




Ground Investigation Report

Shaftesbury Theatre, London

Client: Orbital Equipment

Project Number: G184804

Date of Issue: 05/12/2019

Project Title	Shaftesbury Theatre, London		Project Ref	G184804
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Report Approved By	Andy Johnston CEng BSc, Divisional Director			
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 Equipment and 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 or 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.

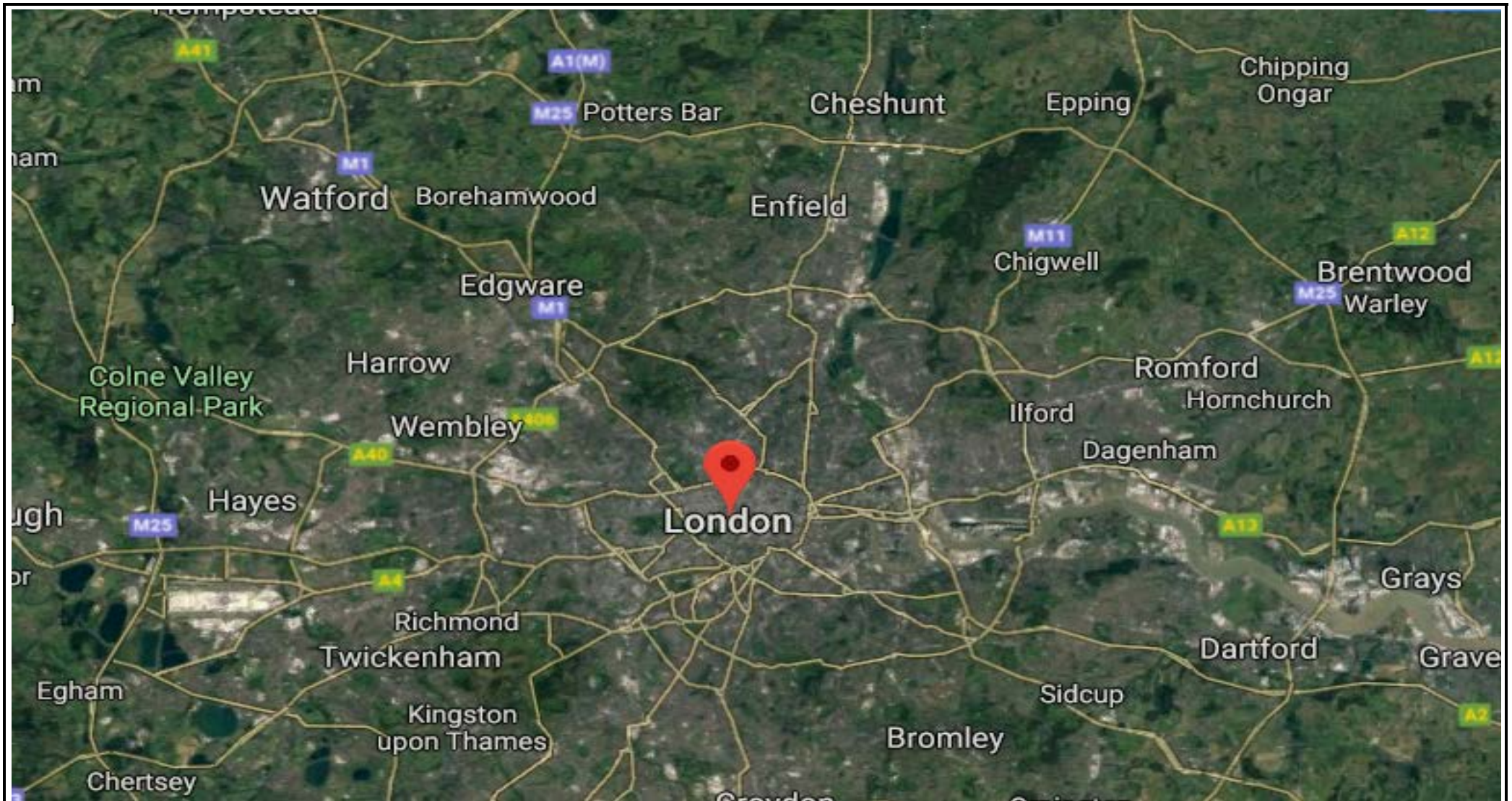
5. References

- 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



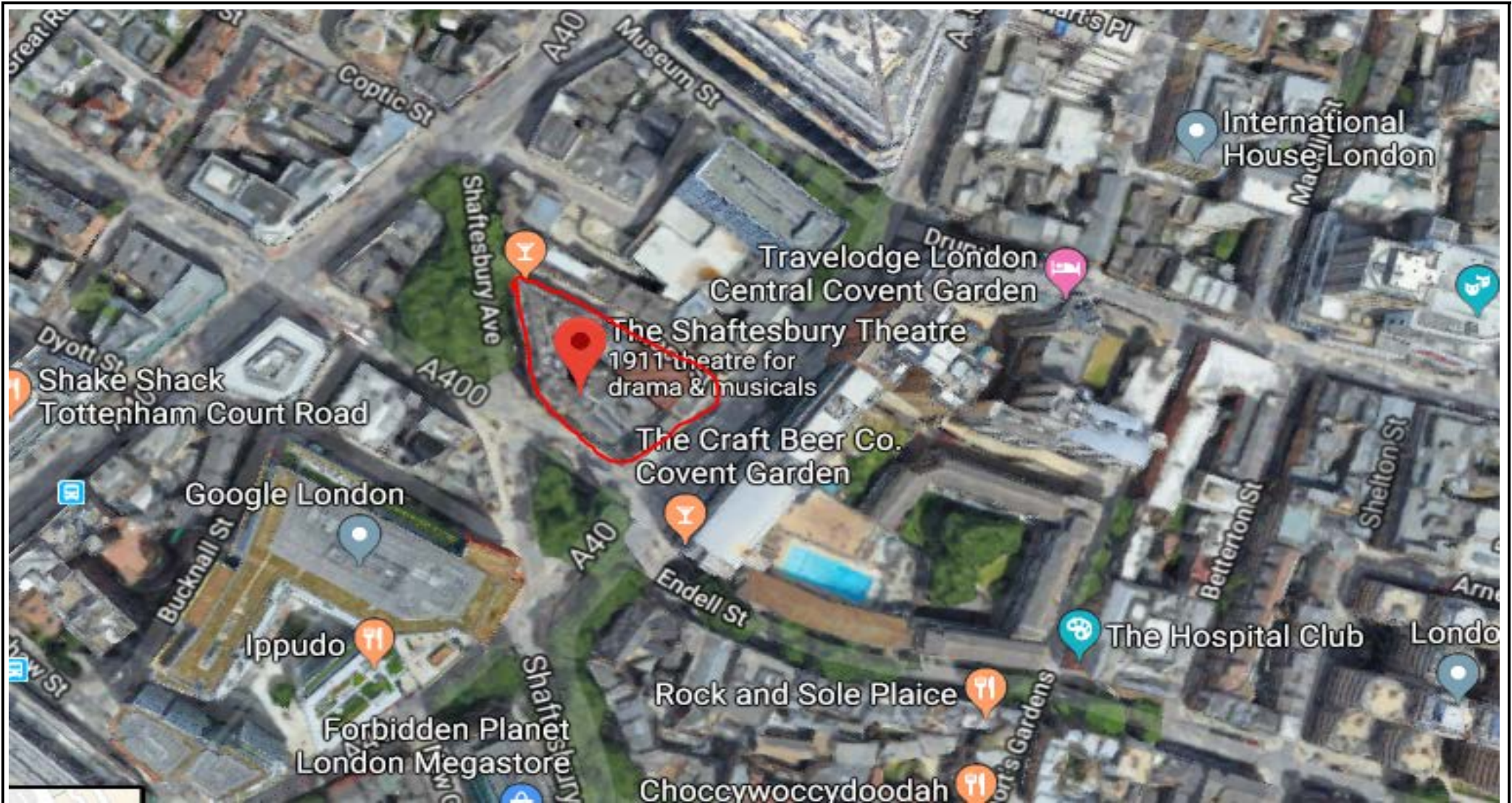
JOB NO.

