ID: Shaftsbury Theatre Orbital Equipment 2B Contract Number: Date Started: Date Completed: Logged: Checked: Status: 184804 01/12/2018 02/12/2018 CW MTM **FINAL** Sheet 1 of 4 Easting: Northing: Ground Level: Plant Used: Print Date: Scale: Cable Percussion

Borehole Log 530144.1 181340.0 Dando 2000 11/12/2018 1:50 Rig Crew: Stephen Weather: Cloudy Termination: Scheduled depth reached SPT Hammer: AR366/AR1826 Energy Ratio: 73/71% Thompson
Samples & In Situ Testing Strata Details Backfill/ Installatio Level Depth Sample ID Test Result Strata Description Legend (mAOD) Pre-excavated pit (by others). key key (2.00)key key -2.00 - 2.10 D1 2.00 MADE GROUND: Greyish brown, clayey, sub-angular to angular, fine to coarse GRAVEL of brick and other lithologies (0.50)2.50 - 2.60 SPT(C) 2.50m, N=24 D2 2.50 MADE GROUND: Greyish brown, firm slightly sandy, gravelly (2,2/3,5,8,8)CLAY. Sand is coarse. Gravel is sub-angular, fine to medium of brick. (1.00)3 3.50 - 3.60 D3 SPT(C) 3.50m, N=32 3.50 Dense becoming medium dense with depth, yellowish brown, very gravelly medium to coarse SAND. Gravel is sub-angular, fine to medium of mixed lithologies. (7,8/8,8,7,9)4 (1.50)SPT(C) 4.50m, N=18 4.50 - 4.60 D4 (8,8/6,4,4,4) 5.00 -5.00 - 5.10 D5 5 Firm, brown, sandy CLAY. Sand is fine to coarse. (0.50)5.50 - 5.60 D₆ 5.50 Stiff to very stiff, dark grey silty CLAY. SPT(S) 6.00m, N=21 -6.00 - 6.45 SD7 6 (3,3/4,5,6,6)-7.00 - 7.10 D8 7 7.50 - 7.95 SD9 SPT(S) 7.50m, N=25 (2,3/5,6,6,8) (9.00)× 8 8.50 - 8.60 D10 SPT(S) 9.00m, N=25 -9.00 - 9.45 **SD11** 9 (2,3/5,6,6,8) 10 Start & End of Shift Observations Borehole Diameter | Casing Diameter | Remarks: Depth (m) Casing (m) Water (m) Depth (m) Dia (mm) Depth (m) Dia (mm) Dia (mm) Hand pit pre dug to 2m bgl. Backfilled with arisings. No Date Time 25-11-2018 07:00 18.00 6.00 150 groundwater was encountered within the borehole. Co-ordinates 25-11-2018 18:00 18 45 6.00 inferred from OS mapping. 15.20 01-12-2018 05:00 18.45 6.00 01-12-2018 14:30 30.10 6.00 05:15 30.10 6.00 02-12-2018 Installation Water Strikes Chiselling From (m) To (m) Duration Remarks Top (m) Base (m) Type Dia (mm) Strike (m) Casing (m) Sealed (m) Time (mins) Rose to (m) Remarks

Contract Name: Client: Borehole ID: Shaftsbury Theatre Orbital Equipment 2B Contract Number: Date Started: Date Completed: Logged: Checked: Status: 184804 01/12/2018 02/12/2018 CW MTM **FINAL** Sheet 2 of 4 Easting: Northing: Ground Level: Plant Used: Print Date: Scale: Cable Percussion Borehole Log 530144.1 181340.0 Dando 2000 11/12/2018 1:50

Rig Crew: Stephen Weather: Cloudy Termination: Scheduled depth reached SPT Hammer: AR366/AR1826 Energy Ratio: 73/71% Thompson
Samples & In Situ Testing Strata Details Backfill/ Installatio Level Sample ID Test Result Legend (mAOD) 10.00 -D12 Stiff to very stiff, dark grey silty CLAY. 10.10 × × 10.50 -**SD13** SPT(S) 10.50m, N=25 (3,4/5,6,6,8) × 10.95 × 11 -11.50 - 11.60 D14 × 12.00 -**SD15** SPT(S) 12.00m, N=26 12 × 12.45 (5,5/6,6,7,7)× 13.00 -D16 13 × 13.10 13.50 -SD17 SPT(S) 13.50m, N=29 13.95 $(5,6/\hat{6},7,7,9)$ × 14 14.50 -D18 14.50 Stiff to very stiff, dark grey, silty fissured CLAY. 14.60 15 00 -SD19 SPT(S) 15.00m, N=32 15 15.45 (6,6/7,8,8,9)× × 16.00 -D20 16 16.10 × (3.95)16.50 -SD21 SPT(S) 16.50m, N=33 16.95 (6,7/7,8,9,9)× 17 17.50 -D22 17.60 × × 18.00 -SPT(S) 18.00m, N=38 SD23 18 × 18.45 (6,7/8,9,10,11) 18.45 Stiff to very stiff, grey, sandy silty CLAY. Sand is fine to Х. medium. × 19.00 -D24 19 × 19.10 19.50 -SD25 SPT(S) 19.50m, N=34 19.95 (4,5/7,7,9,11)20 Start & End of Shift Observations Borehole Diameter | Casing Diameter | Remarks: Depth (m) Casing (m) Water (m) Depth (m) Dia (mm) Depth (m) Dia (mm) Dia (mm) Hand pit pre dug to 2m bgl. Backfilled with arisings. No Time Date

groundwater was encountered within the borehole. Co-ordinates 25-11-2018 18:00 18 45 6.00 inferred from OS mapping. 15.20 01-12-2018 05:00 18.45 6.00 14:30 6.00 01-12-2018 30.10 05:15 30.10 6.00 02-12-2018 Installation Water Strikes Chiselling From (m) To (m) Duration Remarks Top (m) Base (m) Type Dia (mm) Strike (m) Casing (m) Sealed (m) Time (mins) Rose to (m) Remarks

