



MANCHESTER CITY ETIHAD STADIUM

NORTH STAND

MANCHESTER

Completion Report

Consolidation of Potential Abandoned Coal Mine Workings by Drilling and Grouting

Works have been undertaken with permission of Coal Authority



Van Elle
Summit Close
Kirkby in Ashfield
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NG17 8GJ
01773 580580

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Control Sheet

This report has been prepared for the sole benefit, use and information of John Sisk & Sons Limited for the purposes set out in the instructions commissioning it. The liability of Van Elle Ltd in respect of the information contained in the report will not extend to any third party. It is now the client's responsibility to fulfil the Coal Authority's requirements with regards to the Coal Authority Permit.

SUMMARY TABLE: COMPLETION REPORT FOR THE DRILLING AND GROUTING TREATMENT OF POTENTIAL MINEWORKINGS	
SITE:	The works have been undertaken at the position of the North Stand of the Etihad Stadium operated by Manchester City Football Club.
CLIENT:	John Sisk & Sons Limited, 2410 Regents Court, The Crescent, Birmingham Business Park, Birmingham
DATE:	December 2023
REFERENCE:	VE224505-01 – PS3510 V2
DEVELOPMENT PROPOSAL:	<p>The proposed alterations to the Etihad Stadium include:</p> <ul style="list-style-type: none"> • increasing the overall capacity of the north stand; • a new hotel; • football museum and an enhanced City Shop.
COAL MINING GEOLOGY:	<p>The proposed development area and surroundings have been the subject of numerous desk studies and intrusive investigations associated with the Etihad Stadium and related infrastructure. This has recently included a Coal Mining Risk Assessment by Buro Happold that covers the current area of development at the northern end of the stadium. These studies have provided the background information to inform future works.</p> <p>Historically, this area of northern Manchester has been the subject of coal and fireclay mining along with associated heavy engineering works since the beginning of the Industrial Revolution.</p> <p>Solid coal strata belong to the Pennine Upper Coal Measures. These have been extensively exploited, mainly from the Bradford Colliery, a few hundreds of metres to the south-east. However, most recorded workings are in the Bradford series of coal seams at a depth that no longer have a potential impact on ground surface stability.</p> <p>Geological studies have shown that two of the lesser coal seams in the sequence, Charlotte Upper Leaf (c. 0.42m thick) and Charlotte Lower Leaf (c. 0.68m thick) sub-crop beneath the site, dipping towards the south-west at about 20°. However, these are overlain by significant thicknesses of glacial till and Made Ground.</p> <p>The Buro Happold CMRA recognised this but concluded that there remained a risk to surface instability from unrecorded workings in these seams.</p>

	There are recorded mine entries within the general area, but none within the site or influencing distance.	
SCOPE OF DRILLING AND GROUTING WORKS:	<p>A total of 173 no. primary production grout take holes (c. 5,200 linear m) were drilled as part of the shallow mine workings consolidation scheme, including 1 no. test hole.</p> <p>Grout holes were drilled to a general completion depth of 30m bgl in accordance with a Coal Authority treatment permit.</p> <p>Grout was batched on site using a P11 pump. Constituent materials were pumped to each bore under hydrostatic pressure until boreholes were deemed full.</p> <p>The grout for this project comprised both neat OPC grout and a 10:1 PFA:OPC mix. A total of approximately 43.5 tonnes of grout mixture was injected (average 0.25 tonnes per borehole).</p>	
CONCLUSION:	<p>Made Ground and superficial deposits were recorded at all grout injection positions to depths of between 15.2m and 18.8m (average 16,2m). Solid strata comprised mainly mudstone with some intact coal intercepts and bands of coal within mudstone. Soft ground was recorded, mainly within the northern area of the works.</p> <p>Grout takes were generally low, mainly less than 0.3 tonnes per borehole, which is basically sufficient to fill the annulus of the drill hole, with some losses into fractured mudstone or superficial strata. Just one grout hole took 1.1 tonnes of grout. However, it is considered that this is most likely caused by geological disturbance rather than abandoned coal mine workings. A test hole formed close to the high-take production hole took a minimal quantity of grout.</p> <p>Overall, there was no positive evidence of abandoned, unrecorded workings beneath the area of the North Stand treated by this investigation.</p> <p>It is considered that no further ground stabilisation works are required.</p> <p>It is recommended that vigilance is maintained, particularly during earthworks phases of future work, for possible coal related features including unrecorded mine entries.</p>	
Author:		Phil Shelton BSc PhD CEng MIMMM FGS <i>Associate</i>
Date:	December 2023	Version: 2.0

1 Introduction

John Sisk & Sons Limited (JSSL), in their capacity as Principal Contractor, has instructed Van Elle (VE) to undertake stabilisation works of potential unrecorded shallow coal mine workings at Manchester City Football Stadium (Etihad Stadium) in order to mitigate potential time independent ground surface instability beneath proposed new built development.

The proposed alterations at the northern end of the Etihad Stadium include:

- increasing the overall capacity of the North Stand;
- a new hotel;
- construction of a football museum and an enhanced Manchester City Shop.

Site location Plans (**Figures 1**) are included in **Appendix A**.

Reference to the Coal Authority Interactive Map Viewer and BGS sources indicates that parts of the site lie within a Development High Risk Area and that there is potential for there being unrecorded mine workings within coal seams at shallow depth; albeit there is also a significant cover of Made Ground and natural superficial soils.

Previous investigations by others, including a CMRA prepared by Buro Happold (Ref: 0053810, dated 13th April 2023) have concluded that there remains a sufficiently significant risk to surface instability to require a stabilisation programme by drilling and grouting.

There are recorded mine entries within the general area, but none within the site or influencing distance. The proposed treatment works undertaken by Van Elle has not included searches for recorded or unrecorded coal mine entries.

This report relates to a programme of pre-construction consolidation treatment of potential abandoned shallow coal mine workings undertaken by Van Elle Ltd (Van Elle) Ref: 224505.01.

The stabilisation works were undertaken in several stages between 1st August and 17th October 2023, following the application and issue of a coal disturbance permit (Ref: 26997) by the Coal Authority (TCA) on 18th July 2023. A copy of the permit is included as **Appendix B**.

The scope of works for the mine workings consolidation has been developed by Van Elle (**Appendix C**) and others. The site works were overseen by an engineer appointed by the client.

The works have included the drilling of 173 no. (c. 5,200 linear metres) primary production rotary boreholes, including 1 no. test hole. The primary production holes were drilled on a 6m x 6m grid with the provision to close the spacing to a 4.25m grid depending on the findings of the drilling and grout takes. In the event, no positive indications of abandoned workings were encountered by the drilling or grouting and so no secondary stabilisation works were considered necessary.

Stabilisation boreholes were backfilled with cementitious grout under hydrostatic pressure. Grout mixes included neat OPC and mixtures of 10:1 PFA:OPC. A total of approximately 43.5 tonnes of grout mixture was injected (average 0.25 tonnes per borehole).

2 Data References

- Proposed site plans – **Appendix A**;
- CIRIA Pub 32 1984 – 2002 Construction over abandoned mine workings;
- CIRIA C758D Nov 2019 Abandoned Mine Workings Manual;
- VE Works Specification, VE224505.1, dated 11 July 2023 – **Appendix C**;
- VE Health and Safety Policy;
- CA Permit 26997, 18th July 2023– **Appendix B**;
- Buro Happold CMRA Ref: 0053810, dated 13 April 2023;
- On-line geological data sources;
- CA Interactive web site.

3 Site Location and Description

The Site is centred on grid reference SJ 86780 98622, which is at the northern end of the existing Etihad Stadium run by Manchester City Football Club, Ashton New Road, Manchester M11 3FF. It is located approximately 2km north-east of Manchester City centre.

The ground level is approximately +59m aOD, rising slightly to the east toward Gibbon Street and Alan Turing Way (to around +61m aOD).

The site area under consideration by the works described here by VE occupies an area of about 1.5 hectares, although previous studies, including Buro Happold's CMRA cover larger areas.

The larger site is bound to the north by a Manchester Metro tramline and station (with Ashton Canal beyond), to the east by Alan Turing Way (A6010), to the west are the National Squash Centre and the Manchester Regional Arena, and to the south is the Etihad Stadium.

The historical development of the site is described in detail by Buro Happold (*ibid*) and references many stages of heavy engineering usage during the Industrial Revolution. These have included potential for shallow coal mining that was common in this area during the 18th and 19th centuries.

The site location and views of the current layout are shown in **Appendix A**.

A site walkover was undertaken of the areas for ground treatment by VE prior to the works.

4 Ground Conditions & Geology¹

Local geological information has been obtained from the British Geological Survey (BGS) published mapping and other sources as detailed below:

- 1:50,000 scale Sheet 85 Manchester;
- 1:10,560 scale Sheet SJ89NE;
- Previous desk studies;
- on-line digital mapping (GeoIndex).

Although not shown on geological sheets, it is considered that Made Ground of variable thickness and composition should be expected in this area. Geological plans show superficial soils to be present comprising glacial till, of Quaternary age. Till (also known now as diamicton) generally consists of poorly sorted, overconsolidated clay, silt, sand and gravel.

Solid strata of the Pennine Upper Coal Measures Formation, which are of Carboniferous age, are expected to be present beneath the Made Ground and superficial soils. These generally comprise cyclical sequences of mudstones, siltstones and sandstones. In this area of Manchester, the Coal Measures contain regular economically viable seams of coal and fireclay. These can occur from very shallow to great depth below ground surface.

The expected proximate geology around the site is shown on **Figures 3 and 4** in **Appendix A**. These show the Charlotte Upper Leaf and Charlotte Lower Leaf coal seams to sub-crop beneath the site. While the Bradford series of coal seams (the most popular coal sequence) are probably too deep to have any influence on ground stability and the Openshaw seam (which overlies the Charlotte seams) probably sub-crops to the south-west, ie down dip, of the stabilisation area – See **Figure 5**.

5 Methodology

The mine workings consolidation works for the area covered by this report were undertaken in several stages between 1st August and 20th September 2023, following the application and issue of a coal disturbance permit (Ref: 26997) by the Coal Authority (TCA) on 18th July 2023. A copy of the permit is included as **Appendix B**.

The works were undertaken in general accordance with the Client's instructions, Van Elle's Specification (**Appendix C**), the Coal Authority permit, Code of Practice for Site Investigations BS5930: 2015 and CIRIA guidances on the treatment of shallow mineworkings. Previous investigations had indicated a significant risk of shallow abandoned coal workings. Works were also undertaken taking consideration of potential coal mine gas release, taking account of CL:AIRE "Good Practice for Risk Assessment for Coal Mine Gas Emissions", October 2021.

¹ Details of ground conditions are not definitive representations, they are intended as a summary only

The mine workings consolidation treatment incorporated the following:

The advancing of a total of 173 no. (c. 5,200 linear metres) primary production rotary grout injection holes including 1 no. test hole. Primary production holes were drilled on a 6m x 6m grid, with provision to add secondary production holes depending on the records of borehole chipping/flush recovery and grout takes. In the event, it was agreed that secondary production holes were unnecessary.

The production stabilisation boreholes were set out on a regular 6m x 6m grid with rows designated A to N, inclusive and 1 to 16 inclusive, giving each grout injection position a unique reference. In practice, irregularities in the stabilisation area boundaries and obstructions to drilling positions meant that some of the grid boreholes were either angled off vertical or omitted – see **Appendix D**. An additional row of primary production holes, designated 'Row X' was added at the northern boundary, adjacent to Row A.

The grout injection boreholes were generally drilled to depths of 30m bgl in accordance with the guidance included within the CA treatment permit (**Appendix B**). Grout injection hole A5 was terminated at a depth of 23m bgl but as this still terminated 1m below the lower intact coal found in this area, VE is confident that this has no impact on the integrity of the works.