G184804

CONTRACT TITLE

Shaftesbury Theatre

SITE LOCATION

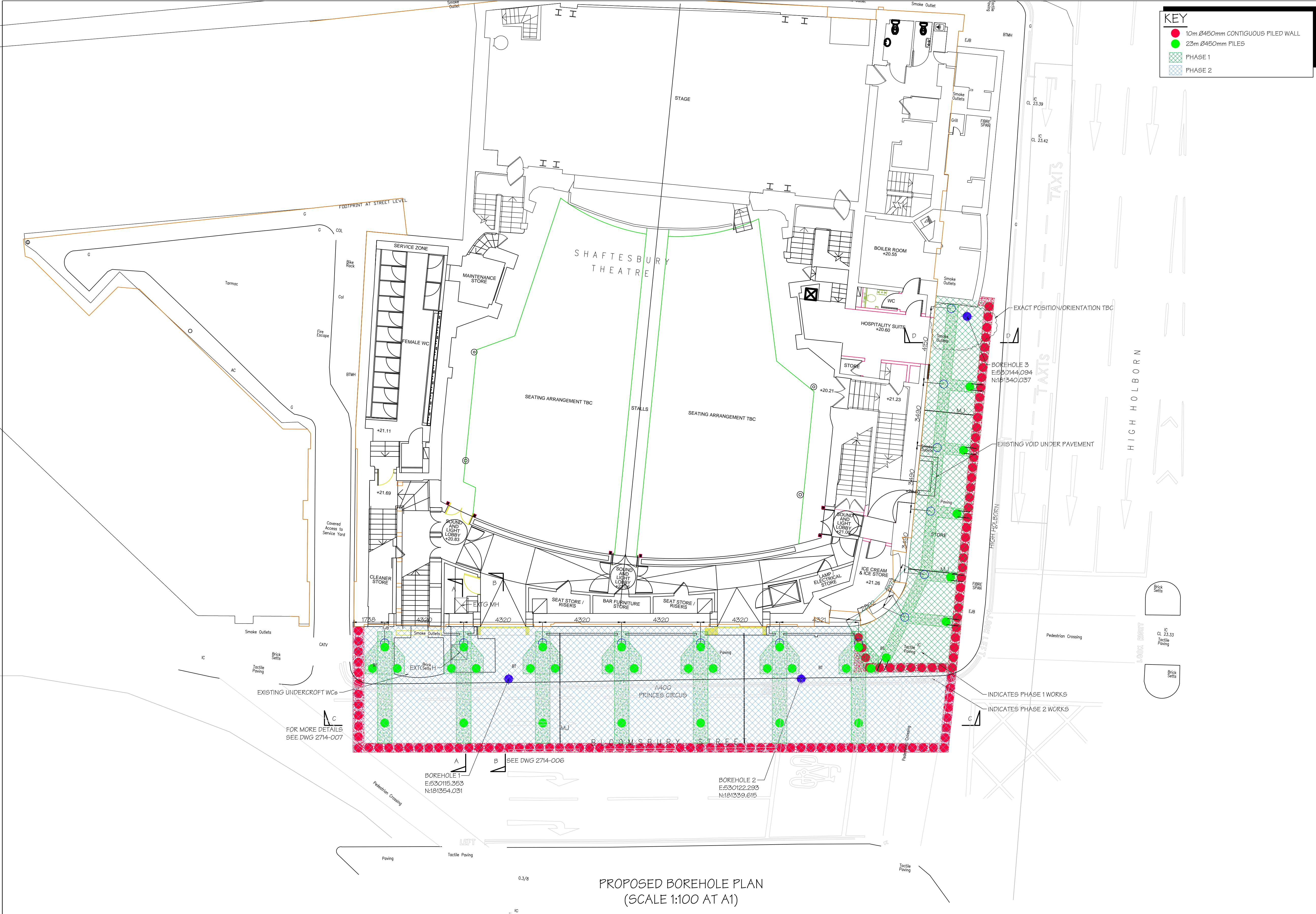


JOB NO.

G184804

CONTRACT TITLE

Shaftesbury Theatre



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

Revisions

Michael Jackson Consulting

Chartered Structural Engineers

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Tel: 0161 790 4404
Fax: 0161 790 4405

Client

The Theatre of Comedy Campaign

Shaftesbury Theatre

Site

SHAFTESBURY THEATRE

Project

PROPOSED BASEMENT

Drawing Title

PROPOSED BOREHOLE LOCATION PLAN

Scale	Date	Drawn	Checked	Passed
AS SHOWN	NOV 2017	SAM		

DRG. No.

