Our Ref: A090070-332/SK/SM

By Email Only

Colin Davidson
WYG Engineering
Geneva Building
Lake View Drive
Sherwood Business Park
Annesley
Nottingham
NG15 0ED

24 November 2017

HIGH STREET, SHAFTON - SOAKAWAY TESTING

Colin,

Further to our proposal dated August 2017 we can confirm that WYG have undertaken the above works at the High Street, Shafton site. Please find below the relevant information from the investigation.

To enable soakaway testing to be carried out three trial pits were excavated by a 3 tonne JCB 3CX excavator to a maximum depth of 2.5mbgl. Trial pits not completing at the 2.5mbgl target depth were terminated due to difficulty of excavation. Following completion of the testing all excavations were backfilled with arisings which were compacted in layers up to ground level.

The locations of the soakaway tests are shown in the exploratory hole location plan attached as Appendix A. Photographs of the site investigation are included as Appendix B.

Geological Conditions

All exploratory locations displayed TOPSOIL comprising dark brown slightly clayey SAND to an average depth of 0.3mbgl overlying superficial deposits comprising firm light brown to light grey sandy CLAY to depths of between 1.55 and 1.70mbgl.

The solid geology varied across the site where trial pits SO01 and SO02 encountered extremely weak friable dark grey mottled black weathered MUDSTONE to 2.5 and 2.3mbgl respectively. SO03 encountered weak light brown tabular micaceous SANDSTONE underlying superficial clay deposits to 1.7mbgl. The mudstone and sandstone encountered at the base of the trial pits attributing to the Pennine Lower Coal Measures.

Groundwater was not encountered during site works. Details of the ground conditions can be seen in the exploratory trial pit logs attached as Appendix C.

Laboratory Geotechnical Results

Three bulk samples were taken from the recovered material at each trial pit location and selected samples were sent to a UKAS accredited geotechnical laboratory for particle size distribution (PSD) testing. The results can be found attached as Appendix D and is summarised in Table 1 below:

Table 1: Summary of Particle Size Distribution Grading

Location Reference	Depth (mbgl)	Silt/Clay Content (%)	Sand Content (%)	Gravel Content (%)	Cobble Content (%)	Moisture Content (%)
SO01	0.3 - 2.5	70	4	26	0	13
SO02	0.3 - 1.8	95	5	0	0	34
SO03	0.5 - 1.5	19	18	63	0	8.3

Soakaway Testing

A single soakaway test was undertaken at each location, due to poor soakage three full tests were not achieved. SO01, SO02 and SO03 were filled to 0.59, 0.59 and 0.50mbgl respectively.

The soakaway tests were carried out and results calculated in accordance with BRE Digest 365 Soakaway Design. Rates of infiltration was measured using data loggers. Manual measurements we taken for the first 10 minutes and sporadically throughout the test as a backup for the electronic data.

The infiltration rate was calculated using the following formula:

$$f = \frac{V_{p75-25}}{a_{p50} \times t_{p75-25}}$$

Where:

f = soil infiltration rate (m/s)

V_{p75-25} = the effective storage volume of water in the trial pit between 75 % and 25 % effective depth.

a_{p50} = the internal surface area of the trial pit up to 50 % effective depth and including the base area

t_{p75-25} = the time for the water level to fall from 75 % to 25 % effective depth.

The soil infiltration rates are summarised in Table 2 below and can be seen on graphical plots as Appendix E.

Table 2: Summary of Soakaway Test Results

Location Reference	Stratum	Infiltration Rate (m/s)	Average Site Infiltration Rate (m/s)
SO01	Clay / Mudstone	$1.40E^{-07}$	$9.61E^{-07}$
SO02	Clay / Mudstone	$9.75E^{-07}$	
SO03	Clay / Sandstone	$1.77E^{-06}$	

Summary & Recommendations

Due to poor soakage, a single test was completed within all soakaway test locations to determine permeability of the deposits at the site.

Superficial clay deposits was encountered to depths of between 1.55 and 1.70mbgl with mudstone and sandstone attributing to the Lower Pennine Coal Measures underlying creating the base of the trial pits.

Infiltration rates were calculated as $1.40E^{-07}$, $9.75E^{-07}$ and $1.77E^{-06}$ within SO01, SO02 and SO03 respectively with an average site soil infiltration rate of $9.61E^{-07}$.

Based on the results of the soakaway testing, soakaways are not considered to be a viable drainage solution. It is therefore recommended that drainage should be via conventional piped gravity system to a suitable outfall location to be agreed with the regulator / local drainage authority.

Please do not hesitate to contact me if you have any queries.

Yours sincerely



Sean King
Geo-Environmental Consultant
WYG Environment

Appendix A – Exploratory Hole Location Plan

Project Id:	A090070-332	Title:	Site Plan
Project Title:	High Street, Shafton	Scale:	1:1000
Location:	Barnsley	Engineer:	WYG
Client:	WYG	Contractor:	WYG

Legend Key

- Locations By Type - Empty
- Locations By Type - TP



Appendix B – Site Photographs



Photograph No. 1



Photograph No. 2

WYG EPT
Geneva Building
Lake View Drive
Sherwood Park
Annesley
Nottinghamshire
NG15 0ED

Tel: 01623 684550
E-mail: nottingham@wyg.com

Environmental Consultancy
Ground Technologies & Investigation

Project:- High Street, Shafton

Client: WYG

Project No:- A090070-332

Date: 02/11/2017



Photograph No. 3



Photograph No. 4

WYG EPT
Geneva Building
Lake View Drive
Sherwood Park
Annesley
Nottinghamshire
NG15 0ED

Tel: 01623 684550
E-mail: nottingham@wyg.com

Environmental Consultancy
Ground Technologies & Investigation

Project:- High Street, Shafton

Client: WYG

Project No:- A090070-332

Date: 02/11/2017

Appendix C – Trial Pit Logs

Project: **High Street, Shafton**	Location Details	Status	Pit Number
Location: **Barnsley**	Easting: 439407.00 Northing: 410882.00	DRAFT	**SO01**
Client: **WYG**	Level: 80.00mAOD Depth: 2.50m		Sheet 1 of 1
	Logger: SK Type: TP		

Hole Information		Groundwater				Scale: 1:25
Pit Dimensions	Orientation: °	Strike (m)	Rose To (m)	After (mins)	Remarks	Checked By: SM
0.60m / 2.10m	Shoring: None					Approved By: SDC
	Stability: Stable					Start Date: 02/11/2017
	Plant: JCB 3CX					Finish Date: 02/11/2017

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Backfill	Samples and Testing: Depth (m)	Ref	Tests / Results
Grass over TOPSOIL comprising dark brown slightly clayey SAND.								
Firm light brown to light grey sandy CLAY.		0.25	79.75			0.30 - 2.50	B1	
Extremely weak friable dark grey mottled black weathered MUDSTONE. (PENNINE LOWER COAL MEASURES)		1.70	78.30					
EOH at 2.50m - Full Depth		2.50	77.50					

Observations / Remarks

Soakaway test undertaken.

Project Number

A090070-332

Project: **High Street, Shafton**	Location Details	Status	Pit Number
Location: **Barnsley**	Easting: 439363.00 Northing: 410849.00	DRAFT	**SO02**
Client: **WYG**	Level: 81.00mAOD Depth: 2.30m		Sheet 1 of 1
	Logger: SK Type: TP		

Hole Information		Groundwater				Scale: 1:25
Pit Dimensions	Orientation: °	Strike (m)	Rose To (m)	After (mins)	Remarks	Checked By: SM
0.60m / 2.80m	Shoring: None					Approved By: SDC
	Stability: Stable					Start Date: 02/11/2017
	Plant: JCB 3CX					Finish Date: 02/11/2017

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Backfill	Samples and Testing: Depth (m)	Ref	Tests / Results
Grass over TOPSOIL comprising dark brown slightly clayey SAND.								
Firm light brown to light grey slightly sandy CLAY.		0.30	80.70			0.30 - 1.80	B1	
Extremely weak friable dark grey mottled black weathered MUDSTONE. (PENNINE LOWER COAL MEASURES)		1.70	79.30			1.80 - 2.20	B2	
EOH at 2.30m - Difficulty of Excavation.		2.30	78.70					

Observations / Remarks

Soakaway test undertaken.

Project Number

A090070-332

Project: **High Street, Shafton**	Location Details	Status	Pit Number
Location: **Barnsley**	Easting: 439333.00 Northing: 410823.00	DRAFT	**SO03**
Client: **WYG**	Level: 81.00mAOD Depth: 1.70m		Sheet 1 of 1
	Logger: SK Type: TP		

Hole Information		Groundwater				Scale: 1:25
Pit Dimensions	Orientation: °	Strike (m)	Rose To (m)	After (mins)	Remarks	Checked By: SM
0.60m / 2.80m	Shoring: None					Approved By: SDC
	Stability: Stable					Start Date: 02/11/2017
	Plant: JCB 3CX					Finish Date: 02/11/2017

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Backfill	Samples and Testing: Depth (m)	Ref	Tests / Results
Grass over TOPSOIL comprising dark brown slightly clayey SAND.								
Firm light brown to light grey slightly sandy CLAY.		0.40	80.60			0.50 - 1.50	B1	
Weak light brown tabular micaceous SANDSTONE.		1.55	79.45			1.60 - 1.70	B2	
EOH at 1.70m - Difficulty of Excavation.		1.70	79.30					

Observations / Remarks

Soakaway test undertaken.

Project Number

A090070-332

Appendix D – Geotechnical Laboratory Results

Nicholls Colton Group
7 - 11 Harding Street
Leicester
LE1 4DH

Nicholls Colton Group

Cover Sheet

WYG
Geneva Building
Lake View Drive
Sherwood Business Park
Annesley
Nottingham
NG15 0ED

Analytical Test Report: L17/2546/WYG/001

Your Project Reference:	**High Street, Shafton**	Samples Received on:	15.11.2017
Your Order Number:	NOT/1190	Testing Instruction Received:	15.11.2017
Report Issue Number:	1	Sample Tested :	16 to 22.11.2017
Samples Analysed	3 Soils	Report issued:	23.11.2017

Signed

Lee Harbottle
GCM Operations Manager
Nicholls Colton Group

Notes:

Samples will be retained for 14 days after issue of this report unless otherwise requested.

Sample preparation was in accordance with BS1377:Part 1:2016.

The results included within the report are representative of the samples submitted for analysis.

A certificate of sampling was not supplied.

Samples were provided by client

1377 Moisture Content

Moisture content testing was in accordance with BS1377 : Part 2 :1990 Clause 3.2.3.2 (medium).