A total of approximately 43.5 tonnes of grout (average 0.25 tonnes per borehole) was batched on site using a P11 pump. Constituent materials were pumped to each bore under hydrostatic pressure until boreholes were deemed full.

The grout for this project comprised a mixture of a neat OPC and a 10:1 PFA:OPC mix. The rotary injection borehole details and grout takes are tabulated and represented spatially in **Appendix D**.

Drilling

The drill and grout works were designed to consolidate voids and disturbed ground resulting from the coal workings and thereby mitigate the risk from the potential long-term collapse of abandoned mine workings at shallow depth beneath the completed development.

The treatment has also been designed in consideration of the existing site layout, the development proposal and health and safety issues. Drilling was undertaken by open hole methods using a Casagrande C6 XP2 track-mounted rig and water flush. During drilling, each grout injection hole was fitted with threaded steel casing (101mm diameter) to rockhead. The purpose of this was to ensure borehole stability through the upper Made Ground and superficial strata. Casings were set to depths of between 16.0m and 17.0m bgl.

Superficial deposits (including Made Ground and glacial till) and some heavily weathered solid strata were found to depths of between 15.2m and 18.8m bgl (average 16.2m bgl).

Once the casing had been set, Primary stabilisation boreholes were then progressed at a nominal 76mm diameter to completion.

For the most part, Primary production stabilisation holes over the southern half of the treatment area recorded mudstone from top of bedrock (c. 16.0m bgl) to 30m bgl. Towards the north and north west stabilisation holes recorded intact coal and mudstone with coal bands, presumably one of the Charlotte Leaf's, along with occasional zones of soft ground and flush loss. Beneath the soft zones, solid strata were recorded to hole termination – see **Appendix D**.

No indication of abandoned coal mine workings were recorded.

Throughout the works monitoring for the presence of harmful gases was maintained at the drill rig. Gases included: carbon monoxide (CO), carbon dioxide (CO₂) hydrogen sulphide (H₂S) and methane (CH₄) along with levels of airborne oxygen (O₂). The drilling crew also carried personal gas alarms, which activate visible and audible alarms should concentrations of any of these gases reach pre-determined trigger levels. No harmful levels of gases were recorded during the works.

A summary of grout hole drilling records is included in **Appendix D**.

Grouting

Each borehole was filled with a cementitious grout with a composition of either neat OPC or 10:1 PFA and OPC. A total of about 43.5 tonnes of grout was used at an average of about 0.25 tonnes per borehole. Only one borehole took more than 0.5 tonnes, which was at K6 and took 1.1 tonnes. The Test Hole TH1, was formed close to K6 and took only a minimal quantity of grout.

The grout takes show no indication of filling of abandoned workings.

Grout was batched on site using a P11 pump. Constituent materials were pumped to each bore under hydrostatic pressure until boreholes were deemed full. All plant was certified safe and maintained properly throughout the operation.

During grouting grout quality control was undertaken by testing. These included flow and bleed tests on a daily basis during grouting periods. In addition, sets of grout cubes were formed for 7 day 14 day and 28 day strength testing.

Flow and bleed test results are summarised below, which are all satisfactory.

DATE		Bleed Test Start	Bleed Test Finish	Flow Test
02/08/2023		990	985	300mm
04/08/2023		995	990	310mm
08/08/2023		990	985	300mm
09/08/2023		995	990	310mm
10/08/2023		990	985	305mm
06/09/2023		995	990	295mm
07/09/2023		995	990	290mm
08/09/2023		980	975	300mm
11/09/2023		990	985	305mm
12/09/2023		990	985	310mm
13/09/2023		985	980	275mm
14/09/2023		990	985	280mm
17/10/2023		985	980	300mm
19/10/2023		980	975	295mm
20/10/1900		980	975	310mm
23/10/2023		980	985	300mm

Cube test results showed grout strengths of between 6.0N/mm² and 14.9N/mm² after 28 days curing (See **Appendix E**). This is satisfactory for grout stabilisation treatment.

Test Boreholes

One non-production test grout borehole (TH1) was drilled at the grid position shown in **Appendix D**. The position of the test hole was selected by Van Elle close to production hole K6, which had recorded the largest grout take. The drilling showed mudstone and grout, which is as expected. During the test, the hole was subjected to sustained pressure grouting. The results confirmed that 2 bars of back pressure were sustained for 2 minutes without any loss of pressure. The test hole took just 0.26 tonnes of grout as the casing was removed.

A summary of test grout hole details is included in **Appendix D**.

6 Ground Stability Assessment

This Ground Stability Assessment considers the proposed development following drill and grouting works designed to consolidate potential abandoned coal mine workings.

Risk Assessment

Borehole drilling associated with the abandoned mine stabilisation works identified mainly solid mudstone, sometimes with coal bands. Where coal was identified it is believed likely that this was one or both of the Charlotte Upper and Lower Leaves. For the most part, where coal was encountered, this was intact and resulted in low grout takes.

Occasionally, soft ground with a loss of flush returns was recorded during drilling, but again these took low grout takes.

Drilling data show the thickness and position of the coal seam(s) as a useful marker horizon(s) in this area. However, further interpretation of the geological data is beyond the scope of this report.

The recorded coal seams are overlain by competent mudstone and relatively thick Made Ground and natural superficial strata.

Drillers' records give a qualitative description of the condition of solid strata including coal and/or mine workings as encountered using rotary drilling methods. These are based on chipping returns and borehole penetration rates and can be summarised as follows:

Mudstone only	-	Coal absent;
Intact Coal	-	Interpreted as intact coal;
Soft Ground	-	Interpreted as rapid penetration through potential old mine workings or geological features;
Broken Ground	-	Interpreted as ground, including small voids disturbed by potential old mine workings;
Void	-	Empty space, with drill rods falling with no resistance, most probably as a result of abandoned coal mine workings.

Appendix D shows the positions of the grout injection holes along with a visual representation of the conditions encountered at the level of the coal seams. These results can be summarised as follows:

Mudstone only	-	Recorded at 67% of injection boreholes
Intact Coal and Coal Bands	-	Recorded at 24% of injection boreholes
Soft Ground	-	Recorded at 9% of injection boreholes
Broken Ground	-	Not encountered
Void	-	Not encountered

Appendix D tabulates the quantities of grout injected into each injection borehole.

Based on the use of nominal 100mm diameter casing through Made Ground and natural superficial strata to c. 16m bgl and open 75mm diameter open hole drilling to c. 30m bgl, then the volume to be filled with grout, assuming no loss, is about 0.19m³. Liquid grout is of relatively low density and 0.19m³ equates to approximately 0.23 tonnes.

Depending on the porosity of the natural superficial strata and Made Ground, the removal of steel casing can result in small increases in grout takes. In the absence of disturbed ground in the solid strata, grout takes in 30m deep injection boreholes under hydrostatic pressure can often reach 0.3 tonnes.

The occurrence of open discontinuities, small faults and unworked coal seams can often see these values double, but usually on a fairly localised basis.

From experience, where grout injection programmes encounter abandoned coal workings, average grout takes in boreholes are in the region of 0.9 tonnes and 1.2 tonnes, with holes intercepting intact coal (commonly about 30%) taking the minimum quantities (c. 0.25 tonnes), but with others taking between 1 tonne and 5 tonnes – occasionally in excess of 40 tonnes.

The results at the current site can be expressed terms of the proportion of injection holes taking specific ranges of grout as shown below.

Less than 0.3 tonnes	-	83%
0.3 to 0.5 tonnes	-	17%
0.5 to 1.0 tonnes	-	0%
More than 1.0 tonnes	-	0.06% (1 no. injection hole).

In this case, for the most part the grouting records indicate that the site contains no abandoned workings. There are no grounds to require the closing of the grouting grid from 6m x 6m to a 4.25m spacing.

Having undergone the mine workings consolidation treatment undertaken by VE between August and October 2023, it is considered that no further works will be necessary within the footprint of the proposed developments in respect of coal mining legacy.

There are no recorded mine entries at the site. However, there is always a risk of encountering an unrecorded mine entry in development risk areas. It is not considered appropriate to make a specific search, but earthworks contractors and ground workers should be informed of the need to be vigilant during site clearance and construction works.

7 Conclusion

In order to prepare for the proposed development at the site known as North Stand Etihad Stadium, Manchester City Football Club a mine working consolidation programme has been undertaken by drilling and grouting.

Grout was batched on site using a P11 pump. Constituent materials were pumped to each bore under hydrostatic pressure until boreholes were deemed full.

A total of 173 no. production grout holes were drilled on a surveyed grid. Grout holes were drilled to an average depth of 30m bgl utilising water flush. Evidence of abandoned coal mine workings were not recorded.

Grouting was undertaken via a 6tonne air driven mixer then pumped out via a 3" electric Matt pump down each borehole under static head pressure until the borehole was deemed full. The grout mix for this project comprised either neat OPC and 10:1 PFA:3OPC mixture.

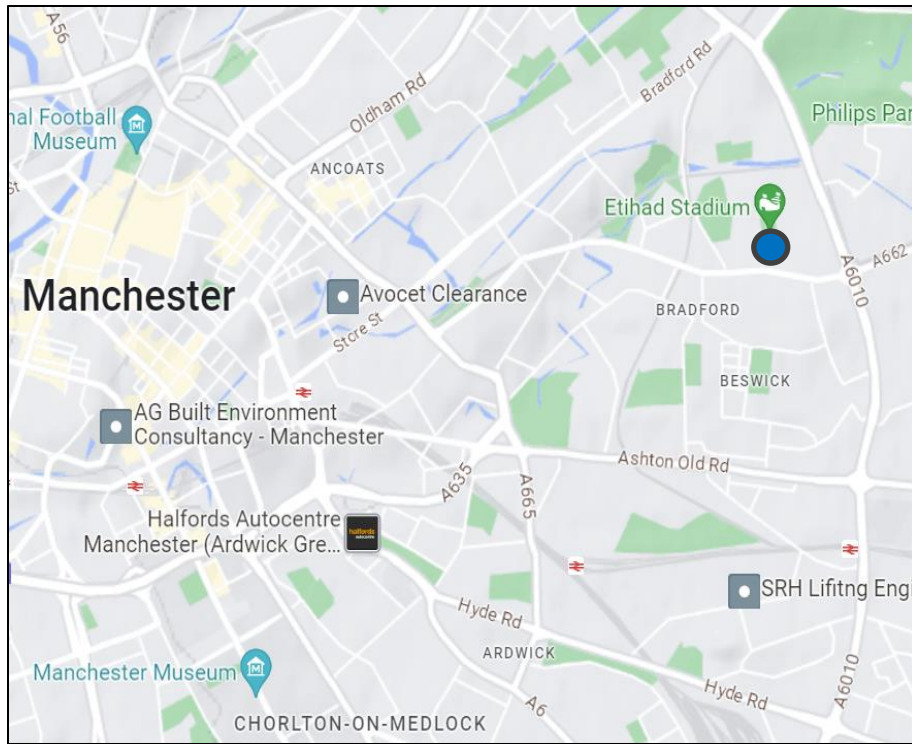
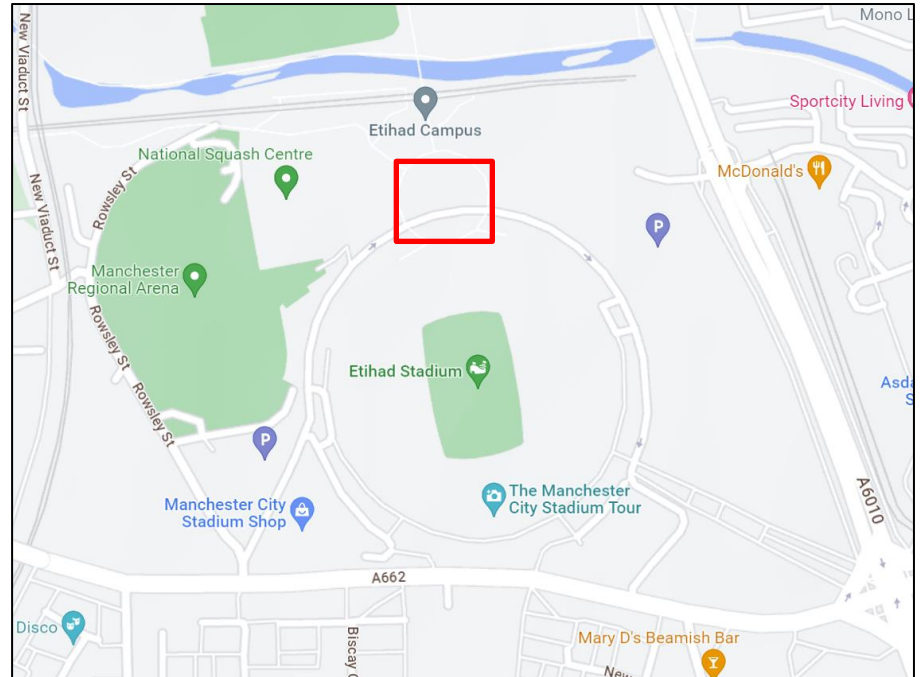
A total of approximately 43.5 tonnes of grout was injected (average 0.25 tonnes per borehole).

