



Your Environment

SURFACE WATER DRAINAGE STRATEGY BARCHESTER, WESTERGATE HOUSE, FONTWELL

For Wrens Construction Ltd

Your Environment

Head Office, Chilgrove Business Centre, Chilgrove Park Road, Chilgrove, Nr
Chichester, PO18 9HU

Report Number: YE6846, Date: April 2019

Paul Timmins

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	Name	Position	Signature	Date
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Approved:	Colin Hiscock	Director		April 2019
For and on behalf of YourEnvironment				

Issue	Date	Description	Prepared	Reviewed	Approved
00	15/04/19	Final Report	PT	MG	CH

1.0 Executive Summary

YourEnvironment (YE) was instructed by Wrens Construction Ltd to provide a Surface Water Drainage Report to describe the proposed drainage strategy serving an extension to Westergate House, Fontwell, BN18 0SU. The new extension, which adds eight bedrooms to the existing building, was granted permission by Arun District Council on 14th February 2019 (planning ref. AL/123/18/PL).

As part of the decision notice, a planning condition related to surface water drainage was included. The purpose of this report is to provide a drainage layout plan for the development layout which may be approved by Arun DC officers.

We trust this is sufficient for your requirements and should you have any questions please do not hesitate to contact the undersigned.

For *YourEnvironment*

Colin Hiscock

Director

2.0 Introduction

YourEnvironment (YE) was instructed by Wrens Construction Ltd to provide a Surface Water Drainage Report to describe the proposed drainage strategy serving an extension to Westergate House, Fontwell, BN18 0SU. The new extension, which adds eight new bedrooms to an existing building, was granted permission by Arun District Council on 14th February 2019 (planning ref. AL/123/18/PL).

The location of the site is illustrated on Figure 1 (below).



Figure 1: Location of the development site

The development proposes a two storey extension to north east elevation to provide an additional 8 No. bedrooms. Existing and proposed plans are provided in Appendix A.

Planning Condition 4 relates to surface water drainage. It states:

Development shall not commence until full details of the proposed surface water drainage scheme have been submitted to and approved in writing by the Local Planning Authority.

The design should follow the hierarchy of preference for different types of surface water drainage disposal systems as set out in Approved Document H of the Building Regulations, the recommendations of the SUDS Manual produced by CIRIA.

Winter groundwater monitoring to establish highest annual ground water levels and Percolation testing to BRE 365, or similar approved, will be required to support the design of any Infiltration drainage.

No building shall be occupied until the complete surface water drainage system serving the property has been implemented in accordance with the agreed details and the details so agreed shall be maintained in good working order in perpetuity.

3.0 Hierarchy of Preference for Surface Water Disposal

Part H3 of the Building Regulations sets out the hierarchy of preference for the disposal of surface water from new development as follows:

Rainwater Drainage

H3... (3) Rainwater from a system provided pursuant to sub-paragraphs (1) and (2) shall discharge to one of the following, listed in order of priority:

- a) *An adequate soakaway or some other adequate infiltration system; or, where that is not reasonably practicable,*
- b) *A watercourse, or, where that is not reasonably practicable,*
- c) *A sewer.*

Infiltration potential at the site

Desktop studies were undertaken to assess the potential for infiltration drainage at the site. The Soilscales website describes the soils at the site as “Freely draining slightly acid loamy soil”. The BGS Maps identify a superficial layer of Raised Beach Deposits over a bedrock of the Lambeth Group.

Investigations to determine whether the underlying soils at the site were suitable for infiltration were carried out in March and April 2019. These comprised the excavation of two trial pits in order to carry out permeability testing using the BRE365 test procedure and window sampling to identify deeper soils and the groundwater level.

The trial pit logs, window sampler logs and results of the BRE365 tests are provided in Appendix B. Table 1 below provides a schedule of the results recorded.

Trial Pit	Test No.	Permeability Rate (m/s)
1	1	3.10×10^{-5}
1	2	2.10×10^{-5}
1	3	2.30×10^{-5}
2	1	1.20×10^{-4}
2	2	1.10×10^{-4}
2	3	9.20×10^{-5}

Table 1: BRE365 Test Results

Groundwater monitoring was also undertaken at the site. The results (provided in Appendix B) indicate that groundwater is present in WS1 at 2.45m below ground level. No groundwater was present in WS2.