1377 Particle Size Distribution

Testing was in accordance with BS1377:Part 2:1990 clause 9.2 wet sieving method

Date of Issue 10.03.2017

Owned by Emily Blissett - Customer Services Supervisor

Authorised by James Gane - Commercial Manager

G:\LE1 Production\Commercial\Current Reports\2017\L17\WYG - WYG Nottingham\L17-2546-WYG\[L17-2546-WYG 001.xlsx]Cover Sheet

Nicholls Colton Group
7 - 11 Harding Street
Leicester
LE1 4DH

L17/2546/WYG/001

High Street, Shafton

Material Analysis Results

NC Reference		17-37413	17-37414	17-37415
Client Sample Reference		S001	S002	S003
Date of Sampling		02.11.2017	02.11.2017	02.11.2017
Sample type		Disturbed	Disturbed	Disturbed
Visual Description		Brown clay and mudstone.	Brown clay.	Dark grey clay and mudstone.
BS Test Sieve (mm)	**Units**			
300	**% Passing**	100	100	100
125.0	**% Passing**	100	100	100
90.0	**% Passing**	100	100	100
75.0	**% Passing**	100	100	100
63.0	**% Passing**	100	100	100
50.0	**% Passing**	100	100	100
37.5	**% Passing**	97	100	98
28.0	**% Passing**	96	100	92
20.0	**% Passing**	91	100	84
14.0	**% Passing**	89	100	71
10.0	**% Passing**	84	100	63
6.3	**% Passing**	80	100	50
5.0	**% Passing**	78	100	47
3.35	**% Passing**	76	100	43
2.00	**% Passing**	74	100	37
1.18	**% Passing**	73	99	32
0.600	**% Passing**	73	98	27
0.425	**% Passing**	72	98	25
0.300	**% Passing**	72	97	23
0.212	**% Passing**	71	96	22
0.150	**% Passing**	71	96	21
0.063	**% Passing**	70	95	19
Moisture Content	**(%)**	13	34	8.3

Appendix E – Soakaway Test Results

BRE DIGEST 365 SOAKAWAY INFILTRATION RATE CALCULATION

The following spreadsheet calculations are based on the method given in BRE Digest 365

Note: enter values only in the yellow-highlighted cells - do not alter any other cell, even if it appears to be blank.

Project title:	High Street, Shafton, Barnsley			Project number:	A090070-332
Trial pit number:	SO01	Test number:	1	Date of test:	02/11/2017
Test carried out by:	SK	Calculations by:	SK	Verified by:	SDC

Details of pit

Actual depth of pit, D'	(m)	2.5
Effective depth of Pit, D (1)	(m)	1.91
Length of Pit, L	(m)	2.1
Width of Pit, W	(m)	0.6
Proportion of pit volume occupied by gravel solids, P_g (2)		0

Volume, V, of pit between 75% and 25% depths (m^3) = L x W x ½D =	1.20
Effective volume between 75% and 25% depths, V_{p75-25}, = V x P_g =	1.20
Internal surface area of pit up to 50% level, a_{p50}, (m^2) = area of 2 sides + 2 ends + base = (2 x L x ½D) + (2 x W x ½D) + (L x W)	6.42

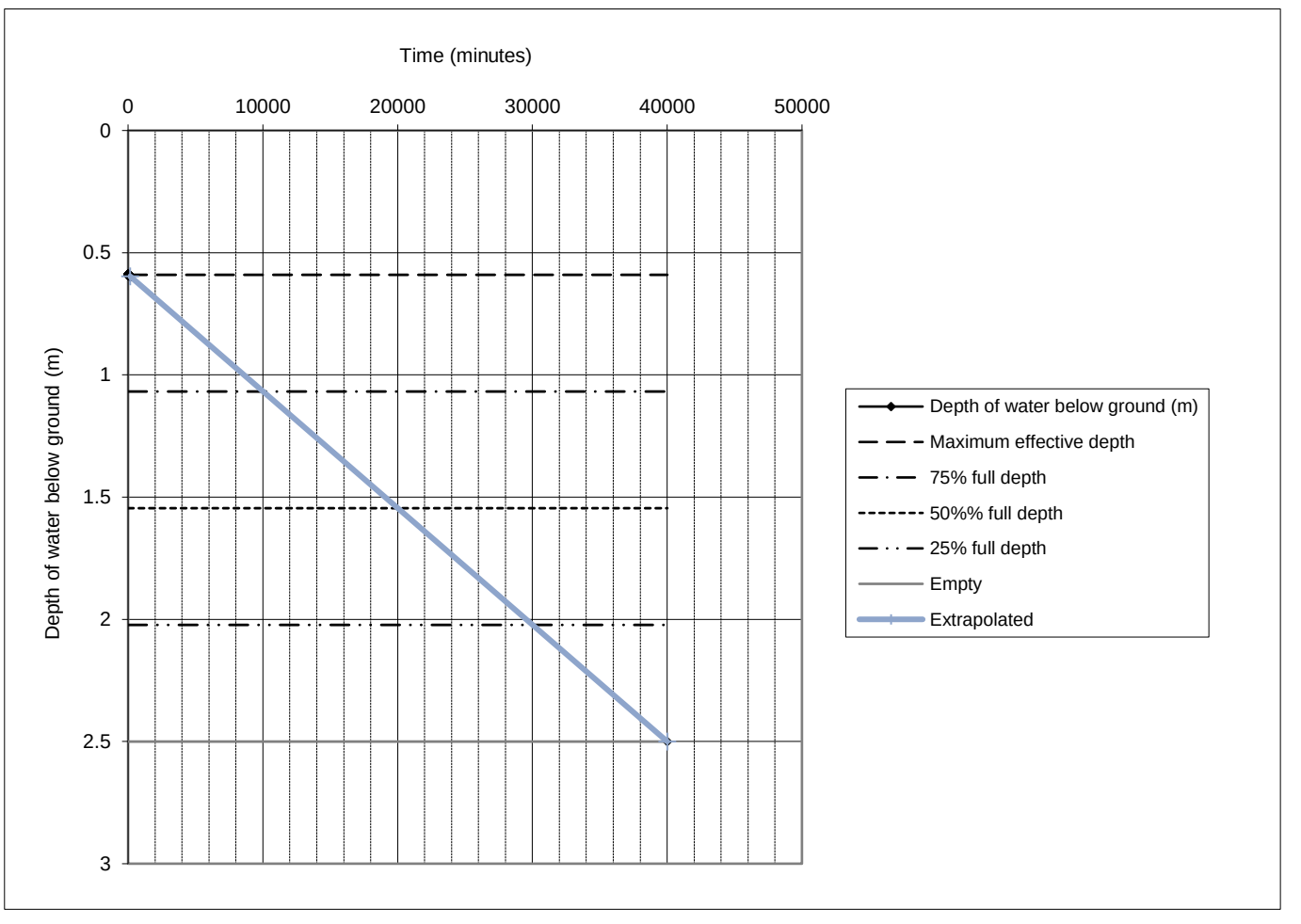
Notes:

(1) For a standard test in which the pit is filled with water, the effective depth will be equal to the actual depth. If the pit is not completely filled, it will be equal to the depth at the start of each test.

(2) Typically, for a gravel of dry density 18kN/m^3, specific gravity of rock solids 2.65, the proportion of volume occupied by rock is 0.69 (i.e. 69%). For dry density 16kN/m^3, the rock volume is 0.61 (61%), and for dry density 20kN/m^3, it is 0.77 (77%). If the pit is left open (gravel is not used) then put P_g = 0.

Water level readings

Time elapsed (min)	Depth of water below ground (m)
0	0.59
0.0833333	0.5902
0.1666667	0.5904
0.25	0.5899
0.3333333	0.5904
0.4166667	0.5902
0.5	0.5903
0.5833333	0.5898
0.6666667	0.5902
0.75	0.5902
0.8333333	0.5903
0.9166667	0.59
1	0.5901
1.0833333	0.5899
1.1666667	0.5898
1.25	0.5893
1.3333333	0.5897
1.4166667	0.5894
1.5	0.5892
1.5833333	0.5895
1.6666667	0.5893
1.75	0.5897
1.8333333	0.5893
1.9166667	0.5896
2	0.5892



Time t_{p25} at which water is at 75% of effective depth, from graph (minutes)	11500
Time t_{p75} at which water is at 25% of effective depth, from graph (minutes)	33800
Hence time t_{p75-25} for water to fall from 75% depth to 25% depth (minutes)	22300
Time t_{p75-25} (seconds)	1338000

Soil infiltration rate, $f = \frac{V_{p75-25}}{a_{p50} \times t_{p75-25}} = \frac{1.20}{6.42 \times 1338000}$

Hence, **Soil infiltration rate, f = 1.40E-07** m/s

BRE DIGEST 365 SOAKAWAY INFILTRATION RATE CALCULATION

The following spreadsheet calculations are based on the method given in BRE Digest 365

Note: enter values only in the yellow-highlighted cells - do not alter any other cell, even if it appears to be blank.

Project title:	High Street, Shafton, Barnsley			Project number:	A090070-332
Trial pit number:	SO01	Test number:	1	Date of test:	02/11/2017
Test carried out by:	SK	Calculations by:	SK	Verified by:	SDC

Details of pit

Actual depth of pit, D'	(m)	2.5
Effective depth of Pit, D [(1)]	(m)	1.91
Length of Pit, L	(m)	2.1
Width of Pit, W	(m)	0.6
Proportion of pit volume occupied by gravel solids, P_g [(2)]		0

Volume, V, of pit between 75% and 25% depths (m^3) = L x W x ½D =	1.20
Effective volume between 75% and 25% depths, V_{p75-25}, = V x P_g =	1.20
Internal surface area of pit up to 50% level, a_{p50}, (m^2) = area of 2 sides + 2 ends + base = (2 x L x ½D) + (2 x W x ½D) + (L x W)	6.42