No further drilling and grouting works are required at this site.

APPENDIX A

FIGURES AND DRAWINGS





KEY:

 Approximate Site Location

 Approximate Site Boundary

DO NOT SCALE



Van Elle Limited
Kirkby Lane, Pinxton
Nottinghamshire
NG16 6JA

Tel: 01773 580580
Fax: 01773 862100

TITLE:

Site Location Plan

PROJECT:

North Stand, Etihad Stadium

PROJECT No:

VE224505.01

DATE:

November 2023

SCALE:

NTS

DRAWN:

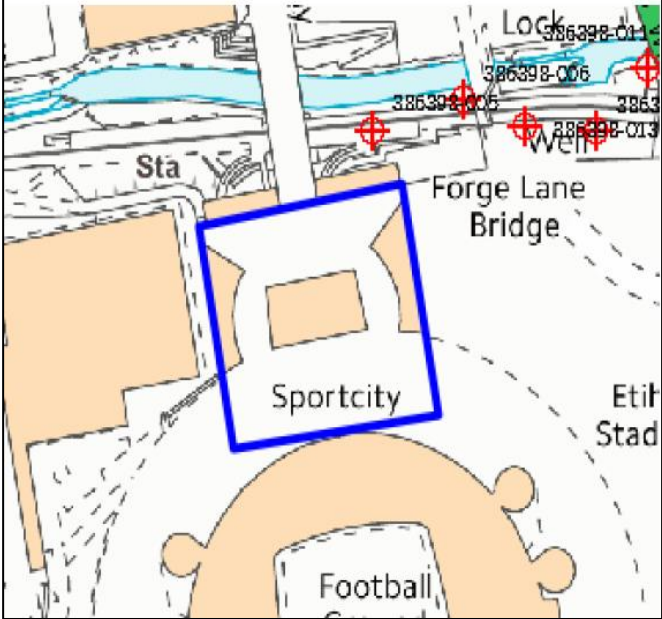
PS

DWG No:

Figure 1



Permit Ref: 26997



KEY:



Site Boundary



Van Elle Limited
Kirkby Lane, Pinxton
Nottinghamshire
NG16 6JA

Tel: 01773 580580
Fax: 01773 862100

TITLE:

Aerial View of site

PROJECT:

North Stand, Etihad Stadium

PROJECT No:

VE224505.01

DATE:

November 2023

SCALE:

NTS

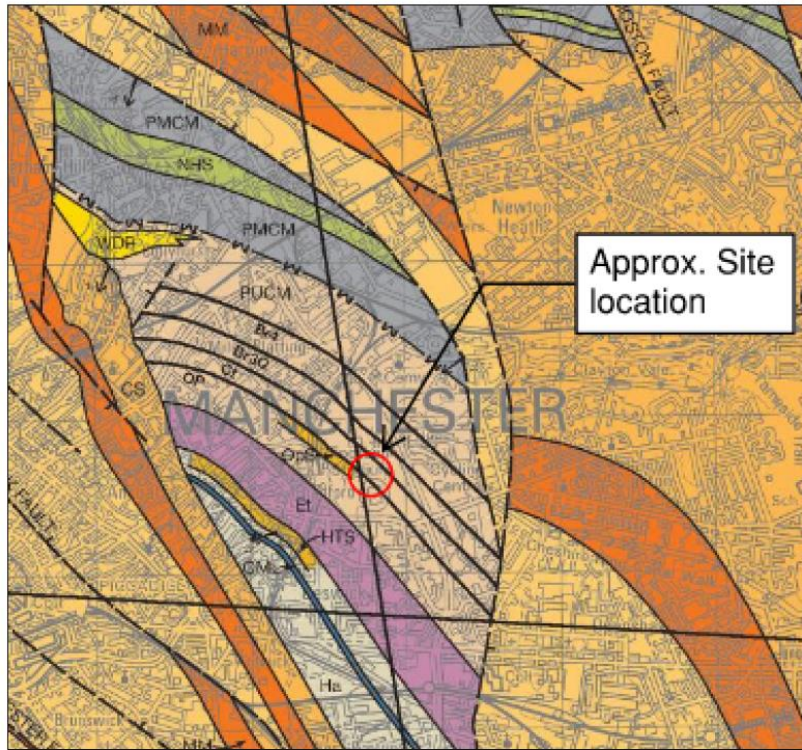
DRAWN:

PS

DWG No:

Figure 2

DO NOT SCALE



Extract of 1:50,000 BGS map (Sheet 85)



Extract of 1:10,000 BGS map (SJ89NE)

KEY:

DO NOT SCALE



Van Elle Limited
Kirkby Lane, Pinxton
Nottinghamshire
NG16 6JA

Tel: 01773 580580
Fax: 01773 862100

TITLE:

Geological Context

PROJECT:

North Stand, Etihad Stadium

PROJECT No:

VE224505.01

DATE:

November 2023

SCALE:

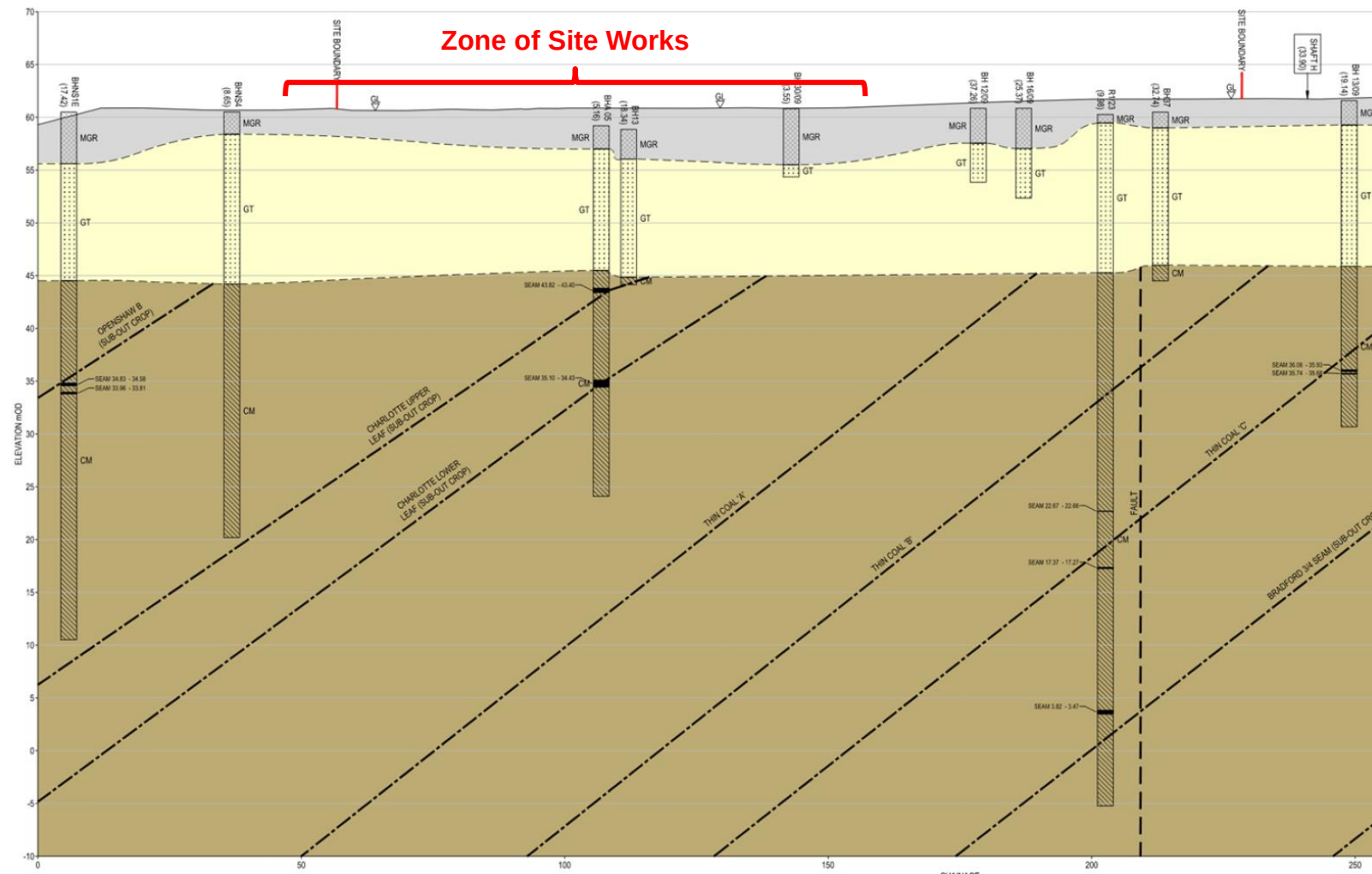
NTS

DRAWN:

PS

DWG No:

Figure 3



KEY:



Van Elle Limited
Kirkby Lane, Pinxton
Nottinghamshire
NG16 6JA

Tel: 01773 580580
Fax: 01773 862100

TITLE:

Geological Model (after Buro Happold)

PROJECT:

North Stand, Etihad Stadium

PROJECT No:

VE224505.01

DATE:

November 2023

SCALE:

NTS

DRAWN:

PS

DWG No:

Figure 4

DO NOT SCALE



-  Development High Risk
-  Recorded Shallow Mine workings
-  Recorded Mine Entry
-  Possible Shallow Mine workings

KEY:

 Approximate Treatment Area

DO NOT SCALE



Van Elle Limited
Kirkby Lane, Pinxton
Nottinghamshire
NG16 6JA

Tel: 01773 580580
Fax: 01773 862100

TITLE:

Coal Mining Context

PROJECT:

North Stand, Etihad Stadium

PROJECT No:

VE224505.01

DATE:

November 2023

SCALE:

NTS

DRAWN:

PS

DWG No:

Figure 6

APPENDIX B

COAL AUTHORITY PERMIT





The Coal
Authority

Permit to Enter or Disturb Coal Authority Interests

Permit 26997

Name and Address of Permit Holder:

Manchester City Football Club Ltd
Etihad Stadium
Etihad Campus
M11 3FF

Site Location:

Etihad Stadium
North Stand
Ashton New Road
Manchester
M11 3FF

This certificate hereby grants the above named Permit Holder a Permit to carry out:-

Treatment of unrecorded shallow mine workings by drilling and pressure grouting as required to facilitate safe and stable development in general accordance with CIRIA C758D all within the Authority's interests at the identified site location above as shown on the Grant Permit Boundary (overleaf) for the period of **12 months** from the granted date shown below. *The granting of this Permit does not constitute advice given by the Authority in relation to the proposed operations. It is the Permit Holder's responsibility to obtain appropriate health, safety, environmental, technical and legal advice.*