Due to the test results gained from the investigations undertaken, it is concluded that the site is suitable for infiltration forms of surface water disposal. Since no groundwater has been identified to a depth of 3m below ground level in WS2, it is proposed that a soakaway be placed close to the location of TP2/WS2.

The lowest permeability rate at the location of TP2 is 9.20×10^{-5} m/s (0.3312m/hr). This value shall be used for design purposes.

4.0 Surface Water runoff disposal

Surface water runoff shall be managed from the roof of the new extension. Runoff shall be piped to a new soakaway structure located in the area of WS2 to allow it to percolate into the ground.

The proposed drainage design layout is shown in Figure 2 below and provided in Appendix C. The calculations below have been used to confirm that the soakaway is sized adequately.

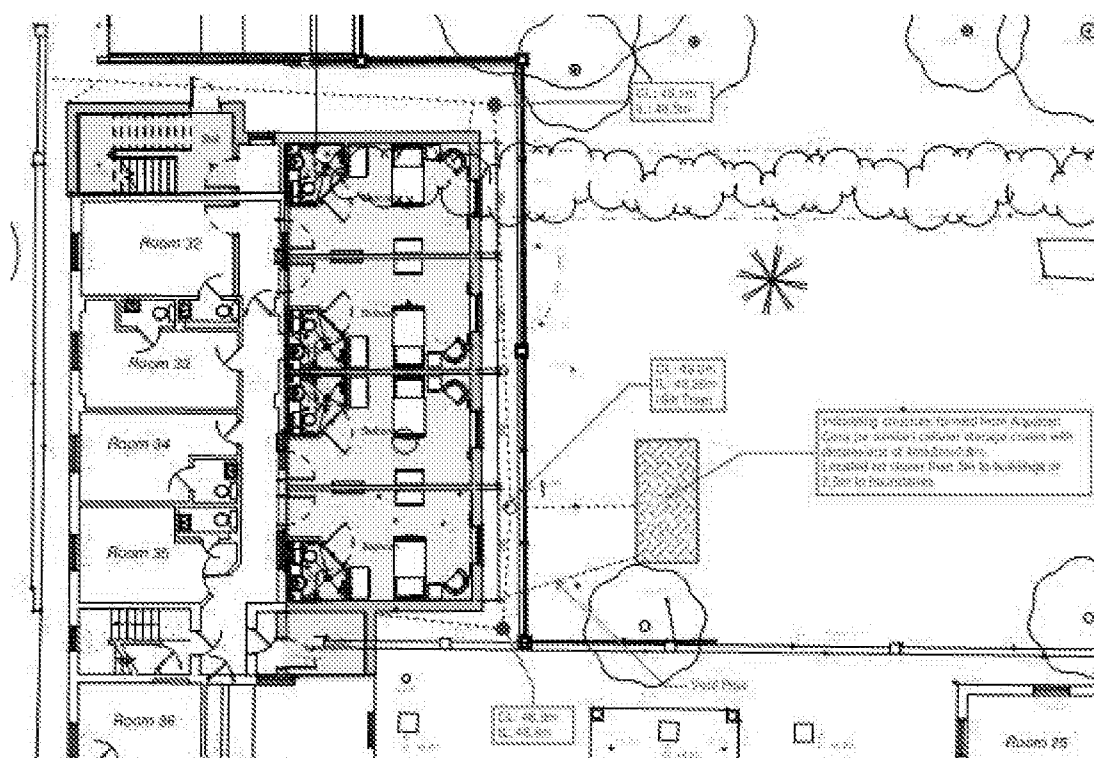


Figure 2 - Proposed Drainage Strategy

Soakaway Dimensions

The soakaway is designed to drain the roof to the new extension which has a total area of 130m². The Soakaway shall be formed of cellular storage crates to the following design specifications:

Ground Level	49.5m
Invert Level	47.6m
Drained Area	130sqm
Width	2.0m
Length	4.0m
Height	0.8m
Cover to surface	1.3m
Infiltration Rate	0.3312m/hr (TP2)

Table 2: Design characteristics of the proposed soakaway

Standard details for the proposed soakaway are provided in Appendix D. Silt traps are to be installed upstream of the infiltration structure to reduce the risk of silt reducing the structure's effectiveness over time. The soakaway has been positioned to be at least 5m away from any buildings and at least 2.5m away from any boundary.