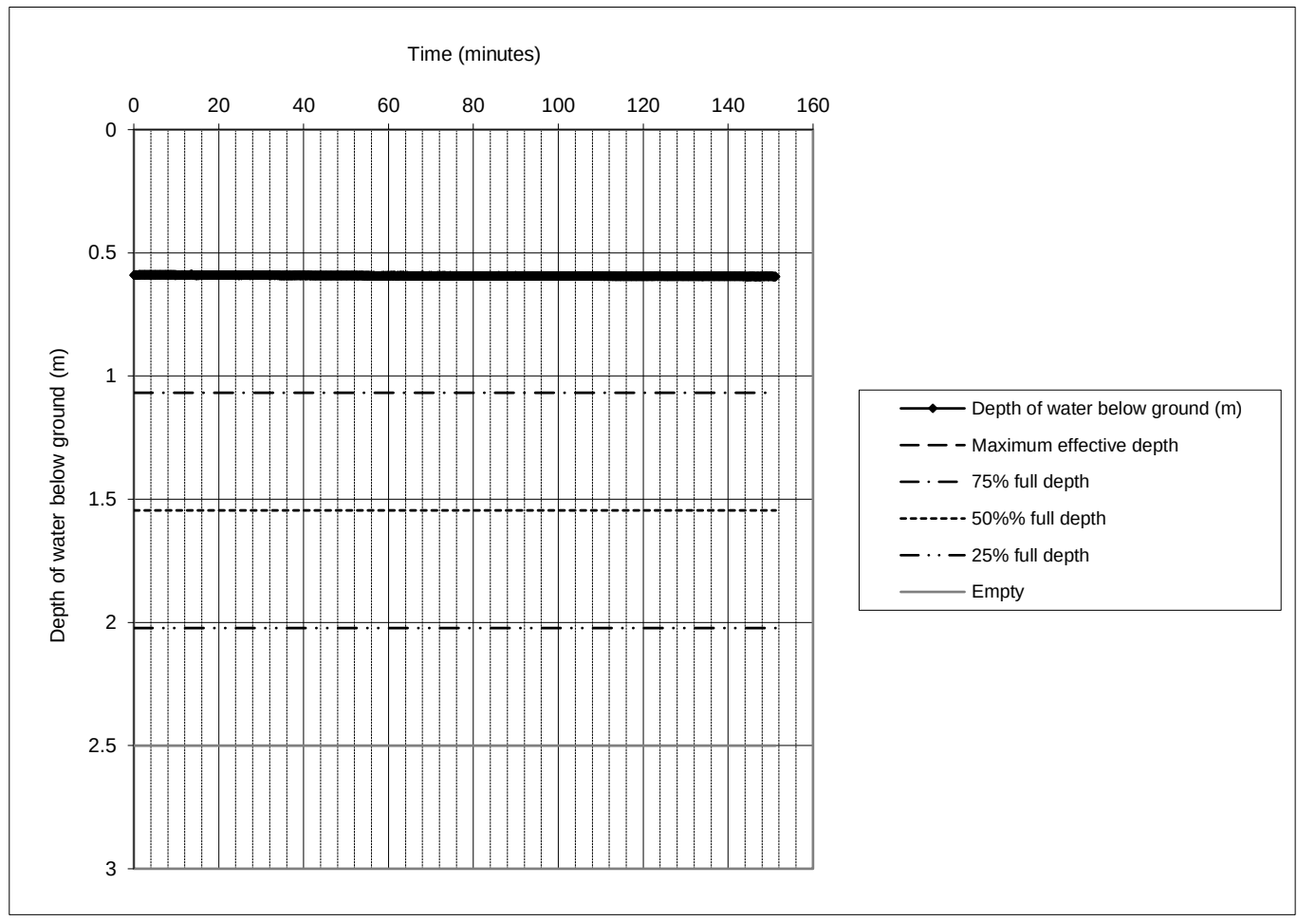
Notes:

(1) For a standard test in which the pit is filled with water, the effective depth will be equal to the actual depth. If the pit is not completely filled, it will be equal to the depth at the start of each test.

(2) Typically, for a gravel of dry density 18kN/m^3, specific gravity of rock solids 2.65, the proportion of volume occupied by rock is 0.69 (i.e. 69%). For dry density 16kN/m^3, the rock volume is 0.61 (61%), and for dry density 20kN/m^3, it is 0.77 (77%). If the pit is left open (gravel is not used) then put P_g = 0.

Water level readings

Time elapsed (min)	Depth of water below ground (m)
0	0.59
0.0833333	0.5902
0.1666667	0.5904
0.25	0.5899
0.3333333	0.5904
0.4166667	0.5902
0.5	0.5903
0.5833333	0.5898
0.6666667	0.5902
0.75	0.5902
0.8333333	0.5903
0.9166667	0.59
1	0.5901
1.0833333	0.5899
1.1666667	0.5898
1.25	0.5893
1.3333333	0.5897
1.4166667	0.5894
1.5	0.5892
1.5833333	0.5895
1.6666667	0.5893
1.75	0.5897
1.8333333	0.5893
1.9166667	0.5896
2	0.5892



Time t_{p25} at which water is at 75% of effective depth, from graph (minutes)	11500
Time t_{p75} at which water is at 25% of effective depth, from graph (minutes)	33800
Hence time t_{p75-25} for water to fall from 75% depth to 25% depth (minutes)	22300
Time t_{p75-25} (seconds)	1338000

Soil infiltration rate, $f = \frac{V_{p75-25}}{a_{p50} \times t_{p75-25}} = \frac{1.20}{6.42 \times 1338000}$

Hence, **Soil infiltration rate, f = 1.40E-07** m/s

BRE DIGEST 365 SOAKAWAY INFILTRATION RATE CALCULATION

The following spreadsheet calculations are based on the method given in BRE Digest 365

Note: enter values only in the yellow-highlighted cells - do not alter any other cell, even if it appears to be blank.

Project title:	High Street, Shafton, Barnsley			Project number:	A090070-332
Trial pit number:	SO02	Test number:	1	Date of test:	02/11/2017
Test carried out by:	SK	Calculations by:	SK	Verified by:	SDC

Details of pit

Actual depth of pit, D'	(m)	2.3
Effective depth of Pit, D (1)	(m)	1.71
Length of Pit, L	(m)	2.8
Width of Pit, W	(m)	0.6
Proportion of pit volume occupied by gravel solids, P_g (2)		0

Volume, V, of pit between 75% and 25% depths (m^3) = L x W x ½D =	1.44
Effective volume between 75% and 25% depths, V_{p75-25}, = V x P_g =	1.44
Internal surface area of pit up to 50% level, a_{p50}, (m^2) = area of 2 sides + 2 ends + base = (2 x L x ½D) + (2 x W x ½D) + (L x W)	7.49

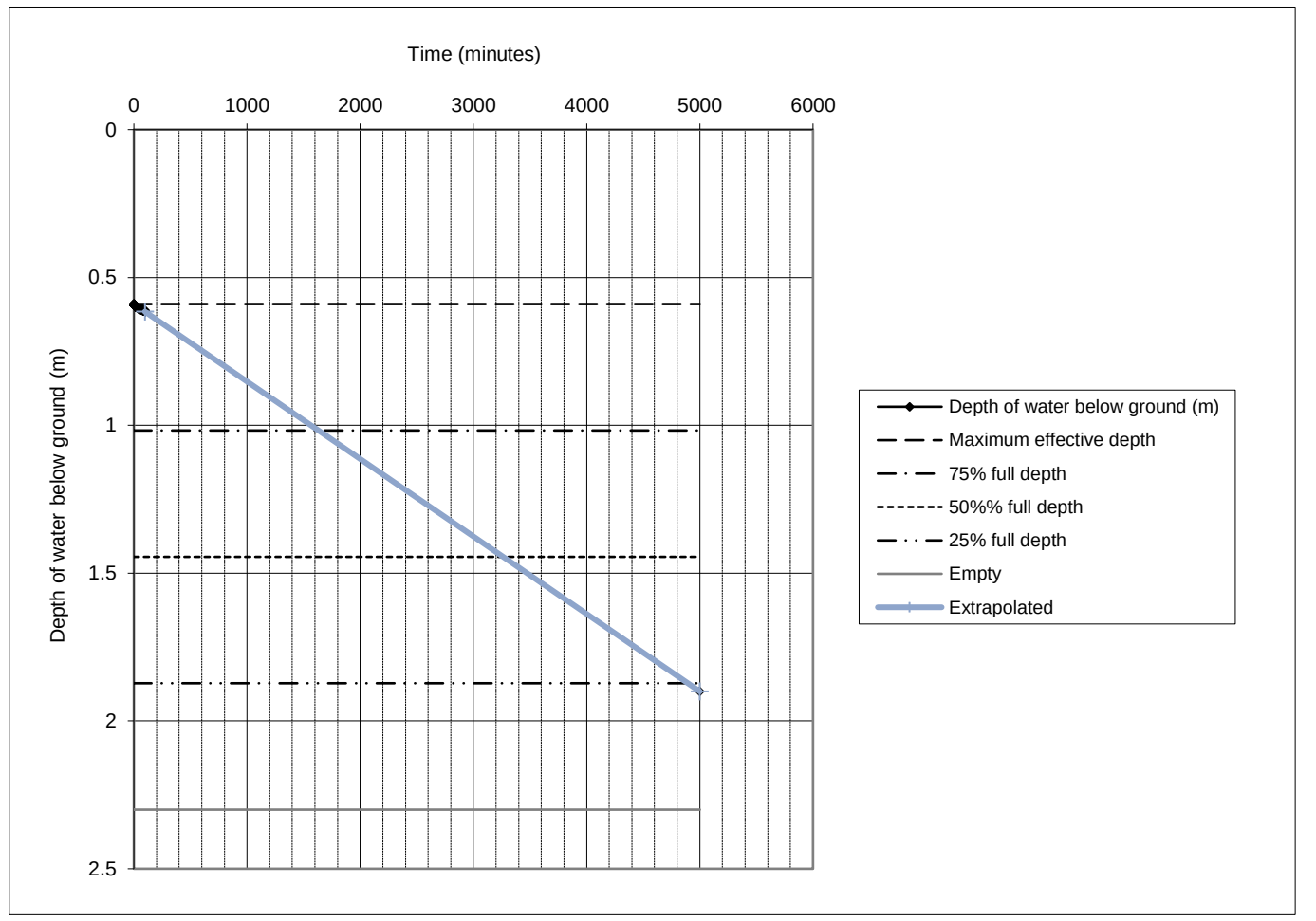
Notes:

(1) For a standard test in which the pit is filled with water, the effective depth will be equal to the actual depth. If the pit is not completely filled, it will be equal to the depth at the start of each test.

(2) Typically, for a gravel of dry density 18kN/m^3, specific gravity of rock solids 2.65, the proportion of volume occupied by rock is 0.69 (i.e. 69%). For dry density 16kN/m^3, the rock volume is 0.61 (61%), and for dry density 20kN/m^3, it is 0.77 (77%). If the pit is left open (gravel is not used) then put P_g = 0.

Water level readings

Time elapsed (min)	Depth of water below ground (m)
0	0.59
0.0833333	0.5904
0.1666667	0.5905
0.25	0.5906
0.3333333	0.591
0.4166667	0.5904
0.5	0.5908
0.5833333	0.5913
0.6666667	0.5915
0.75	0.591
0.8333333	0.5914
0.9166667	0.5914
1	0.5915
1.0833333	0.5919
1.1666667	0.5916
1.25	0.5911
1.3333333	0.5917
1.4166667	0.5916
1.5	0.5919
1.5833333	0.5915
1.6666667	0.5918
1.75	0.5918
1.8333333	0.5918
1.9166667	0.5918
2	0.5919



Time t_{p25} at which water is at 75% of effective depth, from graph (minutes)	1650
Time t_{p75} at which water is at 25% of effective depth, from graph (minutes)	4925
Hence time t_{p75-25} for water to fall from 75% depth to 25% depth (minutes)	3275
Time t_{p75-25} (seconds)	196500

Soil infiltration rate, $f = \frac{V_{p75-25}}{a_{p50} \times t_{p75-25}} = \frac{1.44}{7.49 \times 196500}$

Hence, **Soil infiltration rate, f = 9.75E-07** m/s

BRE DIGEST 365 SOAKAWAY INFILTRATION RATE CALCULATION

The following spreadsheet calculations are based on the method given in BRE Digest 365

Note: enter values only in the yellow-highlighted cells - do not alter any other cell, even if it appears to be blank.