Conditions:

- *Manned entry (i.e.) into mine entries/workings) is strictly prohibited.*
- *Water flush drilling only*
- *Gas Monitoring for CO, CH₄, CO₂, O₂, and H₂S at borehole and rig*
- *Operators undertaking the work must be in possession of this certificate and the Permit boundary plan at the time of works*
- *Appropriate borehole reinstatement and sealing without delay and to withstand site level changes*

Signed: Leigh Sharpe Granted Date: 18th July 2023

For and on behalf of The Coal Authority

Nominated Representative: Leigh Sharpe, Permitting Manager;

The Coal Authority, Permitting Office, 200 Lichfield Lane, Mansfield, Notts, NG18 4RG

Tel: 01623 637450; E-Mail: permissions@coal.gov.uk

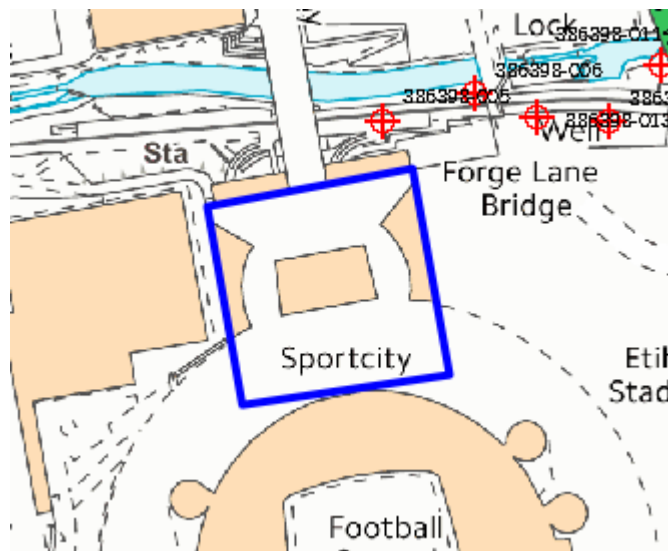


The Coal
Authority

Granted Permit Boundary

Permit Ref: 26997

Permit Boundary:



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Permit Ref.	26997	Project / Site Location	Etihad Stadium, North Stand, Ashton New Road, Manchester, M11 3FF
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Please supply all relevant documents, including this completed form within 3 months of the permitted works being completed.

Where relevant the report should include; borehole logs and details of mine or mine entry treatment works carried out (incl. engineering drawings, grout takes etc.) and a scaled site layout plan (correlated to O.S N' Grid) showing all relevant mine entry positions, coal seams, voids and broken ground proved by the works.

Summary of works

Start date **31/7/23**

Finish date **26-10-23**

Have any variations occurred? ☒ No ☐ Yes If so was the Authority notified? ☒ No ☐ Yes

Please describe;

NO VARIATIONS

Did if any of the following incidents occur?

- ☐ Spontaneous combustion ☐ Water emission ☐ Gas emission (elevated or above action levels)
☐ Geotechnical instability ☐ Legal issues incl. damage or potential claims ☒ None

If yes, please detail each item;

Were any of the following encountered? Please give a brief summary of the works undertaken.

- ☒ Intact coal only ☐ Broken ground ☐ Backfilled ground ☐ Voids

Description;

ALL POSITIONS DRILLED ENCOUNTERED NO COAL OR THIN COALS (0.5-1.0m) BETWEEN DEPTHS OF ~16-22m BELOW EXISTING GROUND LEVEL. NO EVIDENCE OF PAST WORKINGS WAS FOUND IN ANY BOREHOLE. NO UNRECORDED MINING ANOMALIES WERE ENCOUNTERED. ALL BOREHOLES WERE BACKFILLED WITH A CEMENTIOUS GROUT. NO ELEVATED GAS READINGS WERE RECORDED.

Will further works be necessary that require a Permit? ☐ No ☒ Yes

If yes, please describe, including any recommendations;

PILING WORKS ARE SCHEDULED AND PERMIT APPLIED FOR.

Name: Paul Gnocott BSc (Hons) FGS	Email: paul.gnocott@evan-elli.co.uk
Company: VAN ELL LIMITED	Tel: 0173 580580 / 07860 840396

APPENDIX C

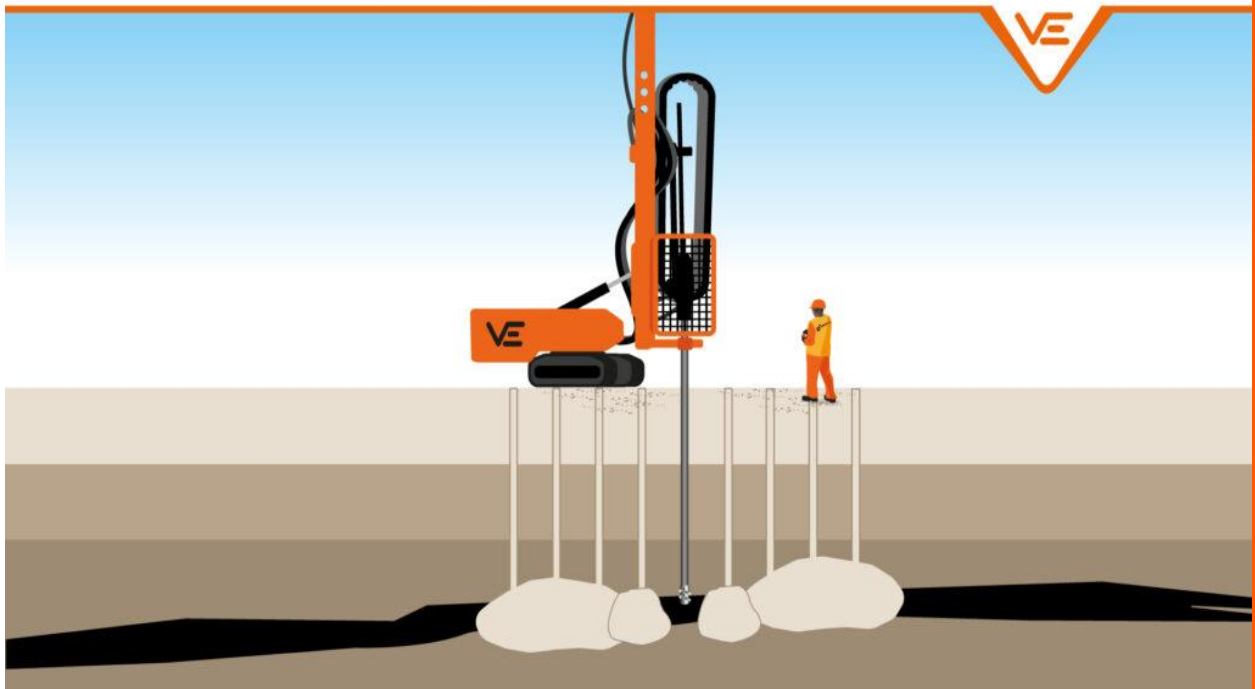
TREATMENT SPECIFICATION



Land to North of Etihad Stadium

Specification for Consolidation of Mine Workings by Drilling and Grouting

Bulk infill drilling and grouting



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Control Sheet

This report has been prepared for the sole benefit, use and information of John Sisk & Sons Limited for the purposes set out in the instructions commissioning it. The liability of Van Elle Ltd in respect of the information contained in the report will not extend to any third party.

Prepared by	Paul Grocott BSc MIMMM FGS	Signed	Date 11/07/2023
Approved by	David Bourne	Signed	Date 11/07/2023

1.0 Introduction

John Sisk & Sons Limited (JSSL), in their capacity as Principal Contractor, has instructed Van Elle (VE) to prepare a design and specification to allow the stabilisation and consolidation of underlying Coal seams and any workings found within them only. Any geological / manmade features above the coal seams will not form part of these works.

The stabilisation of the workings / coal seams will be carried out by Drilling and Grouting, an industry wide term, used to describe the processes identified and described below.

The Drilling Grid (shown in Figure 1) shows the areas to be treated from suspected workings within the Charlotte Upper and Lower Seams.



Figure 1: 6m Borehole Grid

The Drilling and Grouting works have been designed to treat the coal seams only and not any features manmade or natural below, above or in between each seam.

1.1 Site Location and Description

The site is located off the A6020, Alan Turing Road to the east northeast of Manchester City centre the treatment area is some 10,500m² and is located to the north of the stadium where the existing club shop sits, shown in Figure 2.



Figure 2: Site plan

1.2 Ground Conditions & Geology

A check of the BGS GeoIndex online resource GeoIndex shows the site to be underlain by the “Pennine Upper Coal Measures” comprising of mudstone, siltstone, and sandstone with some bands of coal’.

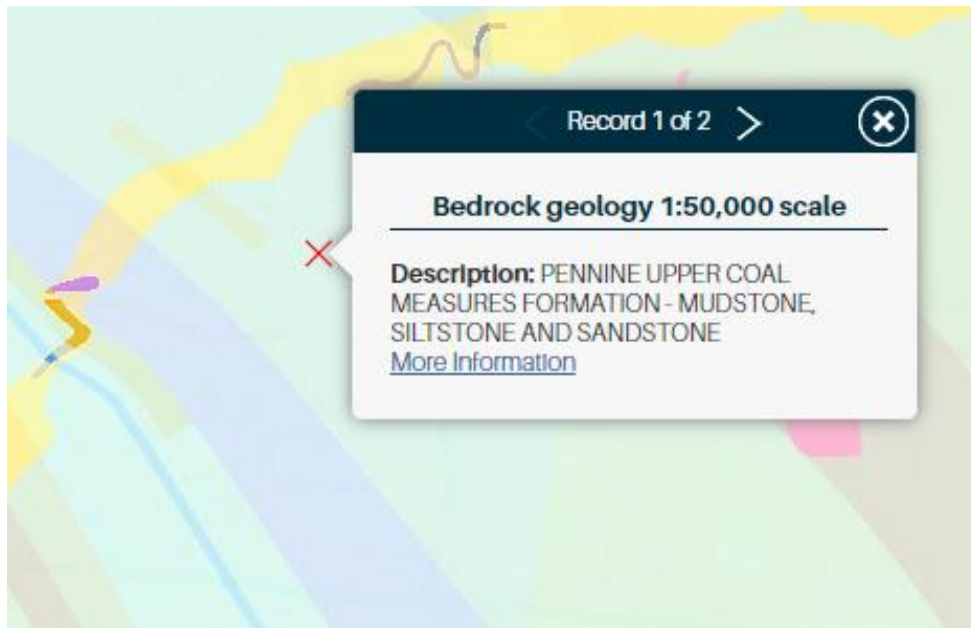


Plate 3. Showing Geological Environment

A further check of the Coal Authority Interactive viewer also revealed that the site is within a former coal mining area. It was therefore recommended that these “seams” be investigated and if found to be showing evidence of workings to be consolidating by drilling and grouting.



Plate 4 – showing former coal mining area.

1.3 Purpose of the Works

Treatment of coal seams / workings is required where less than ten times seam thickness of rock cover exists between the top of the worked seam and the base of the proposed piles/rock head.

This 10T rule is an industry adopted common practice based on information and guidance given within Section 5.3 of CIRIA Publication C758D published in 2019.

1.4 Permissions

1.4.1 Coal Authority

A permit to treat workings will be obtained from the Coal Authority. A copy of the permit shall be kept on site by the foreman.

1.4.2 Environment Agency

Any permits required by the EA must be obtained by the Client / Principal Contractor unless otherwise agreed.

1.5 Services

All services must be identified on site and shown to the Foreman and drill crew. All protection, diversion, and reinstatement of any service under CDM fall under the responsibility of the Principal Contractor and permits to work must be issued.

2.0 Specification

2.1 Design

A 6m grid has been superimposed on the whole footprint of the future development. There is a potential to reduce the grid spacing, should grout takes be high in any particular area. Boreholes are to be drilled to an average depth of 30m below existing ground level to intercept the target seam(s).