Using the criteria in Table 2, the soakaway has been hydraulically modelled using the Source Control module of the Microdrainage suite of software. The results are provided in Appendix D and confirm that no flooding shall occur during the 1 in 100 year return period event (including an allowance of 40% for climate change).

The performance of the system has been modelled against a 1 in 10 year return period event to determine the level of the runoff within the soakaway. The modelling states that the depth of water will be 0.359m above the base of the soakaway. With reference to the standard details for soakaway's formed of cellular storage crates, the incoming pipe will be at around 700mm above the invert of the soakaway,

The base of the soakaway will be at 47.6m (or 1.9m below ground level). Groundwater monitoring at the nearby window sampling point WS2 identified that no groundwater was present at 3.0m below ground level.

Maintenance and Management

The soakaway shall be maintained on a regular basis by the landowner. The maintenance actions recommended by the CIRIA SuDS Manual 2015 (Table 13.1) are reproduced below.

TABLE 13.1 Operation and maintenance requirements for soakaways		
Maintenance schedule	Required action	Typical frequency
Regular maintenance	Inspect for sediment and debris in pre-treatment components and floor of inspection tube or chamber and inside of concrete manhole rings	Annually
	Cleaning of gutters and any filters on downpipes	Annually (or as required based on inspections)
	Trimming any roots that may be causing blockages	Annually (or as required)
Occasional maintenance	Remove sediment and debris from pre-treatment components and floor of inspection tube or chamber and inside of concrete manhole rings	As required, based on inspections
Remedial actions	Reconstruct soakaway and/or replace or clean void fill, if performance deteriorates or failure occurs	As required
	Replacement of clogged geotextile (will require reconstruction of soakaway)	As required
Monitoring	Inspect silt traps and note rate of sediment accumulation	Monthly in the first year and then annually
	Check soakaway to ensure emptying is occurring	Annually

5.0 Limitations

YE have prepared this report with all reasonable skill, care and diligence. The work undertaken to provide the basis of this report comprised a study of available documented information from a variety of sources.

The opinions given in this report have been dictated by the finite data on which are they based and are relevant only to the purpose for which the report was commissioned.

Information reviewed should not be considered exhaustive and has accepted in good faith as providing true and representative data with respect to site conditions. Should additional information become available which may influence the opinion expressed in this report, YE reserves the right to review such information and, if warranted, to alter the opinions accordingly.

It should be noted that any risks identified in this report are perceived risks based on the information reviewed.

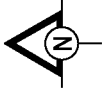
The recommendations contained in this report represent our professional opinions. These opinions were arrived at in accordance with currently accepted industry practices at this time and as such are not a guarantee that the study site is free of hazardous conditions.

This report has been prepared solely for the use of the named client, and may not be relied upon by other parties without written consent from YE. YE disclaim any responsibility to the client and others in respect of any matters outside the agreed scope of the work