2714 - 209 P1

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Project ID: 184804

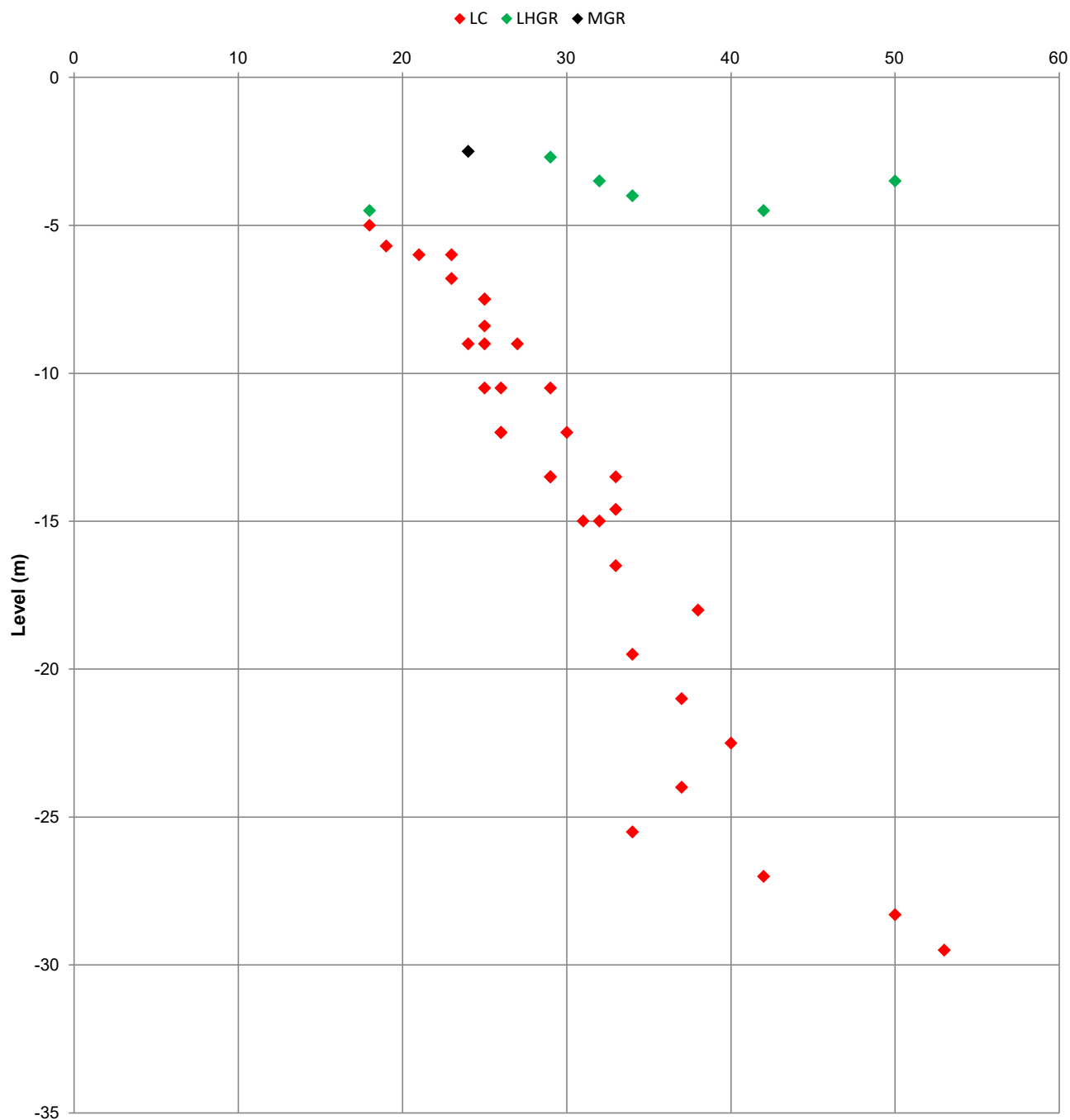
Project Title: **Shaftsbury Theatre**

Final Depth: 0

Client: **Orbital Equipment**

Location:

Date Drilled:



Date Reported: 05/12/2019

Data Status:



Summit Close,
Kirkby-in-Ashfield,
01773 304056

SPT N Value By Elevation

London Clay

Project ID: **184804**

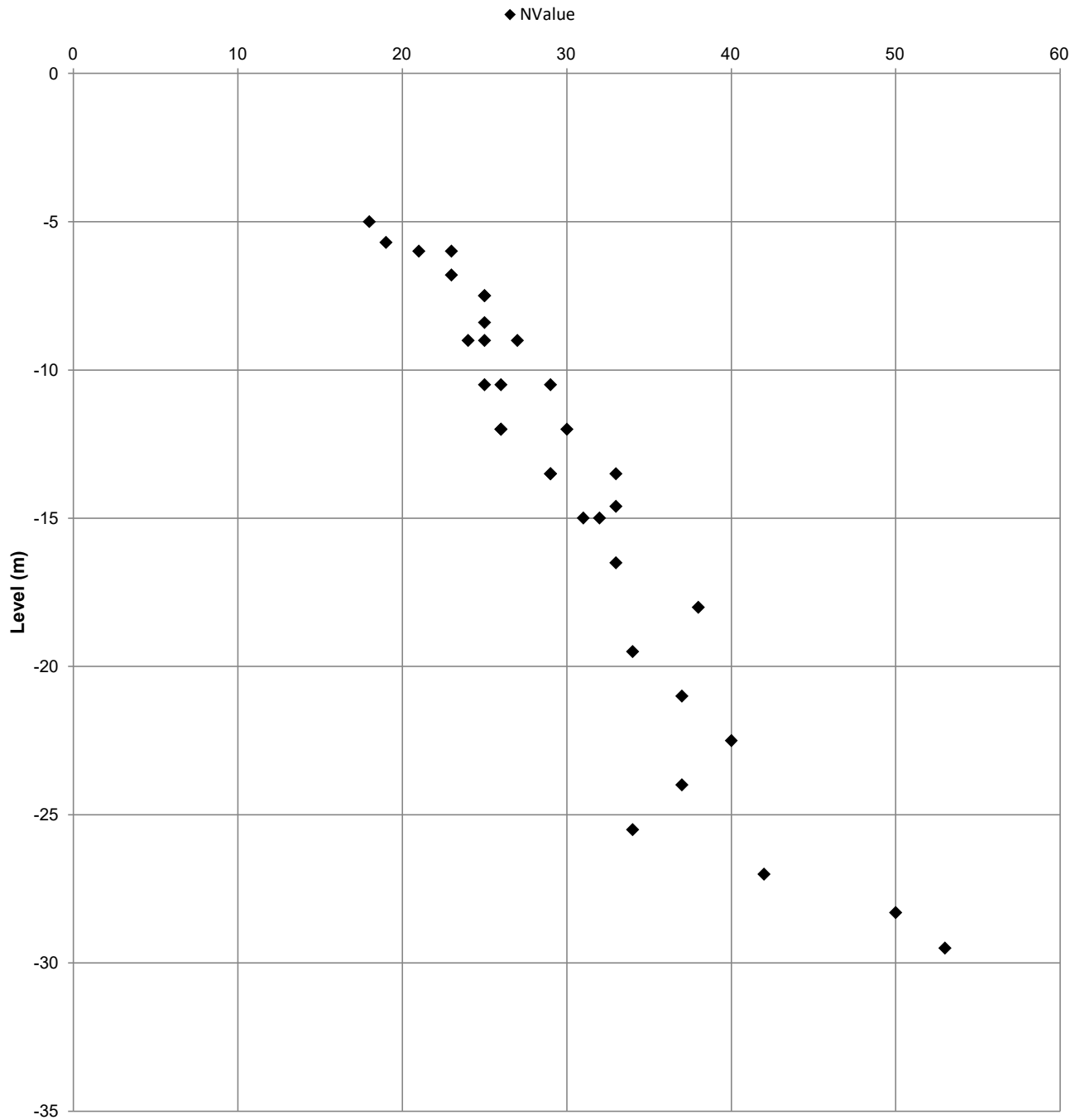
Project Title: **Shaftsbury Theatre**

Final Depth: **30.1**

Client: **Orbital Equipment**

Location:

Date Drilled: **01/12/18**



Date Reported: **05/12/2019**

Data Status:



Summit Close,
Kirkby-in-Ashfield,
01773 304056

SPT N Value By Elevation

Gravel

Project ID: **184804**

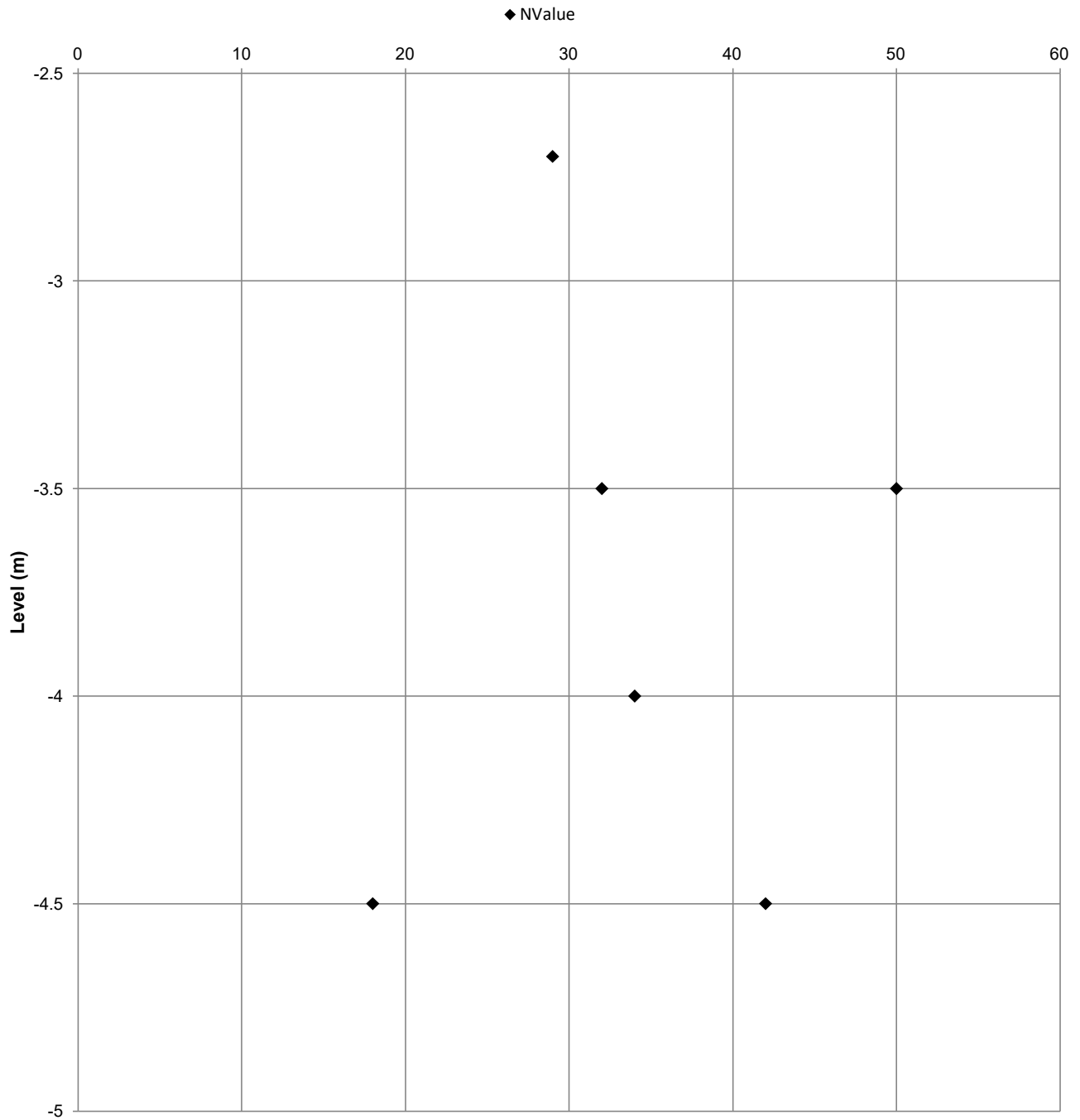
Project Title: **Shaftsbury Theatre**

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Client: **Orbital Equipment**

Location:

Date Drilled: **01/12/18**



Date Reported: **05/12/2019**

Data Status:



Summit Close,
Kirkby-in-Ashfield,
01773 304056

SPT N Value By Elevation

Made Ground

Project ID: **184804**

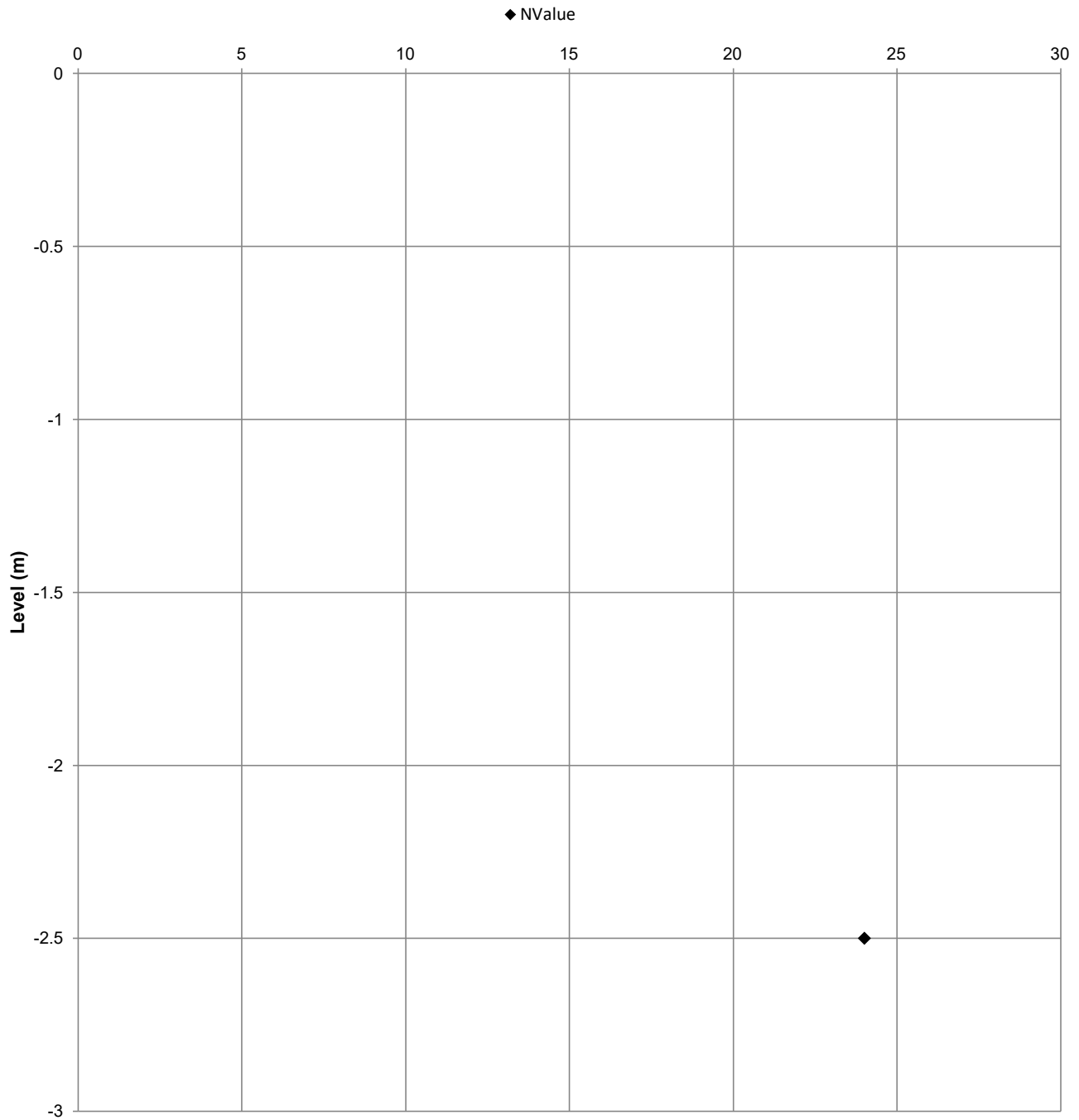
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Final Depth: **30.1**