Treatment will be afforded to the **Coal Seams Only**.

There are several tension piles on site which will clash with the treatment area. Information gleaned from the tender documents does not give an accurate record of the location, depth, or orientation of said tension piles and therefore a 3m standoff in all directions will be adopted.

2.2 Supervision

A full time non-working foreman will be on site during the project, who will be responsible for ensuring the works comply with the specification. He will liaise with VE contract management staff daily.

The Foreman will be supported by a visiting Contracts Supervisor and Contracts Manager, further IT and Engineering support will be provided from back in the office and if required on site.

2.3 Drilling

Drilling will be carried out using hydraulic driven rotary percussive drill rig, advancing 101mm steel casing to rockhead. Once this casing has been socketed in at this horizon, drilling will continue down to target seam. A nominal 76mm diameter borehole into the target seam to allow grouting and consolidation. Rotary percussive drilling techniques will be used with water as the flushing medium. The rigs will be fitted with a fully interlocked guard, which will be in operation at all times that drilling is being carried out.

2.3.1 Primary Grid

A primary grid of 6m will be drilled with boreholes extending to average depth 30m bgl. If grout takes exceed 5T in any one borehole a reduced grid spacing will be drilled around this position to assist with consolidating the workings in this area.

2.3.2 Perimeter

This does not appear necessary since there is no great dip in the workings or significant voids.

2.3.3 Records

Full records shall be maintained during the works, showing job name and location, hole reference number, date, plant in use and crew members, inclination of borehole, daily and cumulative length drilled depth to each major change in stratum, description noting where

stratum is broken, details of any voids or suspected workings and depth of completed borehole.

2.3.4 Unknown Mineshafts

Should unknown mineshafts be encountered it will be necessary to probe drill the shaft to work out its diameter. The PC should then record the position via GPS and VE will inform the Coal Authority as the permit holder. The CA will amend the permit to allow treatment.

A shaft safety platform would then need to be mobilised to allow treatment. Methodology and risks will be covered in an amended set of RAMS and Specification.

2.4 Grouting

2.4.1 Materials & Mix

Grout materials shall consist of Pulverised Fuel Ash and Ordinary Portland Cement, mixed at a ratio of 10:1 with a water solids ratio of no more than 40%. No thixotropic or thickening agents will be added during agitation. OPC shall comply with BS12 and PFA shall be in accordance with BS 3892: part 2.

If open voids are encountered the introduction of pea gravel shall be used within the grout mix.

2.4.2 Equipment

Grout will be batched on site using an agitator mixer powered using an electric motor powered by a diesel generator. Constituent materials shall be introduced by a loading shovel and pumped to each treatment borehole using an electric MAPP pump and pressure head atop the steel casing. All plant shall be certified safe and maintained properly throughout the operation.

2.4.3 Water

A source of water will be provided to Van Elle from a hydrant with a standpipe.

2.4.5 Testing

4 Grout cubes shall be taken daily, whichever is the greater, and tested at 3, 7 and 28 day intervals to achieve a minimum strength of 1N/mm² after 28 days.

The foreman shall ensure that mixes are tested regularly for flow and bleed using a Colcrete type flowmeter and graduated beaker respectively. Flows should be with the range of 300-600mm and bleed should be no more than 2% by volume.

2.5 Testing

2.5.1 Test holes

Test holes will be drilled at the site to validate the works. The position of the test holes will be chosen to correspond with the areas of the site where the highest grout takes are recorded. The position of the test holes will be indicated on the Grout borehole layout plan. All test holes will be pressurised to correspond with the amount of overburden (i.e., 10kN/m of overburden) for 2 minutes. The test shall be considered a pass where not more

than 1t can be injected, and the pressure drops by no more than 10% for 2 minutes. Drill and Grout records of test holes will be kept.

2.5.2 Gas testing

A gas monitor shall be used throughout the consolidation program to monitor for the presence of three harmful gases, carbon monoxide (CO), hydrogen sulphide (H₂S) and Methane (CH₄). Levels of airborne Oxygen (O₂) will also be monitored. The gas alarms have visible and aural alarms should concentrations of any of these gases touch pre-determined trigger levels. Records of the gas monitoring shall be kept.

3.0 Reporting

A completion report will be compiled within 28 days of the works being completed. The report will include drilling records, grouting records, testing records and an as-built location plan showing the location of the boreholes and any test holes carried out. It will also summarise total length drilled, and quantities of grout materials.

4.0 References

CIRIA Special Publication C758D –Abandoned Mineworkings

ETIHAD GROUND INVESTIGATION - FACTUAL GROUND INVESTIGATION REPORT,
Geotechnical Engineering Limited (17/03/2023)

Appendix 1

Sample Drilling & Grouting Records

CON 10 R2 31/03/15



Kirkby Lane, Pinxton, Nottinghamshire NG16 6JA
Telephone: (01773) 580580 Fax: (01773) 862100
Website: www.van-elle.co.uk E-mail: info@van-elle.co.uk

Open Hole Drillers Log

[illegible]



DAILY & ACCUMULATIVE GROUTING RETURN

Job No. Client Site Address

HOLE REF.	DEPT H (M)	ANGLE/ PRESSURE	BRIEF LOG OF HOLE	QUANT OF GROUT (T)	OPC	PFA	SAND	PEA GRAVEL		CEMENT	PFA	SAND	PEA GRAVEL
									Today's Deliveries				
									Previous Deliveries				
									Total Deliveries				
									Total Used				
									Stock on Site				
										OPERATIVES ON SITE			
										REMARKS			
										I CONFIRM THIS IS A TRUE RECORD			
										VAN ELLE OPERATIVE SIGNATURE			
													
										CLIENTS SIGNATURE			
													
										DATE			
TOTAL HOLES GROUTED TODAY		TODAY'S TOTAL GROUT											
PREVIOUS TOTAL		PREVIOUS TOTAL											
TOTAL TODATE		TOTAL GROUTING											

APPENDIX D

DRILLING AND GROUTING DATA



PS3510 Manchester City Football Ground																							
VE224505-01																							
Drilling and Grouting Data Sheet																							
					Overburden		No Coal		Intact Coal		Soft Ground									Grouting			
Reference	Date	Angle °	Comp Depth m	To m		From m	To m	From m	To m	From m	To m						Comments	Casing	Flush		OPC	PFA	TOTAL
A 3	12-Sep-23	81	30.0	16.0	16.00	24.70	24.70	26.50									Mudstone / Coal	16.0 Full			0.020	0.20	0.22
A 4	12-Sep-23	90	30.0	16.5	16.50	22.00				22.00	23.50						Mudstone / Soft	16.0 Loss			0.030	0.30	0.33
A 5	18-Sep-23	84	23.0	17.0	17.00	21.00	21.00	22.00									Mudstone / Coal bands	16.0 Full			0.015	0.15	0.17
A 6	15-Sep-23	90	30.0	16.3	16.30	20.60	20.60	21.60									Mudstone / Coal bands	16.0 Full			0.018	0.18	0.20
A 7	18-Sep-23	90	30.0	17.0	17.00	17.50	17.50	18.50									Mudstone / Coal	16.0 Full			0.020	0.20	0.22
A 8	18-Sep-23	90	30.0	16.0	16.00	17.00	17.00	17.70									Mudstone / Coal	16.0 Full			0.015	0.15	0.17
A 9					Not Accessible due to deep drainage																		
A 10	19-Sep-23	79	30.0	16.4	16.40	30.00											Mudstone	16.0 Full			0.015	0.15	0.17
A 11	19-Sep-23	79	30.0	16.2	16.20	30.00											Mudstone	16.0 Full			0.015	0.15	0.17
B 3	12-Sep-23	79	30.0	16.2	16.20	25.60	25.60	27.20									Mudstone / Coal	16.0 Full			0.025	0.25	0.28
B 4	12-Sep-23	90	30.0	16.2	16.20	24.00	24.00	25.30									Mudstone / Coal	16.0 Full			0.020	0.20	0.22
B 5	15-Sep-23	84	30.0	16.3	16.30	21.80	21.80	23.00									Mudstone / Coal bands	16.0 Full			0.018	0.18	0.20
B 6	15-Sep-23	84	30.0	16.2	16.20	21.50	21.50	22.50									Mudstone / Coal bands	16.0 Full			0.018	0.18	0.20
B 7	15-Sep-23	90	30.0	16.0	16.00	16.90	16.90	17.90									Mudstone / Coal	16.0 Full			0.015	0.15	0.17
B 8	18-Sep-23	90	30.0	16.0			16.00	17.00									Coal	16.0 Full			0.015	0.15	0.17
B 9	19-Sep-23	90	30.0	16.5	16.50	30.00											Mudstone	16.0 Full			0.018	0.18	0.20
B 10	19-Sep-23	90	30.0	15.8	15.80	30.00											Mudstone	16.0 Full			0.015	0.15	0.17
B 11	19-Sep-23	90	30.0	15.8	15.80	30.00											Mudstone	16.0 Full			0.020	0.20	0.22
B 12	06-Sep-23	90	30.0	16.1	16.10	30.00											Mudstone	16.0 Full			0.020	0.20	0.22
C 2	14-Sep-23	90	30.0	16.0	16.00	28.00				28.00	29.00						Mudstone / Soft	16.0 Loss			0.025	0.25	0.28
C 3	12-Sep-23	79	30.0	16.3	16.30	26.70	26.70	28.20									Mudstone / Coal bands	16.0 Full			0.020	0.20	0.22
C 4	12-Sep-23	90	30.0	16.0	16.00	25.20	25.20	26.50									Mudstone / Coal bands	16.0 Full			0.025	0.25	0.28
C 5	15-Sep-23	84	30.0	16.0	16.00	22.50				22.50	24.00						Mudstone / Soft	16.0 Loss			0.020	0.20	0.22
C 6	14-Sep-23	84	30.0	16.0	16.00	21.00	21.00	22.10									Mudstone / Coal bands	16.0 Full			0.020	0.20	0.22
C 7	08-Sep-23	90	30.0	16.0	16.00	30.00											Mudstone	16.0 Full			0.020	0.20	0.22
C 8	07-Sep-23	90	30.0	16.4			16.40	16.90									Coal	16.0 Full			0.020	0.20	0.22
C 9	19-Sep-23	90	30.0	16.5			16.50	17.00									Coal	16.0 Full			0.018	0.18	0.20
C 10	19-Sep-23	84	30.0	16.1	16.10	30.00											Mudstone	16.0 Full			0.020	0.20	0.22
C 11	08-Sep-23	82	30.0	16.0	16.00	30.00											Mudstone	16.0 Full			0.020	0.20	0.22
C 12	06-Sep-23	90	30.0	16.0	16.00	30.00											Mudstone	16.0 Full			0.025	0.25	0.28
C 13	05-Sep-23	90	30.0	16.0	16.00	30.00											Mudstone	16.0 Full			0.020	0.20	0.22
D 2	14-Sep-23	90	31.0	16.0	16.00	28.80	28.80	30.00									Mudstone / Soft	16.0 Full			0.020	0.20	0.22
D 3	13-Sep-23	79	30.0	16.0	16.00	27.00	27.00	28.50									Mudstone / Coal bands	16.0 Full			0.020	0.20	0.22
D 4	13-Sep-23	90	30.0	16.2	16.20	26.00	26.00	27.00									Mudstone / Coal bands	16.0 Full			0.020	0.20	0.22
D 5	11-Sep-23	84	30.0	16.2	16.20	23.00	23.00	24.30									Mudstone / Coal bands	16.0 Full			0.025	0.25	0.28
D 6	11-Sep-23	84	30.0	16.2	16.20	21.40	21.40	22.80									Mudstone / Coal bands	16.0 Full			0.020	0.20	0.22
D 7	08-Sep-23	90	30.0	15.4	15.40	17.40	17.40	19.40									Mudstone / Coal bands	16.0 Full			0.020	0.20	0.22
D 8	07-Sep-23	90	30.0	16.6	16.60	18.20	18.20	19.60									Mudstone / Coal	16.0 Full			0.020	0.20	0.22
D 9	07-Sep-23	84	30.0	15.7	15.70	17.00	17.00	18.50									Mudstone / Coal bands	16.0 Full			0.020	0.20	0.22
D 10	07-Sep-23	90	30.0	15.7	15.70	16.50	16.50	16.90									Mudstone / Coal	16.0 Full			0.025	0.25	0.28