Project title:	High Street, Shafton, Barnsley			Project number:	A090070-332
Trial pit number:	SO02	Test number:	1	Date of test:	02/11/2017
Test carried out by:	SK	Calculations by:	SK	Verified by:	SDC

Details of pit

Actual depth of pit, D'	(m)	2.3
Effective depth of Pit, D [(1)]	(m)	1.71
Length of Pit, L	(m)	2.8
Width of Pit, W	(m)	0.6
Proportion of pit volume occupied by gravel solids, P_g [(2)]		0

Volume, V, of pit between 75% and 25% depths (m^3) = L x W x ½D =	1.44
Effective volume between 75% and 25% depths, V_{p75-25}, = V x P_g =	1.44
Internal surface area of pit up to 50% level, a_{p50}, (m^2) = area of 2 sides + 2 ends + base = (2 x L x ½D) + (2 x W x ½D) + (L x W)	7.49

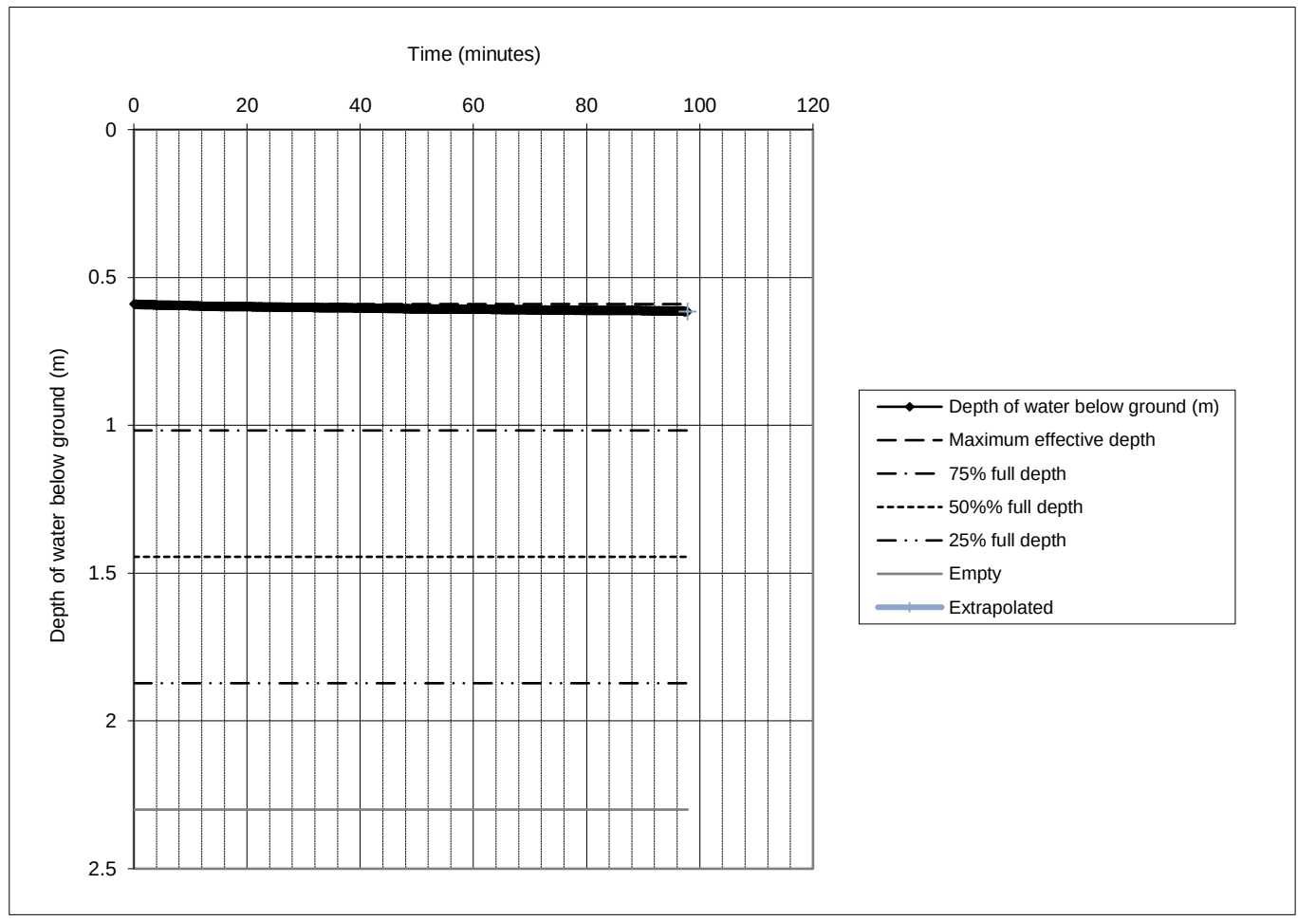
Notes:

(1) For a standard test in which the pit is filled with water, the effective depth will be equal to the actual depth. If the pit is not completely filled, it will be equal to the depth at the start of each test.

(2) Typically, for a gravel of dry density 18kN/m^3, specific gravity of rock solids 2.65, the proportion of volume occupied by rock is 0.69 (i.e. 69%). For dry density 16kN/m^3, the rock volume is 0.61 (61%), and for dry density 20kN/m^3, it is 0.77 (77%). If the pit is left open (gravel is not used) then put P_g = 0.

Water level readings

Time elapsed (min)	Depth of water below ground (m)
0	0.59
0.0833333	0.5904
0.1666667	0.5905
0.25	0.5906
0.3333333	0.591
0.4166667	0.5904
0.5	0.5908
0.5833333	0.5913
0.6666667	0.5915
0.75	0.591
0.8333333	0.5914
0.9166667	0.5914
1	0.5915
1.0833333	0.5919
1.1666667	0.5916
1.25	0.5911
1.3333333	0.5917
1.4166667	0.5916
1.5	0.5919
1.5833333	0.5915
1.6666667	0.5918
1.75	0.5918
1.8333333	0.5918
1.9166667	0.5918
2	0.5919



Time t_{p25} at which water is at 75% of effective depth, from graph (minutes)	1650
Time t_{p75} at which water is at 25% of effective depth, from graph (minutes)	4925
Hence time t_{p75-25} for water to fall from 75% depth to 25% depth (minutes)	3275
Time t_{p75-25} (seconds)	196500

Soil infiltration rate, $f = \frac{V_{p75-25}}{a_{p50} \times t_{p75-25}} = \frac{1.44}{7.49 \times 196500}$

Hence, **Soil infiltration rate, f = 9.75E-07** m/s

BRE DIGEST 365 SOAKAWAY INFILTRATION RATE CALCULATION

The following spreadsheet calculations are based on the method given in BRE Digest 365

Note: enter values only in the yellow-highlighted cells - do not alter any other cell, even if it appears to be blank.

Project title:	High Steet, Shafton, Barnsley			Project number:	A090070-332
Trial pit number:	SO03	Test number:	1	Date of test:	02/11/2017
Test carried out by:	SK	Calculations by:	SK	Verified by:	SDC

Details of pit

Actual depth of pit, D'	(m)	1.7
Effective depth of Pit, D [(1)]	(m)	1.2
Length of Pit, L	(m)	2.8
Width of Pit, W	(m)	0.6
Proportion of pit volume occupied by gravel solids, P_g [(2)]		0

Volume, V, of pit between 75% and 25% depths (m^3) = L x W x ½D =	1.01
Effective volume between 75% and 25% depths, V_{p75-25}, = V x P_g =	1.01
Internal surface area of pit up to 50% level, a_{p50}, (m^2) = area of 2 sides + 2 ends + base = (2 x L x ½D) + (2 x W x ½D) + (L x W)	5.76

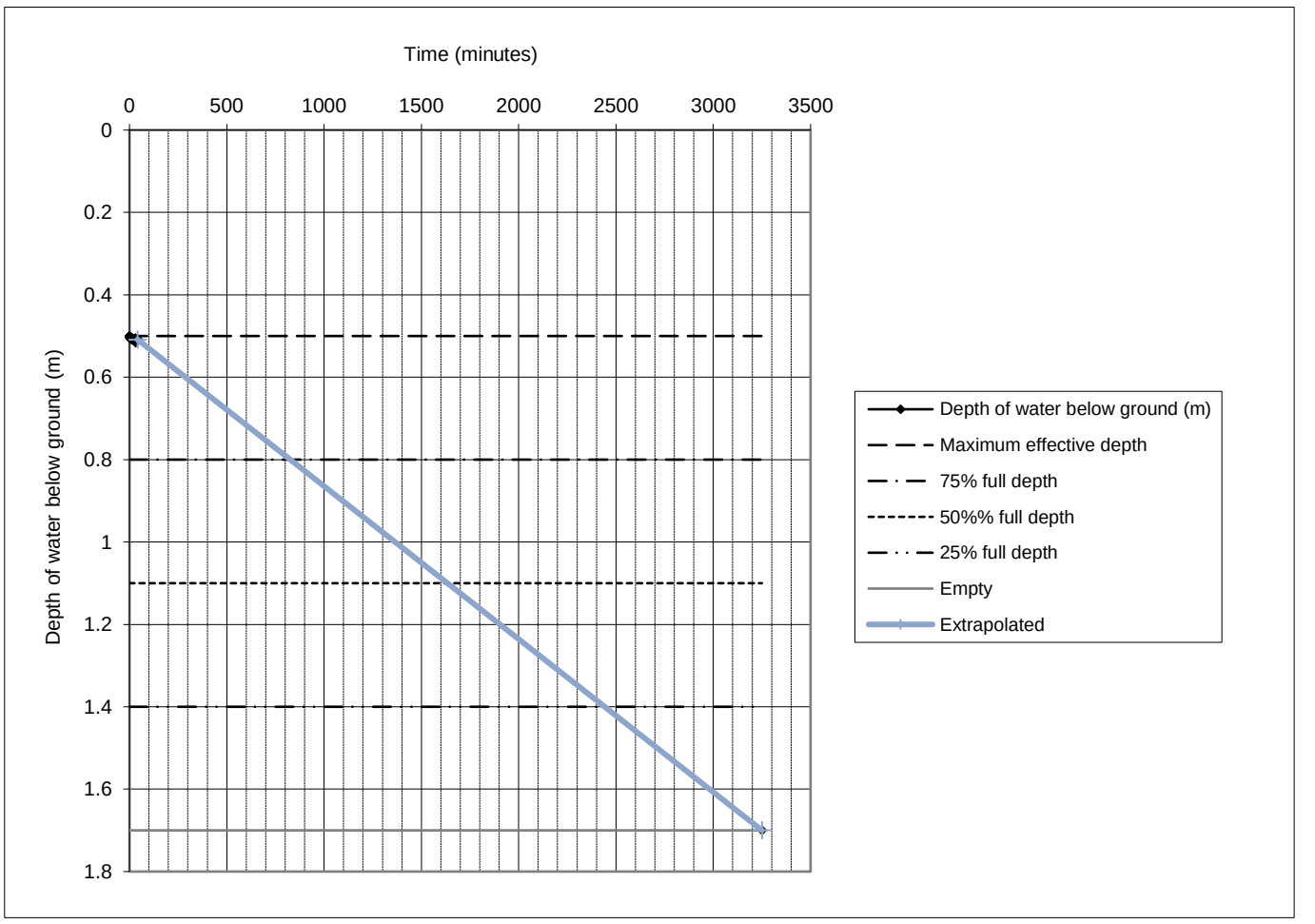
Notes:

(1) For a standard test in which the pit is filled with water, the effective depth will be equal to the actual depth. If the pit is not completely filled, it will be equal to the depth at the start of each test.