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6.00

18.00

25-11-2018

07:00

Contract Name: Client: Borehole ID: Shaftsbury Theatre Orbital Equipment 2B Contract Number: Date Started: Date Completed: Logged: Checked: Status: 184804 01/12/2018 02/12/2018 CW MTM **FINAL** Sheet 3 of 4 Easting: Northing: Ground Level: Plant Used: Print Date: Scale: Cable Percussion

Borehole Log 530144.1 181340.0 Dando 2000 11/12/2018 1:50 Rig Crew: Stephen Weather: Cloudy Termination: Scheduled depth reached SPT Hammer: AR366/AR1826 Energy Ratio: 73/71% Thompson
Samples & In Situ Testing Strata Details Backfill/ Installatio Level Sample ID Test Result Legend (mAOD) 20.00 -D26 Stiff to very stiff, grey, sandy silty CLAY. Sand is fine to 20.10 ×. ×. × × 21.00 -SD27 SPT(S) 21.00m, N=37 21 21.45 (4,6/8,8,9,12) × 21.50 -D28 21.60 × × 22 × × 22.50 -SD29 SPT(S) 22.50m, N=40 22.95 (6,7/9,9,10,12) X. 23.00 -D30 23 × 23.10 × 24.00 -SD31 SPT(S) 24.00m, N=37 × 24 24.45 (5,7/8,8,10,11)× 24.50 -D32 24.60 × (11.65)25 Х. <u>.</u>.. 25.50 -SPT(S) 25.50m, N=34 **SD33** 25.95 (5,6/6,8,9,11)× 26.00 -D34 26 26.10 × × × 27.00 -SD35 SPT(S) 27.00m, N=42 27 × 27.45 (4,6/8,10,11,13) X. 27.50 -D36 × 27.60 Х. 28 28.30 -SD37 SPT(S) 28.30m, 50 × 28.55 (12,13/50 for 95mm) 28.50 -D38 28.60 29 29.50 -**SD39** SPT(S) 29.50m, 53 (10,11/53 for 160mm) 29.81 30 Start & End of Shift Observations Borehole Diameter | Casing Diameter | Remarks: Time | Depth (m) | Casing (m) | Water (m) | Depth (m) | Dia (mm) | Depth (m) | Dia (mm) | Hand pit pre dug to 2m bgl. Backfilled with arisings. No Date 25-11-2018 07:00 18.00 6.00 groundwater was encountered within the borehole. Co-ordinates 25-11-2018 18:00 18 45 6.00 inferred from OS mapping. 15.20 01-12-2018 05:00 18.45 6.00 14:30 6.00 01-12-2018 30.10 05:15 30.10 6.00 02-12-2018 Installation Water Strikes Chiselling From (m) To (m) Duration Remarks Top (m) Base (m) Type Dia (mm) Strike (m) Casing (m) Sealed (m) Time (mins) Rose to (m) Remarks

Contract Name: Borehole ID: Client: Shaftsbury Theatre Orbital Equipment 2B Contract Number: Date Started: Logged: Checked: Status: Date Completed: 184804 01/12/2018 02/12/2018 CW MTM **FINAL** Sheet 4 of 4 Cable Percussion Easting: Northing: Ground Level: Plant Used: Print Date: Scale: 530144.1 181340.0 Dando 2000 11/12/2018 1:50 Borehole Log

Bor	ehole Log			0144.1		181340	0.0		Danc	10 2000	11/12/2018		1:50	
Weather: Clo	udy	Rig Cr	rew: Ster	ohen	Term	nination: \$	Schedule	ed depth reache	ed	SPT Hamn	ner: AR366/AR1826 En	nergy F	Ratio: 73	/71%
	Samples & In	Situ Testi	ing		Tarret 1	l _	ı	Si	rata Details					ndwater
Depth	Sample ID	Te	est Result	t	Level (mAOD)	Depth (m) (Thickness)	Legend			Description			Water Strike	Backfill/ Installation
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Star Date	t & End of S Time Dep	hift Obs	ervation	S Water (m	Boreho	ole Diame	eter Ca	sing Diameter th (m) Dia (mm)		J	Lat Darley 1 22			
25-11-2018	07:00			vvaici (III	18.00) 150) 6.	00 150		dug to 2m	bgl. Backfilled with a untered within the bo	irising	js. No e. Co-o	rdinates
25-11-2018 01-12-2018 01-12-2018	18:00 18 05:00 18 14:30 36	8.45 8.45 0.10	6.00 6.00 6.00	15.20					inferred from	OS mappi	ing.	1016	. . UU-0	rumates
02-12-2018		0.10	6.00		1		etallation				Water Strikes			

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Chiselling

From (m) To (m) Duration

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