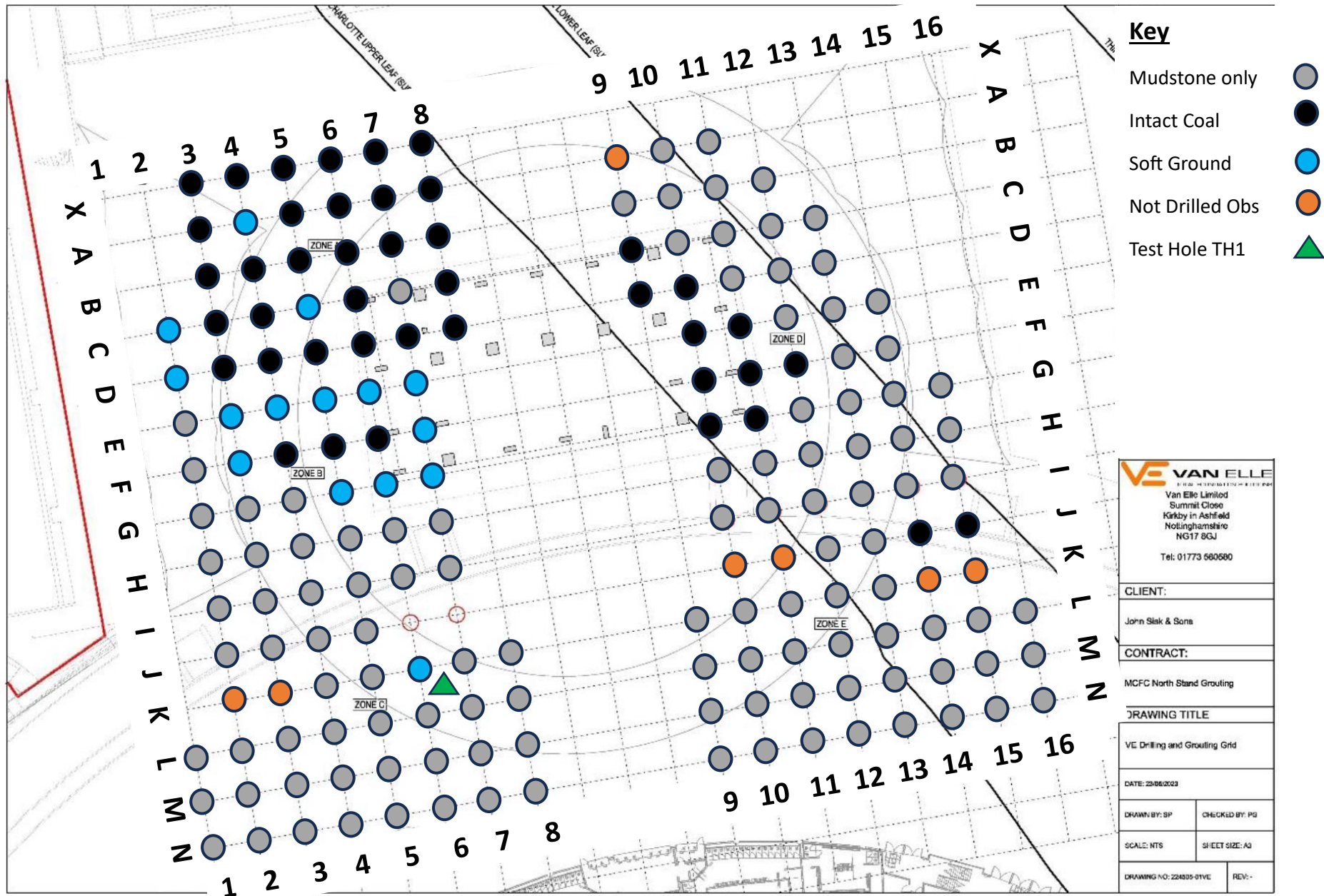
D 11	07-Sep-23	84	30.0	16.0	16.00	30.00										Mudstone	16.0	Full		0.020	0.20	0.22
D 12	06-Sep-23	90	30.0	15.7	15.70	30.00										Mudstone	16.0	Full		0.030	0.30	0.33
D 13	05-Sep-23	90	30.0	16.0	16.00	30.00										Mudstone	16.0	Full		0.020	0.20	0.22
E 2	06-Sep-23	79	30.0	16.4	16.40	30.00										Mudstone	16.0	Full		0.020	0.20	0.22
E 3	13-Sep-23	79	32.0	16.6	16.60	29.00	29.00	30.50								Mudstone / Soft	16.0	Poor		0.025	0.25	0.28
E 4	13-Sep-23	90	30.0	16.3	16.30	27.00	27.00	28.00								Mudstone / Soft	16.0	Poor		0.025	0.25	0.28
E 5	11-Sep-23	84	30.0	16.0	16.00	24.50	24.50	26.20								Mudstone / Soft	16.0	Loss		0.030	0.30	0.33
E 6	11-Sep-23	84	30.0	16.3	16.30	23.00	23.00	24.50								Mudstone / Soft	16.0	Poor		0.025	0.25	0.28
E 7	08-Sep-23	90	30.0	15.8	15.80	19.50	19.50	21.50								Mudstone / Soft	16.0	Loss		0.030	0.30	0.33
E 8																						
E 9																						
E 10	07-Sep-23	90	30.0	15.8	15.80	17.60	17.60	19.00								Mudstone / Coal	16.0	Full		0.020	0.20	0.22
E 11	07-Sep-23	84	30.0	16.0	16.00	16.50	16.50	18.00								Mudstone / Coal bands	16.0	Full		0.020	0.20	0.22
E 12	06-Sep-23	90	30.0	16.0	16.00	30.00										Mudstone	16.0	Full		0.025	0.25	0.28
E 13	05-Sep-23	90	30.0	15.8	15.80	30.00										Mudstone	16.0	Full		0.020	0.20	0.22
E 14	05-Sep-23	90	30.0	15.2	15.20	30.00										Mudstone	16.0	Full		0.020	0.20	0.22
F 2	04-Sep-23	90	30.0	16.3	16.30	30.00										Mudstone	16.0	Full		0.020	0.20	0.22
F 3	13-Sep-23	79	32.0	16.6	16.60	29.00	29.00	30.50								Mudstone / Soft	16.0	Poor		0.020	0.20	0.22
F 4	13-Sep-23	90	30.0	16.1	16.10	28.00	28.00	29.00								Mudstone / Coal bands	16.0	Full		0.020	0.20	0.22
F 5	11-Sep-23	84	30.0	16.0	16.00	26.00	26.00	27.50								Mudstone / Coal bands	16.0	Full		0.020	0.20	0.22
F 6	11-Sep-23	84	30.0	16.0	16.00	24.70	24.70	26.20								Mudstone / Coal bands	16.0	Full		0.020	0.20	0.22
F 7	08-Sep-23	90	30.0	15.2	15.20	21.00	21.00	22.00								Mudstone / Soft	16.0	Poor		0.025	0.25	0.28
F 8																						
F 9																						
F 10	07-Sep-23	90	30.0	16.0	16.00	18.60	18.60	20.00								Mudstone / Coal bands	16.0	Full		0.020	0.20	0.22
F 11	06-Sep-23	84	30.0	16.0	16.00	18.00	18.00	19.50								Mudstone / Coal bands	16.0	Full		0.018	0.18	0.20
F 12	06-Sep-23	90	30.0	16.0	16.00	16.50										Mudstone / Coal bands	16.0	Full		0.018	0.18	0.20
F 13	04-Sep-23	90	30.0	15.3	15.30	30.00										Mudstone	16.0	Full		0.025	0.25	0.28
F 14	04-Sep-23	90	30.0	15.3	15.30	30.00										Mudstone	16.0	Full		0.020	0.20	0.22
G 2	14-Sep-23	90	30.0	18.0	18.00	30.00										Mudstone	16.0	Full		0.020	0.20	0.22
G 3	13-Sep-23	79	30.0	16.4	16.40	30.00										Mudstone	16.0	Full		0.020	0.20	0.22
G 4	13-Sep-23	90	30.0	16.3	16.30	30.00										Mudstone	16.0	Full		0.020	0.20	0.22
G 5	11-Sep-23	84	30.0	16.0	16.00	24.00	24.00	25.50								Mudstone / Coal	16.0	Poor		0.020	0.20	0.22
G 6	11-Sep-23	84	30.0	16.0	16.00	23.00	23.00	24.50								Mudstone / Coal	16.0	Poor		0.020	0.20	0.22
G 7	08-Sep-23	86	30.0	15.3	15.30	22.00	22.00	23.00								Mudstone / Coal	16.0	Loss		0.025	0.25	0.28
G 8																						
G 9																						
G 10	06-Sep-23	84	30.0	16.0	16.00	19.30	19.30	20.80								Mudstone / Coal bands	16.0	Full		0.018	0.18	0.20
G 11	08-Sep-23	90	30.0	16.0	16.00	30.00	16.00	16.50								Coal	17.0	Full		0.020	0.20	0.22
G 12	06-Sep-23	90	30.0	16.0	16.00	30.00										Mudstone	16.0	Full		0.025	0.25	0.28
G 13	05-Sep-23	90	30.0	15.4	15.40	30.00										Mudstone	16.0	Full		0.020	0.20	0.22
G 14	04-Sep-23	90	30.0	15.3	15.30	30.00										Mudstone	16.0	Poor		0.025	0.25	0.28
G 15	04-Sep-23	90	30.0	15.3	15.30	30.00										Mudstone	16.0	Full		0.025	0.25	0.28
H 2	14-Sep-23	90	30.0	18.4	18.40	30.00										Mudstone	16.0	Full		0.020	0.20	0.22
H 3	14-Sep-23	90	30.0	18.4	18.40	30.00										Mudstone	16.0	Full		0.200		0.20
H 4	13-Sep-23	79	30.0	16.5	16.50	30.00										Mudstone	16.0	Full		0.020	0.20	0.22
H 5	23-Oct-23	90	30.0	16.7	16.70	30.00										Mudstone	16.0	Full		0.240		0.24