(2) Typically, for a gravel of dry density 18kN/m^3, specific gravity of rock solids 2.65, the proportion of volume occupied by rock is 0.69 (i.e. 69%). For dry density 16kN/m^3, the rock volume is 0.61 (61%), and for dry density 20kN/m^3, it is 0.77 (77%). If the pit is left open (gravel is not used) then put P_g = 0.

Water level readings

Time elapsed (min)	Depth of water below ground (m)
0	0.5
0.0833333	0.5006
0.1666667	0.5011
0.25	0.5007
0.3333333	0.5011
0.4166667	0.501
0.5	0.5009
0.5833333	0.5015
0.6666667	0.5014
0.75	0.5016
0.8333333	0.5018
0.9166667	0.5017
1	0.5017
1.0833333	0.5022
1.1666667	0.5022
1.25	0.5022
1.3333333	0.5025
1.4166667	0.5025
1.5	0.5027
1.5833333	0.5026
1.6666667	0.5022
1.75	0.5026
1.8333333	0.5026
1.9166667	0.5032
2	0.5032



Time t_{p25} at which water is at 75% of effective depth, from graph (minutes)	800
Time t_{p75} at which water is at 25% of effective depth, from graph (minutes)	2450
Hence time t_{p75-25} for water to fall from 75% depth to 25% depth (minutes)	1650
Time t_{p75-25} (seconds)	99000

Soil infiltration rate, $f = \frac{V_{p75-25}}{a_{p50} \times t_{p75-25}} = \frac{1.01}{5.76 \times 99000}$

Hence, **Soil infiltration rate, f = 1.77E-06** m/s

BRE DIGEST 365 SOAKAWAY INFILTRATION RATE CALCULATION

The following spreadsheet calculations are based on the method given in BRE Digest 365

Note: enter values only in the yellow-highlighted cells - do not alter any other cell, even if it appears to be blank.

Project title:	High Steet, Shafton, Barnsley			Project number:	A090070-332
Trial pit number:	SO03	Test number:	1	Date of test:	02/11/2017
Test carried out by:	SK	Calculations by:	SK	Verified by:	SDC

Details of pit

Actual depth of pit, D'	(m)	1.7
Effective depth of Pit, D (1)	(m)	1.2
Length of Pit, L	(m)	2.8
Width of Pit, W	(m)	0.6
Proportion of pit volume occupied by gravel solids, P_g (2)		0

Volume, V, of pit between 75% and 25% depths (m^3) = L x W x ½D =	1.01
Effective volume between 75% and 25% depths, V_{p75-25}, = V x P_g =	1.01
Internal surface area of pit up to 50% level, a_{p50}, (m^2) = area of 2 sides + 2 ends + base = (2 x L x ½D) + (2 x W x ½D) + (L x W)	5.76

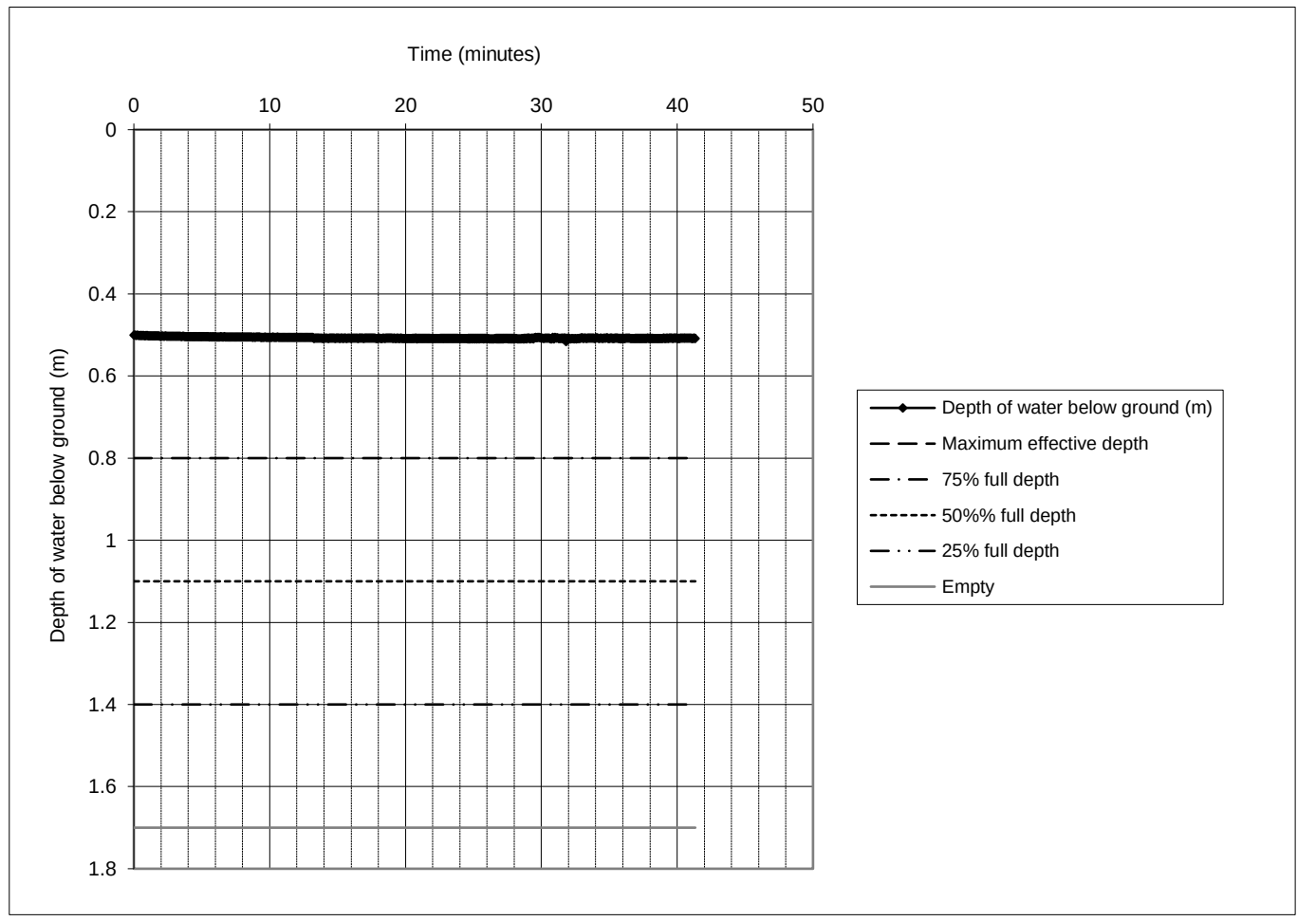
Notes:

(1) For a standard test in which the pit is filled with water, the effective depth will be equal to the actual depth. If the pit is not completely filled, it will be equal to the depth at the start of each test.

(2) Typically, for a gravel of dry density 18kN/m^3, specific gravity of rock solids 2.65, the proportion of volume occupied by rock is 0.69 (i.e. 69%). For dry density 16kN/m^3, the rock volume is 0.61 (61%), and for dry density 20kN/m^3, it is 0.77 (77%). If the pit is left open (gravel is not used) then put P_g = 0.

Water level readings

Time elapsed (min)	Depth of water below ground (m)
0	0.5
0.0833333	0.5006
0.1666667	0.5011
0.25	0.5007
0.3333333	0.5011
0.4166667	0.501
0.5	0.5009
0.5833333	0.5015
0.6666667	0.5014
0.75	0.5016
0.8333333	0.5018
0.9166667	0.5017
1	0.5017
1.0833333	0.5022
1.1666667	0.5022
1.25	0.5022
1.3333333	0.5025
1.4166667	0.5025
1.5	0.5027
1.5833333	0.5026
1.6666667	0.5022
1.75	0.5026
1.8333333	0.5026
1.9166667	0.5032
2	0.5032



Time t_{p25} at which water is at 75% of effective depth, from graph (minutes)	800
Time t_{p75} at which water is at 25% of effective depth, from graph (minutes)	2450
Hence time t_{p75-25} for water to fall from 75% depth to 25% depth (minutes)	1650
Time t_{p75-25} (seconds)	99000

Soil infiltration rate, $f = \frac{V_{p75-25}}{a_{p50} \times t_{p75-25}} = \frac{1.01}{5.76 \times 99000}$

Hence, **Soil infiltration rate, f = 1.77E-06** m/s

Appendix H

CCTV Survey Report

Land at Shafton Barnsley - CCTV Survey Report : 14/02/18

Name :	MIDLAND SURVEY
Contact :	
Location :	
Town :	
Region :	
Postcode :	
Tel :	
Mobile :	
Email :	
Fax :	

Client Information

Name :	WYG Engineering
Contact :	Colin Davidson
Location :	Geneva Building, Lake Veiw Drive
Town :	Annesley, Nottingham
Region :	
Postcode :	NG15 0ED
Tel :	
Mobile :	
Email :	
Fax :	

Site Information

Name :	
Contact :	
Location :	Shafton
Town :	Barnsley
Region :	S72 8PX
Postcode :	
Tel :	
Mobile :	
Email :	
Fax :	

Total grades for project

Grade 1 Defects	0	Grade 2 Defects	2	Grade 3 Defects	5	Grade 4 Defects	0	Grade 5 Defects	0

Graded defect count per section

This section shows the number of graded defects per individual survey. A grade 5 defect being serious and indicating more urgent repair. Grade 3-4 defects are less serious and are less urgent concerning repair. Grade 1-2 defects are relatively minor and could be monitored and/or repaired if thought necessary.