Client: **Orbital Equipment**

Location:

Date Drilled: **01/12/18**



Date Reported: **05/12/2019**

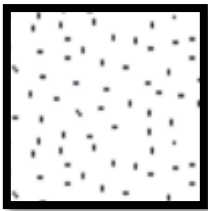
Data Status:

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	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, kPI 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

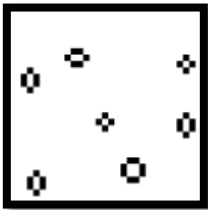
Backfill



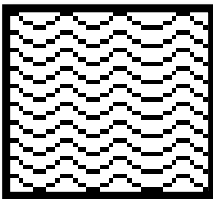
Sand



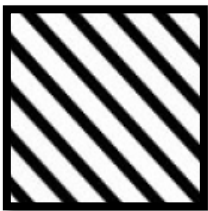
Grout



Gravel



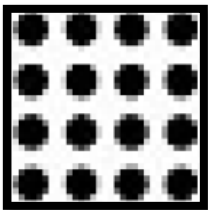
Arisings



Bentonite pellets

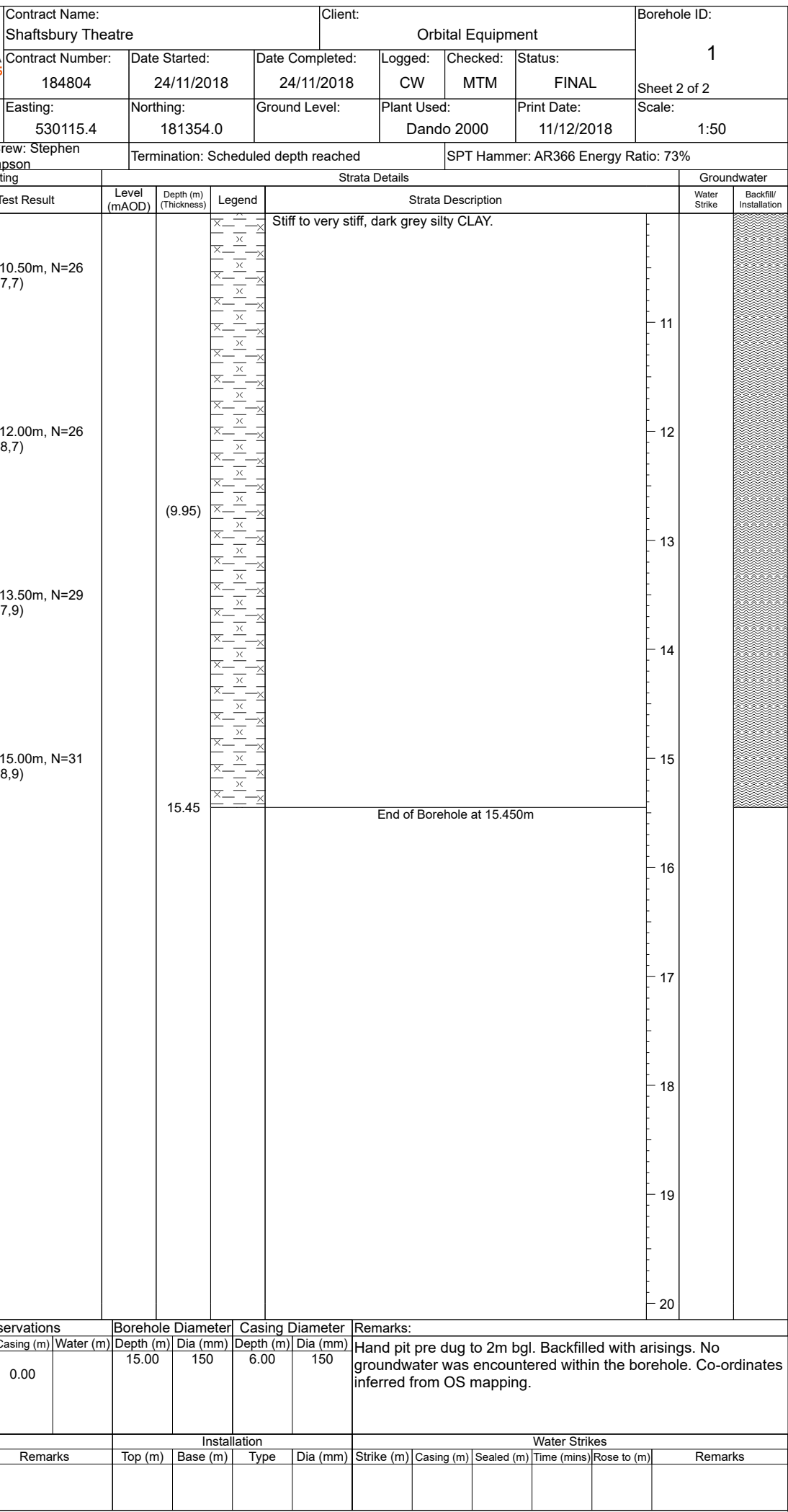


Concrete




Cement Bentonite
pellets

Chiselling				Installation				Water Strikes					
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



Chiselling				Installation				Water Strikes					
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:
Shaftsbury Theatre

Client:
Orbital Equipment

Contract Number:
184804

Date Started:
24/11/2018

Date Completed:
24/11/2018

Logged:
CW

Checked:
MTM

Status:
FINAL

Borehole ID:
2A

Sheet 2 of 2

Cable Percussion
Borehole Log

Easting:
530122.3

Northing:
181339.6

Ground Level:

Plant Used:
Dando 4000

Print Date:
11/12/2018

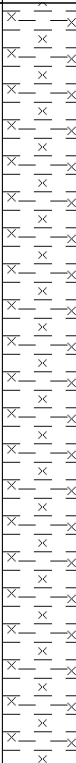

Scale:
1:50

Weather: Fine

Rig Crew: David Pond

Termination: Scheduled depth reached

SPT Hammer: AR1076 Energy Ratio: 74%

Samples & In Situ Testing			Strata Details				Groundwater	
Depth	Sample ID	Test Result	Level (mAOD)	Depth (m) (Thickness)	Legend	Strata Description	Water Strike	Backfill/ Installation
10.50 - 10.95	SD18	SPT(S) 10.50m, N=29 (5,6/6,7,8,8)				Stiff, dark grey silty CLAY.		
11.00	D19						11	
12.00 - 12.45	SD20	SPT(S) 12.00m, N=30 (6,6/7,7,7,9)					12	
12.50	D21		(9.55)				13	
13.50 - 13.95	SD22	SPT(S) 13.50m, N=33 (7,7/7,8,9,9)					14	
14.00	D23						14	
14.60 - 15.05	SD24	SPT(S) 14.60m, N=33 (7,8/8,8,8,9)					15	
			15.05				15	
							16	
							17	
					18			
					19			
					20			
						End of Borehole at 15.050m		

Start & End of Shift Observations

Borehole Diameter

Casing Diameter

Remarks:

Date	Time	Depth (m)	Casing (m)	Water (m)	Depth (m)	Dia (mm)	Depth (m)	Dia (mm)
24-11-2018	03:50				15.05	140	5.00	150
24-11-2018	16:00	2.20	0.00					

Chiselling

Installation

Water Strikes

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

Hand pit pre dug to 2.2m bgl. Backfilled with arisings. No groundwater was encountered within the borehole. Co-ordinates inferred from OS mapping.

Chiselling				Installation				Water Strikes					
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