H 6	23-Oct-23	90	30.0	16.2	16.20	30.00										Mudstone	16.0	Full		0.220		0.22
H 7	23-Oct-23	90	30.0	15.7	15.70	30.00										Mudstone	16.0	Full		0.220		0.22
H 8																						
H 9																						
H 10	16-Oct-23	90	30.0	17.0	17.00	30.00										Mudstone	16.0	Full		0.200		0.20
H 11	16-Oct-23	90	30.0	16.7	16.70	30.00										Mudstone	16.0	Full		0.200		0.20
H 12	16-Oct-23	90	30.0	16.0	16.00	30.00										Mudstone	16.0	Full		0.200		0.20
H 13	05-Sep-23	90	30.0	15.7	15.70	30.00										Mudstone	16.0	Full		0.020	0.20	0.22
H 14	04-Sep-23	90	30.0	15.3	15.30	30.00										Mudstone	16.0	Poor		0.025	0.25	0.28
H 15	04-Sep-23	90	30.0	15.3	15.30	30.00										Mudstone	16.0	Full		0.030	0.30	0.33
I 2	17-Oct-23	90	30.0	17.0	17.00	30.00										Mudstone	16.0	Full		0.200		0.20
I 3	17-Oct-23	86	30.0	17.3	17.30	30.00										Mudstone	16.0	Full		0.200		0.20
I 4	17-Oct-23	90	30.0	16.8	16.80	30.00										Mudstone	16.0	Full		0.200		0.20
I 5	13-Oct-23	79	30.0	16.7	16.70	30.00										Mudstone	16.0	Full		0.220		0.22
I 6	13-Oct-23	90	30.0	16.0	16.00	30.00										Mudstone	16.0	Full		0.220		0.22
I 7	13-Oct-23	90	30.0	15.7	15.70	30.00										Mudstone	16.0	Full		0.200		0.20
I 8																						
I 9																						
I 10	13-Oct-23	90	30.0	16.0	16.00	30.00										Mudstone	16.0	Full		0.200		0.20
I 11	13-Oct-23	90	30.0	16.0	16.00	30.00										Mudstone	16.0	Full		0.200		0.20
I 12	16-Oct-23	79	30.0	17.0	17.00	30.00										Mudstone	16.0	Full		0.200		0.20
I 13	16-Oct-23	79	30.0	17.0	17.00	30.00										Mudstone	16.0	Full		0.200		0.20
I 14	04-Sep-23	90	30.0	15.5	15.50	30.00										Mudstone	16.0	Full		0.020	0.20	0.22
I 15	04-Sep-23	90	30.0	15.7	15.70	30.00										Mudstone	16.0	Full		0.020	0.20	0.22
J 2	17-Oct-23	79	30.0	17.5	17.50	30.00										Mudstone	16.0	Full		0.200		0.20
J 3	17-Oct-23	75	30.0	18.0	18.00	30.00										Mudstone	16.0	Full		0.200		0.20
J 4	04-Aug-23	90	30.0	16.4	16.40	30.00										Mudstone	16.0	Full		0.030	0.30	0.33
J 5	04-Aug-23	90	30.0	16.3	16.30	30.00										Mudstone	16.0	Full		0.025	0.25	0.28
J 6																						
J 7																						
J 8																						
J 9																						
J 10																						
J 11																						
J 12	09-Aug-23	90	30.0	16.7	16.70	30.00										Mudstone	16.0	Full		0.020	0.20	0.22
J 13	09-Aug-23	90	30.0	16.2	16.20	30.00										Mudstone	16.0	Full		0.020	0.20	0.22
J 14	16-Oct-23	90	30.0	16.3	16.30	16.90	16.90	17.50								Mudstone / Coal bands	16.0	Full		0.200		0.20
J 15	16-Oct-23	90	30.0	16.2	16.20	16.80	16.80	17.50								Mudstone / Coal bands	16.0	Full		0.200		0.20
K 2																						
K 3																						
K 4	03-Aug-23	90	30.0	17.7	17.70	30.00										Mudstone	16.0	Full		0.030	0.30	0.33
K 5	03-Aug-23	90	30.0	15.7	15.70	30.00										Mudstone	16.0	Full		0.035	0.35	0.39
K 6	03-Aug-23	90	30.0	15.8	15.80	28.00	28.00	29.00								Mudstone / Soft	16.0	Loss		0.100	1.00	1.10
K 7	04-Aug-23	90	30.0	16.2	16.20	30.00										Mudstone	16.0	Full		0.025	0.25	0.28
K 8	23-Oct-23	90	30.0	15.7	15.70	30.00										Mudstone	16.0	Full		0.200		0.20
K 9	07-Aug-23	90	30.0	16.1	16.10	30.00										Mudstone	16.0	Full		0.020	0.20	0.22
K 10	08-Aug-23	90	30.0	16.2	16.20	30.00										Mudstone	16.0	Full		0.025	0.25	0.28

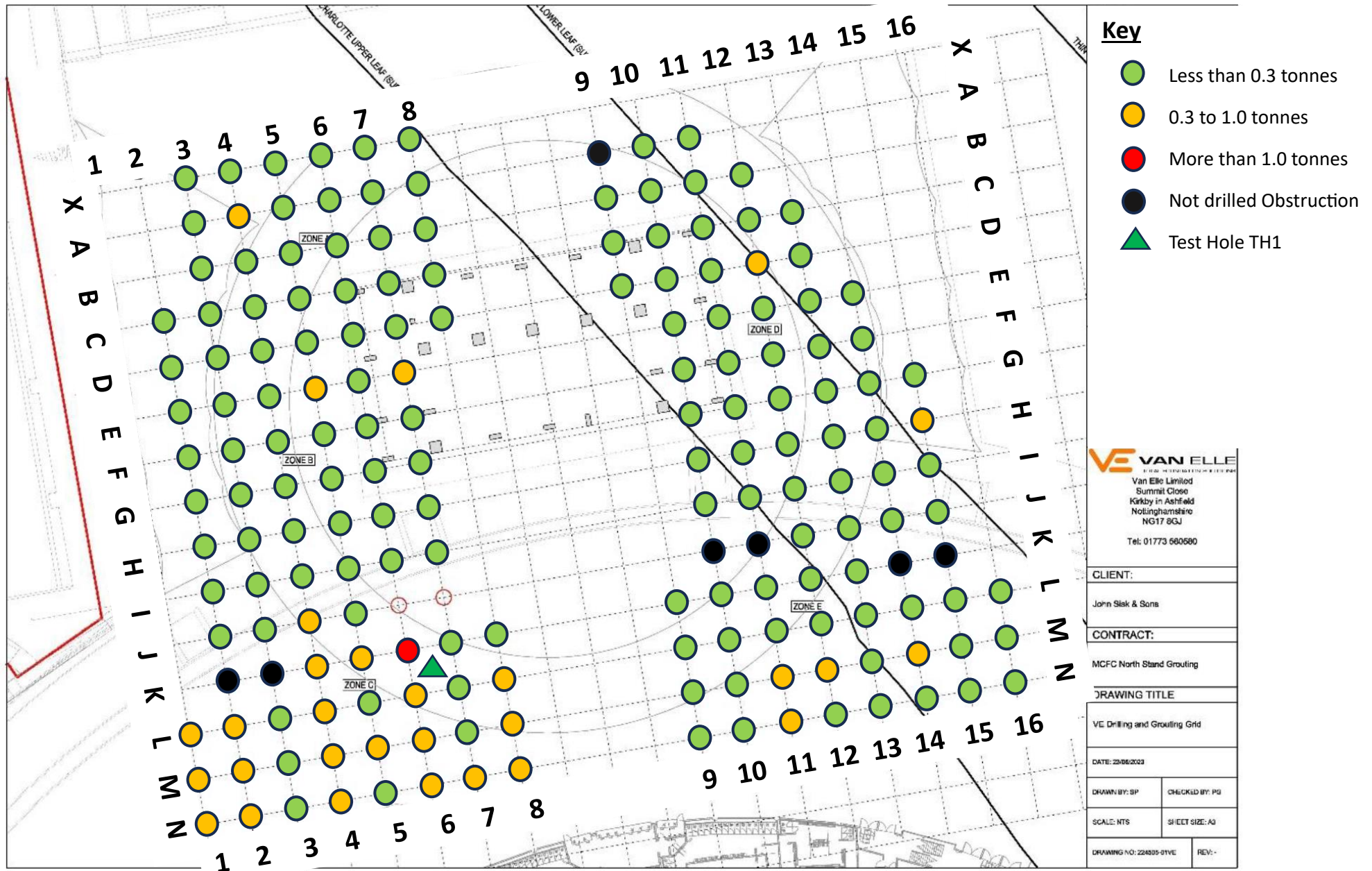
K 11	08-Aug-23	90	30.0	16.2	16.20	30.00								Mudstone	16.0	Full		0.025	0.25	0.28
K 12	09-Aug-23	90	30.0	16.0	16.00	30.00								Mudstone	16.0	Full		0.020	0.20	0.22
K 13	09-Aug-23	90	30.0	16.4	16.40	30.00								Mudstone	16.0	Full		0.020	0.20	0.22
K 14							Not Accessible due to backstay anchors													
K 15							Not Accessible due to backstay anchors													
L 1	02-Aug-23	90	30.0	16.0	16.00	30.00								Mudstone	16.0	Full		0.035	0.35	0.39
L 2	02-Aug-23	90	30.0	16.5	16.50	30.00								Mudstone	16.0	Full		0.030	0.30	0.33
L 3	02-Aug-23	90	30.0	17.5	17.50	30.00								Mudstone	16.0	Full		0.025	0.25	0.28
L 4	02-Aug-23	90	30.0	18.0	18.00	30.00								Mudstone	16.0	Full		0.040	0.40	0.44
L 5	03-Aug-23	90	30.0	16.0	16.00	30.00								Mudstone	16.0	Full		0.025	0.25	0.28
L 6	03-Aug-23	90	30.0	16.0	16.00	30.00								Mudstone	16.0	Full		0.030	0.30	0.33
L 7	04-Aug-23	90	30.0	15.7	15.70	30.00								Mudstone	16.0	Full		0.025	0.25	0.28
L 8	03-Aug-23	90	30.0	15.7	15.70	30.00								Mudstone	16.0	Full		0.030	0.30	0.33
L 9	07-Aug-23	90	30.0	16.2	16.20	30.00								Mudstone	16.0	Full		0.025	0.25	0.28
L 10	08-Aug-23	90	30.0	16.0	16.00	30.00								Mudstone	16.0	Full		0.025	0.25	0.28
L 11	08-Aug-23	90	30.0	16.3	16.30	30.00								Mudstone	16.0	Full		0.025	0.25	0.28
L 12	09-Aug-23	90	30.0	16.2	16.20	30.00								Mudstone	16.0	Full		0.020	0.20	0.22
L 13	09-Aug-23	90	30.0	16.5	16.50	30.00								Mudstone	16.0	Full		0.020	0.20	0.22
L 14	10-Aug-23	90	30.0	16.1	16.10	30.00								Mudstone	16.0	Full		0.020	0.20	0.22
L 15	10-Aug-23	90	30.0	16.4	16.40	30.00								Mudstone	16.0	Full		0.018	0.18	0.20
L 16	10-Aug-23	90	30.0	16.5	16.50	30.00								Mudstone	16.0	Full		0.018	0.18	0.20
M 1	02-Aug-23	90	30.0	16.0	16.00	30.00								Mudstone	16.0	Full		0.030	0.30	0.33
M 2	02-Aug-23	90	30.0	16.1	16.10	30.00								Mudstone	16.0	Full		0.035	0.35	0.39
M 3	02-Aug-23	90	30.0	16.7	16.70	30.00								Mudstone	16.0	Full		0.025	0.25	0.28
M 4	02-Aug-23	90	30.0	18.8	18.80	30.00								Mudstone	16.0	Full		0.040	0.40	0.44
M 5	03-Aug-23	90	30.0	17.0	17.00	30.00								Mudstone	16.0	Full		0.035	0.35	0.39
M 6	03-Aug-23	90	30.0	15.8	15.80	30.00								Mudstone	16.0	Full		0.035	0.35	0.39
M 7	04-Aug-23	90	30.0	16.2	16.20	30.00								Mudstone	16.0	Full		0.025	0.25	0.28
M 8	03-Aug-23	90	30.0	15.8	15.80	30.00								Mudstone	16.0	Full		0.030	0.30	0.33
M 9	07-Aug-23	90	30.0	16.0	16.00	30.00								Mudstone	16.0	Full		0.025	0.25	0.28
M 10	08-Aug-23	90	30.0	15.8	15.80	30.00								Mudstone	16.0	Full		0.025	0.25	0.28
M 11	08-Aug-23	90	30.0	16.3	16.30	30.00								Mudstone	16.0	Full		0.030	0.30	0.33
M 12	08-Aug-23	90	30.0	16.3	16.30	30.00								Mudstone	16.0	Full		0.030	0.30	0.33
M 13	09-Aug-23	90	30.0	16.2	16.20	30.00								Mudstone	16.0	Full		0.020	0.20	0.22
M 14	10-Aug-23	90	42.0	16.2	16.20	42.00								Mudstone / sandstone	16.0	Full		0.030	0.30	0.33
M 15	10-Aug-23	90	30.0	16.0	16.00	30.00								Mudstone	16.0	Full		0.020	0.20	0.22
M 16	10-Aug-23	90	30.0	16.4	16.40	30.00								Mudstone	16.0	Full		0.018	0.18	0.20
N 1	01-Aug-23	90	30.0	15.6	15.60	30.00								Mudstone	16.0	Full		0.030	0.30	0.33
N 2	01-Aug-23	90	30.0	15.7	15.70	30.00								Mudstone	16.0	Full		0.030	0.30	0.33
N 3	01-Aug-23	90	30.0	16.0	16.00	30.00								Mudstone	16.0	Full		0.025	0.25	0.28
N 4	01-Aug-23	90	30.0	16.0	16.00	30.00								Mudstone	16.0	Full		0.030	0.30	0.33
N 5	01-Aug-23	90	30.0	16.2	16.20	30.00								Mudstone	16.0	Full		0.025	0.25	0.28
N 6	01-Aug-23	90	30.0	15.8	15.80	30.00								Mudstone	16.0	Full		0.030	0.30	0.33
N 7	01-Aug-23	90	30.0	15.9	15.90	30.00								Mudstone	16.0	Full		0.030	0.30	0.33
N 8	02-Aug-23	90	30.0	15.8	15.80	30.00								Mudstone	16.0	Full		0.040	0.40	0.44
N 9	07-Aug-23	90	30.0	15.7	15.70	30.00								Mudstone	16.0	Full		0.020	0.20	0.22
N 10	07-Aug-23	90	30.0	15.9	15.90	30.00								Mudstone	16.0	Full		0.020	0.20	0.22
N 11	08-Aug-23	90	30.0	16.1	16.10	30.00								Mudstone	16.0	Full		0.030	0.30	0.33
N 12	08-Aug-23	90	30.0	16.5	16.50	30.00								Mudstone	16.0	Full		0.025	0.25	0.28
N 13	09-Aug-23	90	30.0	16.0	16.00	30.00								Mudstone	16.0	Full		0.020	0.20	0.22
N 14	09-Aug-23	90	30.0	16.0	16.00	30.00								Mudstone	16.0	Full		0.020	0.20	0.22
N 15	10-Aug-23	90	30.0	16.6	16.60	30.00								Mudstone	16.0	Full		0.020	0.20	0.22