Section: 1 **Start:** mh01 ds mh02 **End:** mh02 **Road:** Shafton
Length: 27.9 **Use:** Surface Water **Depth:** **Place:** Barnsley
Structural Grade: 0 **Operational Grade:** 3 **DRB Grade:** B

From To	Dia	Material	G1 - 2	G3	G4	G5
00.0m - 27.9m	225	Vitrified Clay (i.e. all clayware)	0	2	0	0

Section: 2 **Start:** mh02 ds mh04 **End:** mh04 **Road:** Shafton
Length: 24 **Use:** Surface Water **Depth:** **Place:** Barnsley
Structural Grade: 0 **Operational Grade:** 0 **DRB Grade:**

From To	Dia	Material	G1 - 2	G3	G4	G5
00.0m - 24.0m	225	Vitrified Clay (i.e. all clayware)	0	0	0	0

Section: 3 **Start:** mh03 ds mh05 **End:** mh05 **Road:** Shafton
Length: 28.1 **Use:** Foul **Depth:** **Place:** Barnsley
Structural Grade: 0 **Operational Grade:** 5 **DRB Grade:** C

From To	Dia	Material	G1 - 2	G3	G4	G5
00.0m - 28.1m	150	Vitrified Clay (i.e. all clayware)	1	1	0	0

Section: 4 **Start:** mh06 ds mh osa **End:** mh osa **Road:** Shafton
Length: 45.3 **Use:** Foul **Depth:** **Place:** Barnsley
Structural Grade: 0 **Operational Grade:** 3 **DRB Grade:** B

From To	Dia	Material	G1 - 2	G3	G4	G5
00.0m - 45.3m	150	Vitrified Clay (i.e. all clayware)	1	0	0	0

Section: 5 **Start:** mh07 ds mh osa **End:** mh osa **Road:** Shafton
Length: 43.5 **Use:** Surface Water **Depth:** **Place:** Barnsley
Structural Grade: 0 **Operational Grade:** 0 **DRB Grade:**

From To	Dia	Material	G1 - 2	G3	G4	G5
00.0m - 43.5m	300	Vitrified Clay (i.e. all clayware)	0	0	0	0

Total grades for project

Grade 1 Defects	0	Grade 2 Defects	2	Grade 3 Defects	5	Grade 4 Defects	0	Grade 5 Defects	0

Site: Shafton Barnsley

Section 1

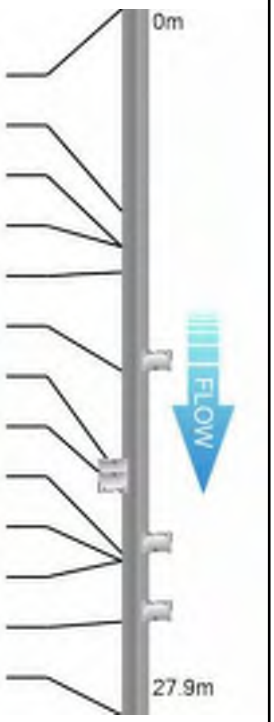
Client:	Location (Street Name):	City/Town/Village	Cust Job Ref.	Surveyors Name:	Date:
WYG Engineering	Shafton	Barnsley			14/02/2018

Start Node Ref:	mh01 ds mh02	Finish Node Ref:	mh02	Direction:	D	Height/Dia:	225
Start Node Depth:		Finish Node Depth:		Use:	S	Shape:	C
Start Node Coordinate:		Finish Node Coordinate:		Material:	VC	Cleaned	N

Drain Type	Lining Type	Lining Mat.	Year Const.	Weather	Flow Cont.	Length	Remarks
A				D	N	27.9	

Structural Peak Grade	0	Operational Grade	3	DRB Grade	B

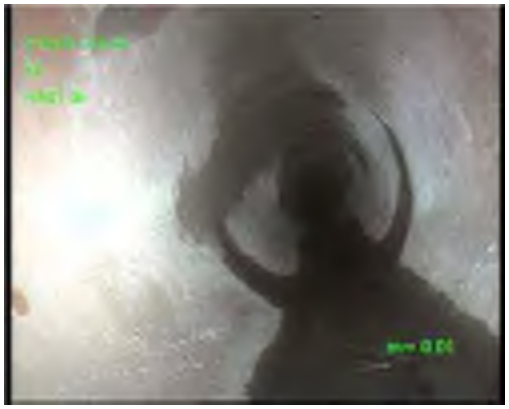
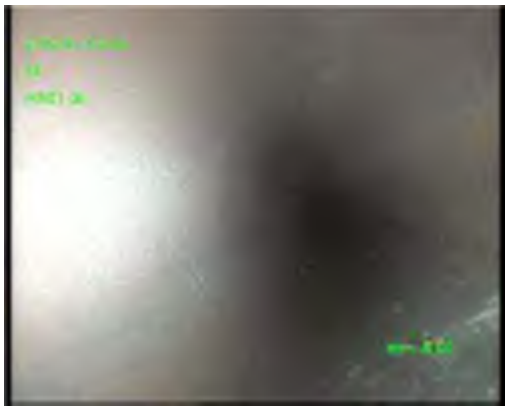
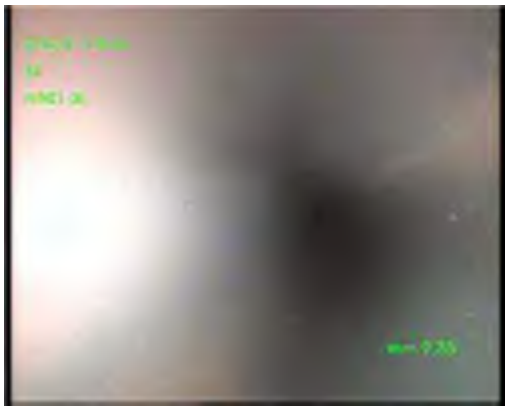
Position	Code	Description	CD	Pic	Grade
00.0	MH	Start node type, manhole		0_0	0
08.0	DER	S1 Settled deposits coarse 10%	S1	0_1	3
09.4	DER	F1 Settled deposits coarse 10%	F1	0_-	3
09.4	WL	S2 Water level 10%	S2	0_2	0
10.4	DER	S3 Settled deposits coarse 10%	S3	0_3	3
14.3	JN	Junction 09 : 150mm Diameter		0_4	0
18.6	JN	Junction 03 : 150mm Diameter		0_5	0
19.1	JN	Junction 03 : 150mm Diameter		0_6	0
21.5	JN	Junction 09 : 150mm Diameter		0_7	0
21.8	DER	F3 Settled deposits coarse 10%	F3	0_-	3
21.8	WL	F2 Water level 10%	F2	0_-	0
24.2	CN	Connection other than junction 09 : 225mm Diameter		0_8	0
27.9	MHF	Finish node type, manhole		0_9	0



Total grades for project

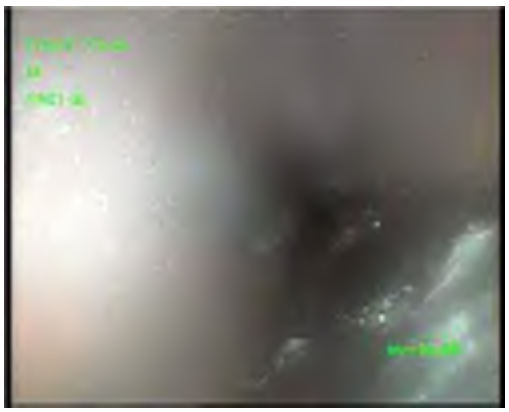
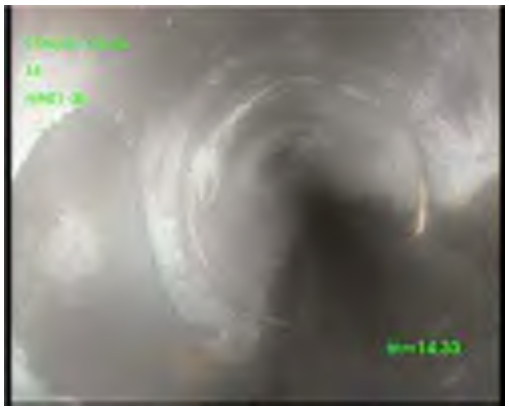
Grade 1 Defects	0	Grade 2 Defects	2	Grade 3 Defects	5	Grade 4 Defects	0	Grade 5 Defects	0

Descriptive Report with Remarks and Observation Images

Pos	Video Ref	Code	Cont.	Description	Image
00.0m	00:00:00	MH		Start node type, manhole, reference mh01 ds mh02 mh01 ds mh02	Image Provided - Ref: 0_0 
08.0m	00:01:42	DER	S1	Settled deposits coarse8m - 9.4m: 10% cross-sectional area loss - Grade 3	Image Provided - Ref: 0_1 
09.4m	00:01:42	DER	F1	Settled deposits coarse Defect End: 10% cross-sectional area loss - Grade 3	
09.4m	00:02:00	WL	S2	Water level9.4m - 21.8m: 10% Height/Diameter	Image Provided - Ref: 0_2 

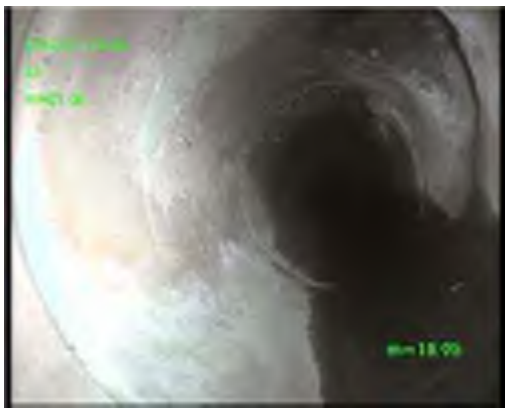
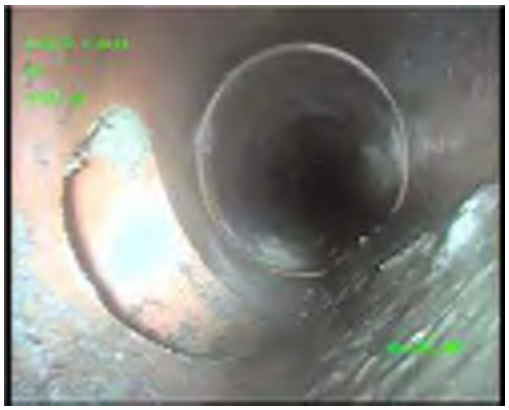
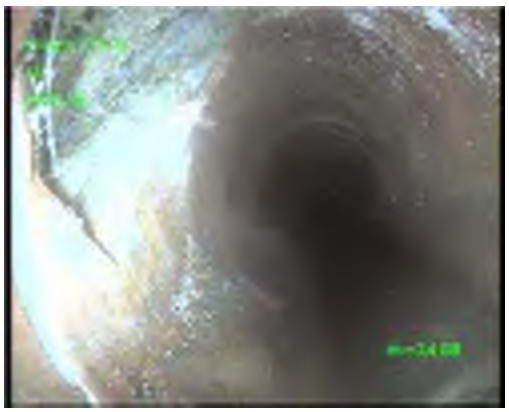
Total grades for project

Grade 1 Defects	0	Grade 2 Defects	2	Grade 3 Defects	5	Grade 4 Defects	0	Grade 5 Defects	0

Pos	Video Ref	Code	Cont.	Description	Image
10.4m	00:02:22	DER	S3	Settled deposits coarse10.4m - 21.8m: 10% cross-sectional area loss - Grade 3	Image Provided - Ref: 0_3 
14.3m	00:03:13	JN		Junction at 09 o'clock: 150mm Diameter	Image Provided - Ref: 0_4 
18.6m	00:04:22	JN		Junction at 03 o'clock: 150mm Diameter	Image Provided - Ref: 0_5 

Total grades for project

Grade 1 Defects	0	Grade 2 Defects	2	Grade 3 Defects	5	Grade 4 Defects	0	Grade 5 Defects	0

Pos	Video Ref	Code	Cont.	Description	Image
19.1m	00:04:28	JN		Junction at 03 o'clock: 150mm Diameter	Image Provided - Ref: 0_6 
21.5m	00:05:03	JN		Junction at 09 o'clock: 150mm Diameter	Image Provided - Ref: 0_7 
21.8m	00:02:22	DER	F3	Settled deposits coarse Defect End: 10% cross-sectional area loss - Grade 3	
21.8m	00:02:00	WL	F2	Water level Defect End: 10% Height/Diameter	
24.2m	00:05:49	CN		Connection other than junction at 09 o'clock: 225mm Diameter	Image Provided - Ref: 0_8 

Total grades for project

Grade 1 Defects	0	Grade 2 Defects	2	Grade 3 Defects	5	Grade 4 Defects	0	Grade 5 Defects	0

Pos	Video Ref	Code	Cont.	Description	Image
27.9m	00:06:51	MHF		Finish node type, manhole, reference mh02 mh02	Image Provided - Ref: 0_9999 

Total grades for project

Grade 1 Defects	0	Grade 2 Defects	2	Grade 3 Defects	5	Grade 4 Defects	0	Grade 5 Defects	0

Site: Shafton Barnsley

Section 2

Client:	Location (Street Name):	City/Town/Village	Cust Job Ref.	Surveyors Name:	Date:
WYG Engineering	Shafton	Barnsley			14/02/2018

Start Node Ref:	mh02 ds mh04	Finish Node Ref:	mh04	Direction:	D	Height/Dia:	225
Start Node Depth:		Finish Node Depth:		Use:	S	Shape:	C
Start Node Coordinate:		Finish Node Coordinate:		Material:	VC	Cleaned	N

Drain Type	Lining Type	Lining Mat.	Year Const.	Weather	Flow Cont.	Length	Remarks
A				D	N	24	

Structural Peak Grade	0	Operational Grade	0	DRB Grade	

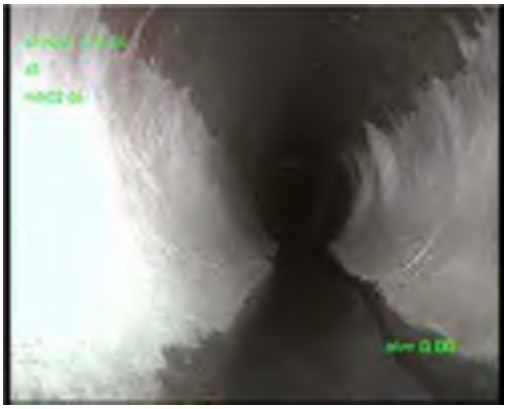
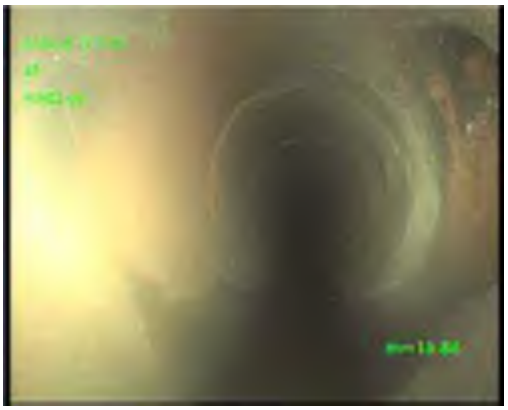
Position	Code	Description	CD	Pic	Grade
00.0	MH	Start node type, manhole		1_0	0
16.9	JN	Junction 03 : 225mm Diameter		1_1	0
17.2	JN	Junction 03 : 150mm Diameter		1_2	0
17.7	JN	Junction 09 : 150mm Diameter		1_3	0
18.1	JN	Junction 09 : 225mm Diameter		1_4	0
24.0	MHF	Finish node type, manhole		1_9	0



Total grades for project

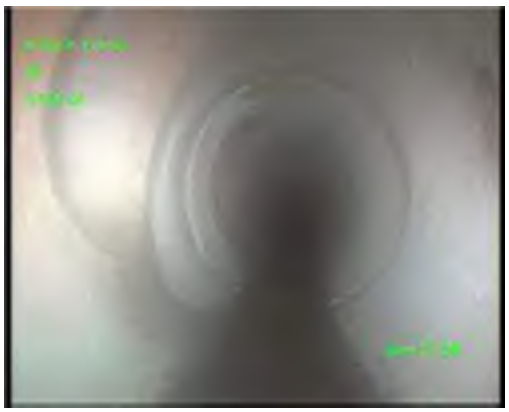
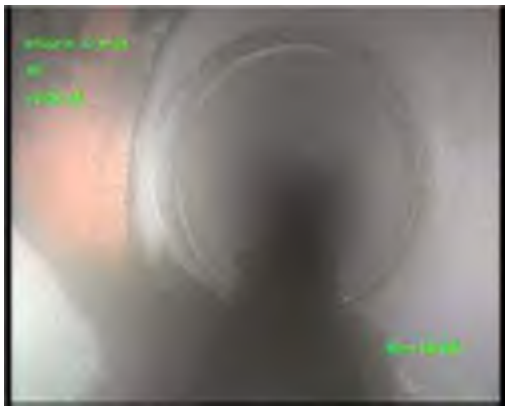
Grade 1 Defects	0	Grade 2 Defects	2	Grade 3 Defects	5	Grade 4 Defects	0	Grade 5 Defects	0

Descriptive Report with Remarks and Observation Images

Pos	Video Ref	Code	Cont.	Description	Image
00.0m	00:00:00	MH		Start node type, manhole, reference mh02 ds mh04 mh02 ds mh03	Image Provided - Ref: 1_0 
16.9m	00:03:45	JN		Junction at 03 o'clock: 225mm Diameter	Image Provided - Ref: 1_1 
17.2m	00:03:59	JN		Junction at 03 o'clock: 150mm Diameter	Image Provided - Ref: 1_2 

Total grades for project

Grade 1 Defects	0	Grade 2 Defects	2	Grade 3 Defects	5	Grade 4 Defects	0	Grade 5 Defects	0

Pos	Video Ref	Code	Cont.	Description	Image
17.7m	00:04:05	JN		Junction at 09 o'clock: 150mm Diameter	Image Provided - Ref: 1_3 
18.1m	00:04:11	JN		Junction at 09 o'clock: 225mm Diameter	Image Provided - Ref: 1_4 
24.0m	00:05:29	MHF		Finish node type, manhole, reference mh04 mh03	Image Provided - Ref: 1_9999 

Total grades for project

Grade 1 Defects	0	Grade 2 Defects	2	Grade 3 Defects	5	Grade 4 Defects	0	Grade 5 Defects	0

Site: Shafton Barnsley

Section 3

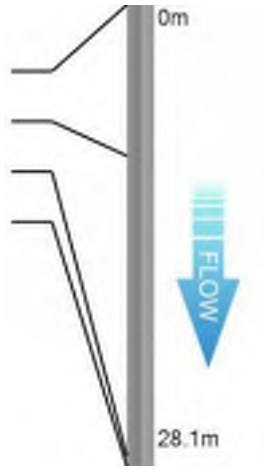
Client:	Location (Street Name):	City/Town/Village	Cust Job Ref.	Surveyors Name:	Date:
WYG Engineering	Shafton	Barnsley			14/02/2018

Start Node Ref:	mh03 ds mh05	Finish Node Ref:	mh05	Direction:	D	Height/Dia:	150
Start Node Depth:		Finish Node Depth:		Use:	F	Shape:	C
Start Node Coordinate:		Finish Node Coordinate:		Material:	VC	Cleaned	N

Drain Type	Lining Type	Lining Mat.	Year Const.	Weather	Flow Cont.	Length	Remarks
A				D	N	28.1	

Structural Peak Grade	0	Operational Grade	5	DRB Grade	C

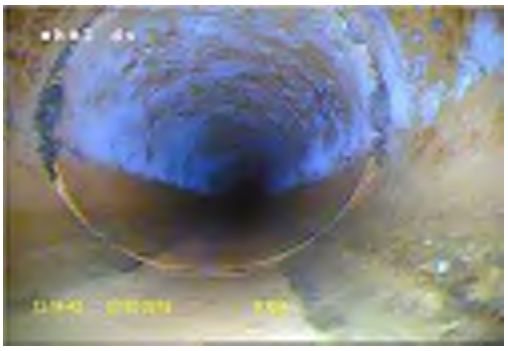
Position	Code	Description	CD	Pic	Grade
00.0	MH	Start node type, manhole			0
09.2	DESJ	Settled deposits fine 5% at joint		2_1	2
27.5	OBX	Other obstacles, other object in invert 04-08 20%		2_2	3
28.1	MHF	Finish node type, manhole		2_9	0



Total grades for project

Grade 1 Defects	0	Grade 2 Defects	2	Grade 3 Defects	5	Grade 4 Defects	0	Grade 5 Defects	0

Descriptive Report with Remarks and Observation Images

Pos	Video Ref	Code	Cont.	Description	Image
00.0m	00:00:00	MH		Start node type, manhole, reference mh03 ds mh05 mh03 ds mh04	
09.2m	00:01:18	DES		Settled deposits fine: 5% cross-sectional area loss at joint - Grade 2	Image Provided - Ref: 2_1 
27.5m	00:03:25	OBX		Other obstacles, other object in invert from 04 o'clock to 08 o'clock: 20% cross-sectional area loss - Grade 3 Settled fouling and tissue	Image Provided - Ref: 2_2 
28.1m	00:03:38	MHF		Finish node type, manhole, reference mh05 mh04	Image Provided - Ref: 2_9999 

Total grades for project

Grade 1 Defects	0	Grade 2 Defects	2	Grade 3 Defects	5	Grade 4 Defects	0	Grade 5 Defects	0

Site: Shafton Barnsley

Section 4

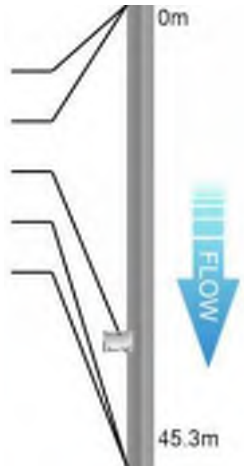
Client:	Location (Street Name):	City/Town/Village	Cust Job Ref.	Surveyors Name:	Date:
WYG Engineering	Shafton	Barnsley			14/02/2018