N 16	10-Aug-23	90	30.0	16.8	16.80	30.00											Mudstone	16.0 Full			0.020	0.20	0.22
X 3	12-Sep-23	79	30.0	16.7	16.70	24.70	24.70	26.20									Mudstone / Coal Bands	16.0 Full			0.020	0.20	0.22
X 4	12-Sep-23	79	30.0	16.6	16.60	21.00	21.00	22.50									Mudstone / Coal Bands	16.0 Full			0.020	0.20	0.22
X 5	18-Sep-23	81	30.0	17.0	17.00	21.00	21.00	22.30									Mudstone / Coal bands	16.0 Full			0.015	0.15	0.17
X 6	15-Sep-23	79	30.0	16.1	16.10	19.70	19.70	21.00									Mudstone / Coal bands	16.0 Full			0.015	0.15	0.17
X 7	18-Sep-23	79	30.0	17.0	17.00	19.00	19.00	20.30									Mudstone / Coal bands	16.0 Full			0.018	0.18	0.20
X 8	18-Sep-23	79	30.0	16.6	16.60	17.50	17.50	19.00									Mudstone / Coal bands	16.0 Full			0.015	0.15	0.17
TH 1	17-Oct-23	90	30.0	16.3	16.30	27.00			27.00	28.00							Mudstone / Soft Grout	16.0 Full			0.260		0.26
Count		173	173	173	169	169	42	42	15	15								173			173	150	173
Sum			5200.0	2806.8	2741.9	4652.1	869.0	919.7	369.5	389.7								2769.0			8.30	35.21	43.51
Maximum			42.0	18.8	18.8	42.0	28.8	30.0	29.0	30.5								17.0			0.26	1.00	1.10
Minimum			23.0	15.2	15.2	16.5	16.0	16.5	19.5	21.5								16.0			0.02	0.15	0.17
Average			30.1	16.2	16.2	27.5	20.7	21.9	24.6	26.0								16.0			0.05	0.23	0.25

VE224505-01 Manchester City Football Ground – Drilling Summary



VE224505-01 Manchester City Football Ground – Grouting Summary



APPENDIX E

CUBE TEST RESULTS



CONCRETE TEST CUBE REPORT



Date: 04/09/2023

Report no: WAB51461540_01

Client: VAN ELLE LTD

Scheme: 224505-01 MCFC Stand, Ashton New Road M11 3FF

Contract no: 51076309

Request Sheet No.	Lab Ref.	Client Ref.	Date Made	Time Made	Date Received in Laboratory	Date Tested	Age days	Dimensions mm	Density kg/m ³	Failure Load kN	Compressive Strength N/mm ²	Specified Strength N/mm ²
4422067	51461540	C1	04/08/2023	1000	09/08/2023	01/09/2023	28	100x100x100	1680	147.9	14.8	10.0
Location: MUFC STAND 224505-01												
Mix details: 10-1 PFA OPC												

The following apply unless otherwise stated under Remarks.

- 1) Laboratory curing range 18°-22°C.
- 2) Cube appearance as received satisfactory.
- 3) Test moisture condition and density saturated.
- 4) Cube failure normal. Concrete appearance normal.
- 5) Volume determined by measurement or designated size. Any fins removed by abrasive stone.
- 6) Laboratory curing conditions cannot be assured during tank cleaning.
- 7) Certificate of sampling not received. Certificate of making and curing not received.
- 8) Rate of Loading 0.4 to 0.8 N/mm² per sec.

Certified that curing of the hardened concrete in the laboratory and testing for shape, dimensions, density and compressive strength was carried out in accordance with BS EN 12390-1:2021, BS EN 12390-2:2019, BS EN 12390-7:2019 and BS 12390-3:2019
Air Content determined in accordance with BS EN 12350-7:2019, Slump test carried out in accordance with BS EN 12350-2:2019

Signed

Julie Schofield - Concrete Section Manager

for and on behalf of SOCOTEC UK Limited

Issued to: Paul Grocott, VAN ELLE LTD

CONCRETE TEST CUBE REPORT



Date: 06/09/2023

Report no: WAB51461544_01

Client: VAN ELLE LTD

Scheme: 224505-01 MCFC Stand, Ashton New Road M11 3FF

Contract no: 51076309

Request Sheet No.	Lab Ref.	Client Ref.	Date Made	Time Made	Date Received in Laboratory	Date Tested	Age days	Dimensions mm	Density kg/m ³	Failure Load kN	Compressive Strength N/mm ²	Specified Strength N/mm ²
4422068	51461544	C2	08/08/2023	1200	09/08/2023	05/09/2023	28	100x100x100	1660	148.9	14.9	not given
Location: MUFC STAND 224505-01												
Mix details: NOT INDICATED												

The following apply unless otherwise stated under Remarks.

- 1) Laboratory curing range 18°-22°C.
- 2) Cube appearance as received satisfactory.
- 3) Test moisture condition and density saturated.
- 4) Cube failure normal. Concrete appearance normal.
- 5) Volume determined by measurement or designated size. Any fins removed by abrasive stone.
- 6) Laboratory curing conditions cannot be assured during tank cleaning.
- 7) Certificate of sampling not received. Certificate of making and curing not received.
- 8) Rate of Loading 0.4 to 0.8 N/mm² per sec.

Certified that curing of the hardened concrete in the laboratory and testing for shape, dimensions, density and compressive strength was carried out in accordance with BS EN 12390-1:2021, BS EN 12390-2:2019, BS EN 12390-7:2019 and BS 12390-3:2019
Air Content determined in accordance with BS EN 12350-7:2019, Slump test carried out in accordance with BS EN 12350-2:2019

Signed

Julie Schofield - Concrete Section Manager

for and on behalf of SOCOTEC UK Limited

Issued to: Paul Grocott, VAN ELLE LTD

29 Rufford Court
Woolston
Warrington
WA1 4RF
United Kingdom
Tel: +44(0) 1925 286220

CONCRETE TEST CUBE REPORT



Date: 06/10/2023

Report no: WAB51470771_01

Client: VAN ELLE LTD

Scheme: 224505-01 MCFC Stand, Ashton New Road M11 3FF

Contract no: 51076309

Request Sheet No.	Lab Ref.	Client Ref.	Date Made	Time Made	Date Received in Laboratory	Date Tested	Age days	Dimensions mm	Density kg/m ³	Failure Load kN	Compressive Strength N/mm ²	Specified Strength N/mm ²
4422069	51470771	3	07/09/2023	0900	08/09/2023	05/10/2023	28	100x100x100	1310	59.9	6.0	not given
Location: NOT INDICATED												
Mix details: PFA-OPC 10-1												

The following apply unless otherwise stated under Remarks.

- 1) Laboratory curing range 18°-22°C.
- 2) Cube appearance as received satisfactory.
- 3) Test moisture condition and density saturated.
- 4) Cube failure normal. Concrete appearance normal.
- 5) Volume determined by measurement or designated size. Any fins removed by abrasive stone.
- 6) Laboratory curing conditions cannot be assured during tank cleaning.
- 7) Certificate of sampling not received. Certificate of making and curing not received.
- 8) Rate of Loading 0.4 to 0.8 N/mm² per sec.

Certified that curing of the hardened concrete in the laboratory and testing for shape, dimensions, density and compressive strength was carried out in accordance with BS EN 12390-1:2021, BS EN 12390-2:2019, BS EN 12390-7:2019 and BS 12390-3:2019
Air Content determined in accordance with BS EN 12350-7:2019, Slump test carried out in accordance with BS EN 12350-2:2019

Signed

Julie Schofield - Concrete Section Manager

for and on behalf of SOCOTEC UK Limited

Issued to: Paul Grocott, VAN ELLE LTD

29 Rufford Court
Woolston
Warrington
WA1 4RF
United Kingdom
Tel: +44(0) 1925 286220

CONCRETE TEST CUBE REPORT



Date: 13/10/2023

Report no: WAB51472916_01

Client: VAN ELLE LTD

Scheme: 224505-01 MCFC Stand, Ashton New Road M11 3FF

Contract no: 51076309

Request Sheet No.	Lab Ref.	Client Ref.	Date Made	Time Made	Date Received in Laboratory	Date Tested	Age days	Dimensions mm	Density kg/m ³	Failure Load kN	Compressive Strength N/mm ²	Specified Strength N/mm ²
4422070	51472916	3	14/09/2023	0850	15/09/2023	12/10/2023	28	100x100x100	1610	118.9	11.9	not given
Location: NORTH STAND												
Mix details: PFA-OPC 10-1												

The following apply unless otherwise stated under Remarks.

- 1) Laboratory curing range 18°-22°C.
- 2) Cube appearance as received satisfactory.
- 3) Test moisture condition and density saturated.
- 4) Cube failure normal. Concrete appearance normal.
- 5) Volume determined by measurement or designated size. Any fins removed by abrasive stone.
- 6) Laboratory curing conditions cannot be assured during tank cleaning.
- 7) Certificate of sampling not received. Certificate of making and curing not received.
- 8) Rate of Loading 0.4 to 0.8 N/mm² per sec.

Certified that curing of the hardened concrete in the laboratory and testing for shape, dimensions, density and compressive strength was carried out in accordance with BS EN 12390-1:2021, BS EN 12390-2:2019, BS EN 12390-7:2019 and BS 12390-3:2019
Air Content determined in accordance with BS EN 12350-7:2019, Slump test carried out in accordance with BS EN 12350-2:2019

Signed

Julie Schofield - Concrete Section Manager

for and on behalf of SOCOTEC UK Limited

Issued to: Paul Grocott, VAN ELLE LTD