Start Node Ref:	mh06 ds mh osa	Finish Node Ref:	mh osa	Direction:	D	Height/Dia:	150
Start Node Depth:		Finish Node Depth:		Use:	F	Shape:	C
Start Node Coordinate:		Finish Node Coordinate:		Material:	VC	Cleaned	N

Drain Type	Lining Type	Lining Mat.	Year Const.	Weather	Flow Cont.	Length	Remarks
A				D	N	45.3	

Structural Peak Grade	0	Operational Grade	3	DRB Grade	B

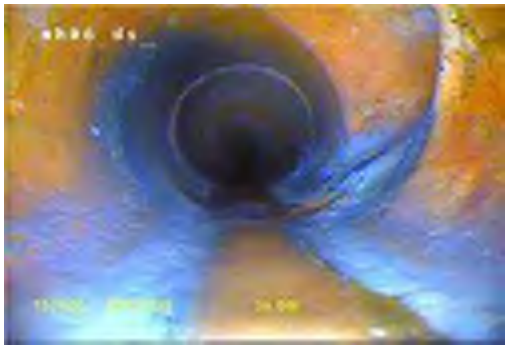
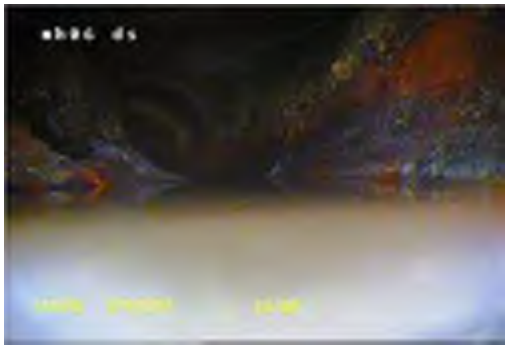
Position	Code	Description	CD	Pic	Grade
00.0	MH	Start node type, manhole		3_0	0
00.0	DEZ	S1 Other 04-08 5%	S1	3_1	2
34.1	JN	Junction 03 : 150mm Diameter		3_2	0
45.3	WL	Water level 20%		3_3	0
45.3	MHF	Finish node type, manhole		3_9	0



Total grades for project

Grade 1 Defects	0	Grade 2 Defects	2	Grade 3 Defects	5	Grade 4 Defects	0	Grade 5 Defects	0

Descriptive Report with Remarks and Observation Images

Pos	Video Ref	Code	Cont.	Description	Image
00.0m	00:00:02	MH		Start node type, manhole, reference mh06 ds mh osa mh06 ds mh osa	Image Provided - Ref: 3_0 
00.0m	00:00:03	DEZ	S1	Other0m - 0m from 04 o'clock to 08 o'clock: 5% cross-sectional area loss - Grade 2 Scale	Image Provided - Ref: 3_1 
34.1m	00:04:06	JN		Junction at 03 o'clock: 150mm Diameter	Image Provided - Ref: 3_2 
45.3m	00:05:15	WL		Water level: 20% Height/Diameter	Image Provided - Ref: 3_3 

Total grades for project

Grade 1 Defects	0	Grade 2 Defects	2	Grade 3 Defects	5	Grade 4 Defects	0	Grade 5 Defects	0

Pos	Video Ref	Code	Cont.	Description	Image
45.3m	00:05:18	MHF		Finish node type, manhole, reference mh osa mh osa	Image Provided - Ref: 3_9999 

Total grades for project

Grade 1 Defects	0	Grade 2 Defects	2	Grade 3 Defects	5	Grade 4 Defects	0	Grade 5 Defects	0

Site: Shafton Barnsley

Section 5

Client:	Location (Street Name):	City/Town/Village	Cust Job Ref.	Surveyors Name:	Date:
WYG Engineering	Shafton	Barnsley			14/02/2018

Start Node Ref:	mh07 ds mh osa	Finish Node Ref:	mh osa	Direction:	D	Height/Dia:	300
Start Node Depth:		Finish Node Depth:		Use:	S	Shape:	C
Start Node Coordinate:		Finish Node Coordinate:		Material:	VC	Cleaned	N

Drain Type	Lining Type	Lining Mat.	Year Const.	Weather	Flow Cont.	Length	Remarks
A				D	N	43.5	

Structural Peak Grade	0	Operational Grade	0	DRB Grade	

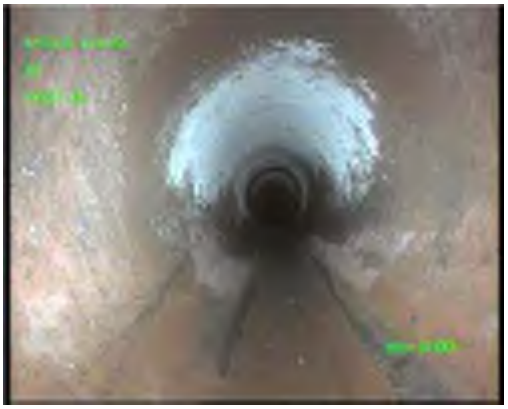
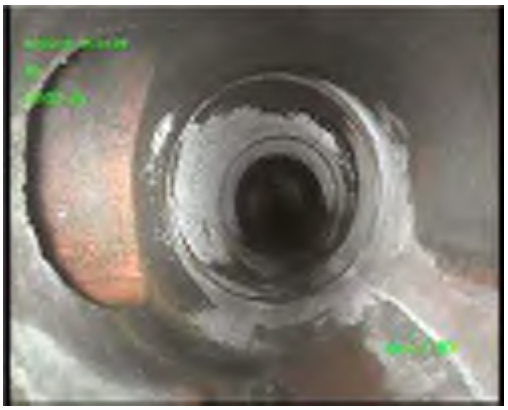
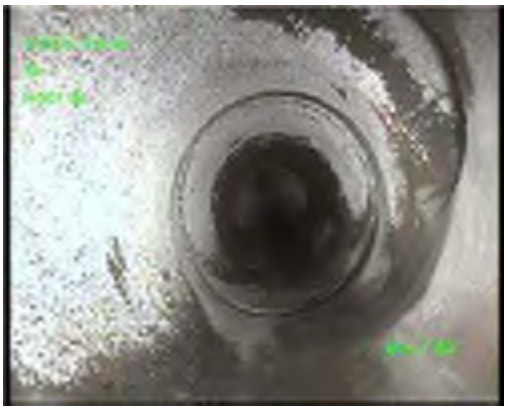
Position	Code	Description	CD	Pic	Grade
00.0	MH	Start node type, manhole		4_0	0
07.4	JN	Junction 09 : 225mm Diameter		4_1	0
07.9	JN	Junction 03 : 150mm Diameter		4_2	0
22.8	JN	Junction 09 : 300mm Diameter		4_3	0
25.4	JN	Junction 09 : 225mm Diameter		4_4	0
25.8	JN	Junction 03 : 150mm Diameter		4_5	0
43.5	MHF	Finish node type, manhole		4_9	0



Total grades for project

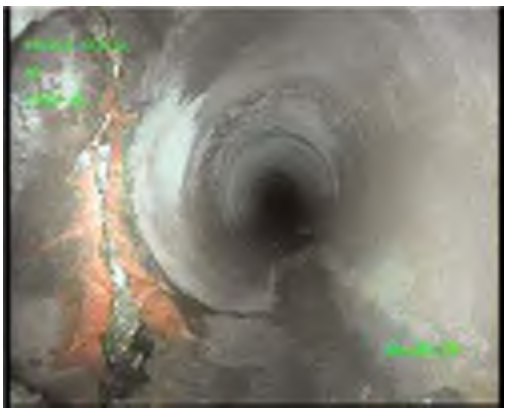
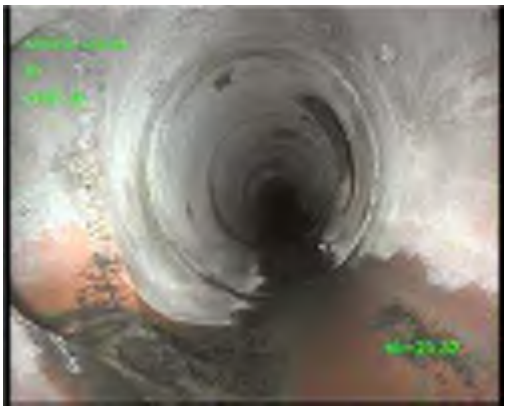
Grade 1 Defects	0	Grade 2 Defects	2	Grade 3 Defects	5	Grade 4 Defects	0	Grade 5 Defects	0

Descriptive Report with Remarks and Observation Images

Pos	Video Ref	Code	Cont.	Description	Image
00.0m	00:00:00	MH		Start node type, manhole, reference mh07 ds mh osa mh07 ds mh osa	Image Provided - Ref: 4_0 
07.4m	00:01:42	JN		Junction at 09 o'clock: 225mm Diameter	Image Provided - Ref: 4_1 
07.9m	00:01:48	JN		Junction at 03 o'clock: 150mm Diameter	Image Provided - Ref: 4_2 

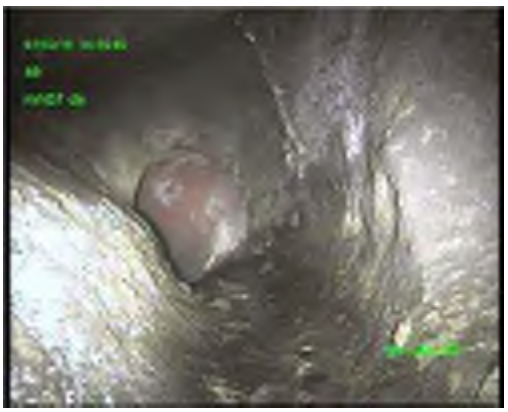
Total grades for project

Grade 1 Defects	0	Grade 2 Defects	2	Grade 3 Defects	5	Grade 4 Defects	0	Grade 5 Defects	0

Pos	Video Ref	Code	Cont.	Description	Image
22.8m	00:05:15	JN		Junction at 09 o'clock: 300mm Diameter	Image Provided - Ref: 4_3 
25.4m	00:05:57	JN		Junction at 09 o'clock: 225mm Diameter	Image Provided - Ref: 4_4 
25.8m	00:06:02	JN		Junction at 03 o'clock: 150mm Diameter	Image Provided - Ref: 4_5 

Total grades for project

Grade 1 Defects	0	Grade 2 Defects	2	Grade 3 Defects	5	Grade 4 Defects	0	Grade 5 Defects	0

Pos	Video Ref	Code	Cont.	Description	Image
43.5m	00:11:50	MHF		Finish node type, manhole, reference mh osa mh osa	Image Provided - Ref: 4_9999 

Total grades for project

Grade 1 Defects	0	Grade 2 Defects	2	Grade 3 Defects	5	Grade 4 Defects	0	Grade 5 Defects	0