Appendix A - Existing and Proposed Layout plans

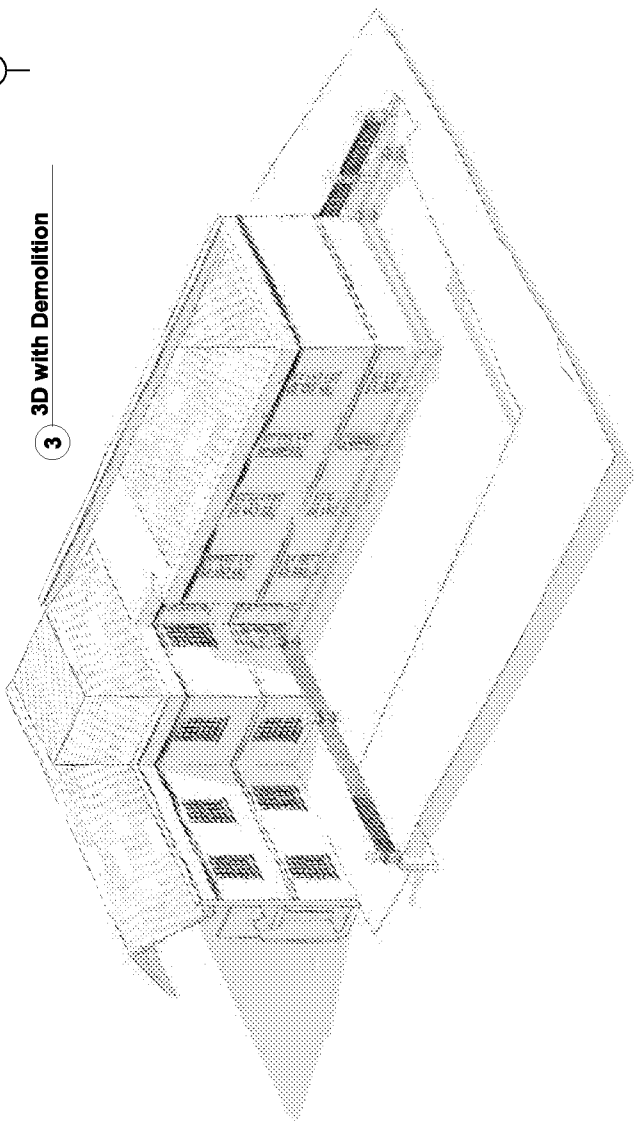


NOTES
Do not scale the drawing.
All dimensions are in millimetres unless stated otherwise.
This drawing is to be used in conjunction with all other drawings.
The design of this drawing is the property of the Architect and is not to be used or reproduced without the written consent of the Architect.

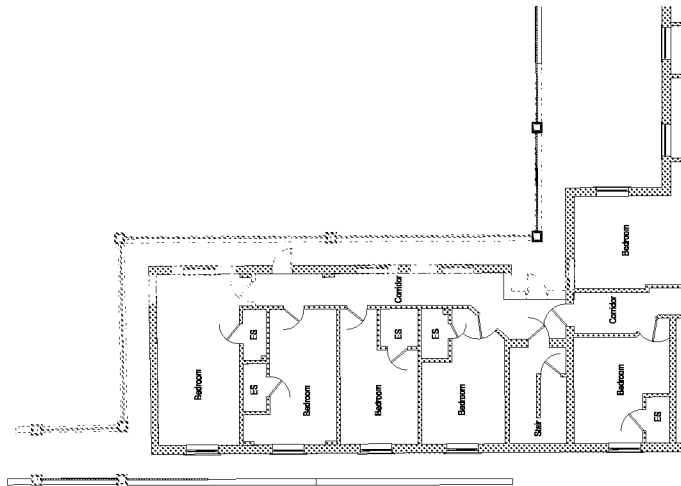


Key

Elements to be Demolished:

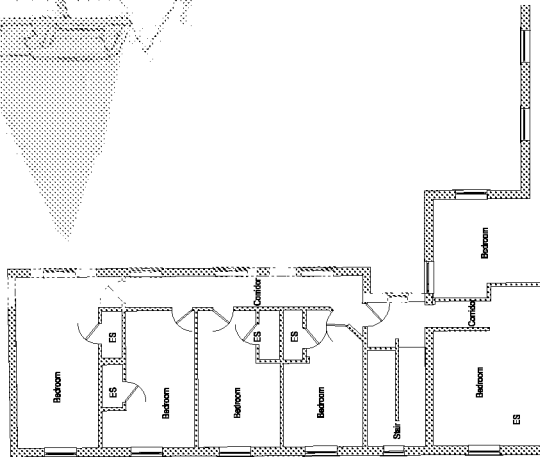


3 3D with Demolition



1 Ground floor Demolitions

1 1:100



2 First Floor Demolitions

2 1:100

Ref	Rev	Description	Date	By	Check	Appr
1	1	Issue for Planning	10/10/19	AR	AR	AR
2	1	Issue for Planning	10/10/19	AR	AR	AR
3	1	Issue for Planning	10/10/19	AR	AR	AR

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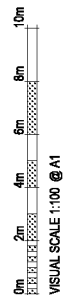
Project:
Proposed 8 Bed Extension
Westgate House
Dennens Lane
Westgate
Purton, BA15 8SU
Client:

Drawing Title:
Demolition Plans

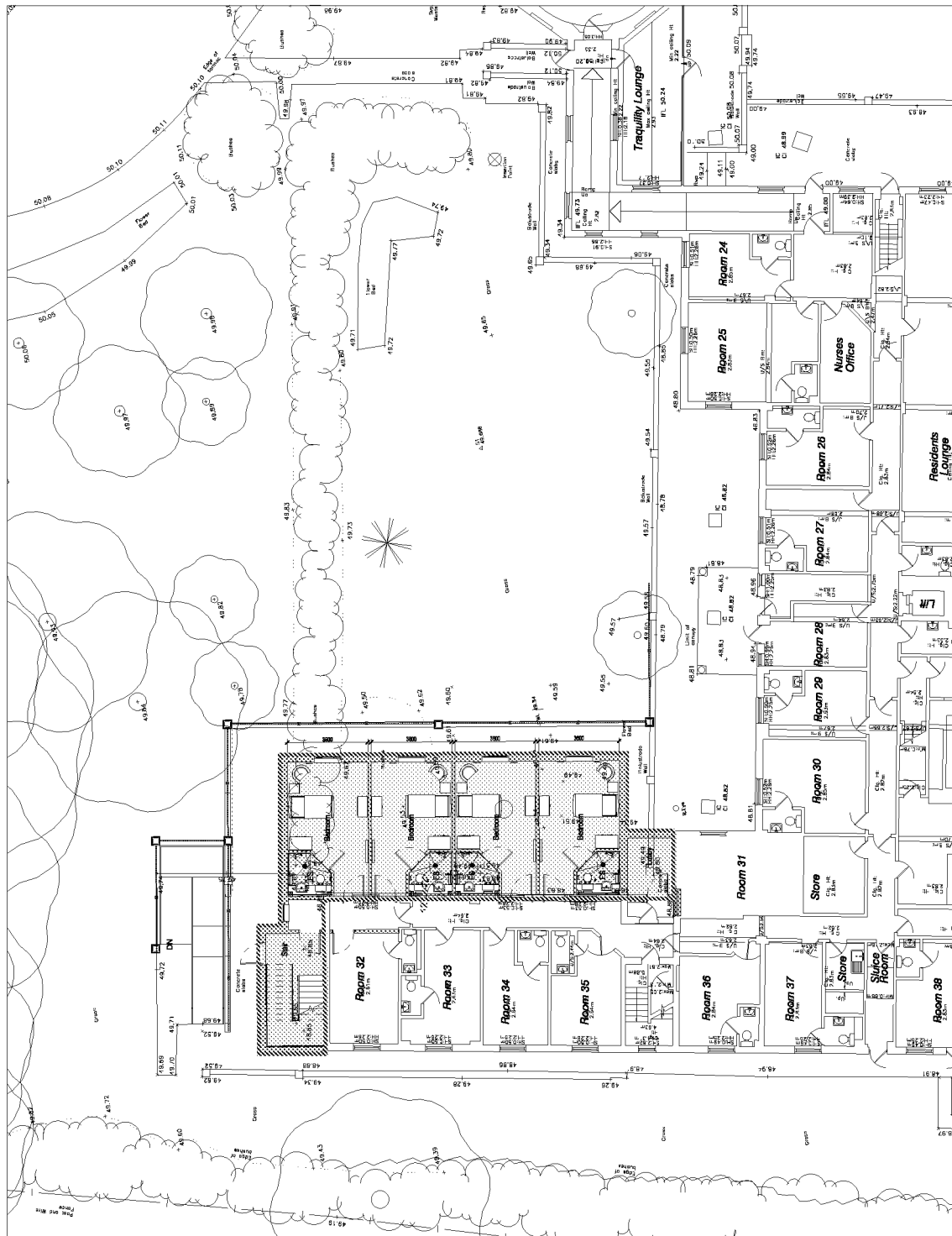
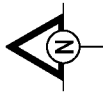
For Review and Comment

Drawn	Checked	Rev	Date	By	Check	Appr
2503	2503	1:100	10/10/19	AR	AR	AR

2503 - 10/10/19 - 01-ZZ-DR - A - 00002



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Project:

Proposed 8 Bed Extension
Westgate House
Denmans Lane
Westgate
Forthwall BN18 0SU
Client:

Drawing Title:
Proposed Site Layout

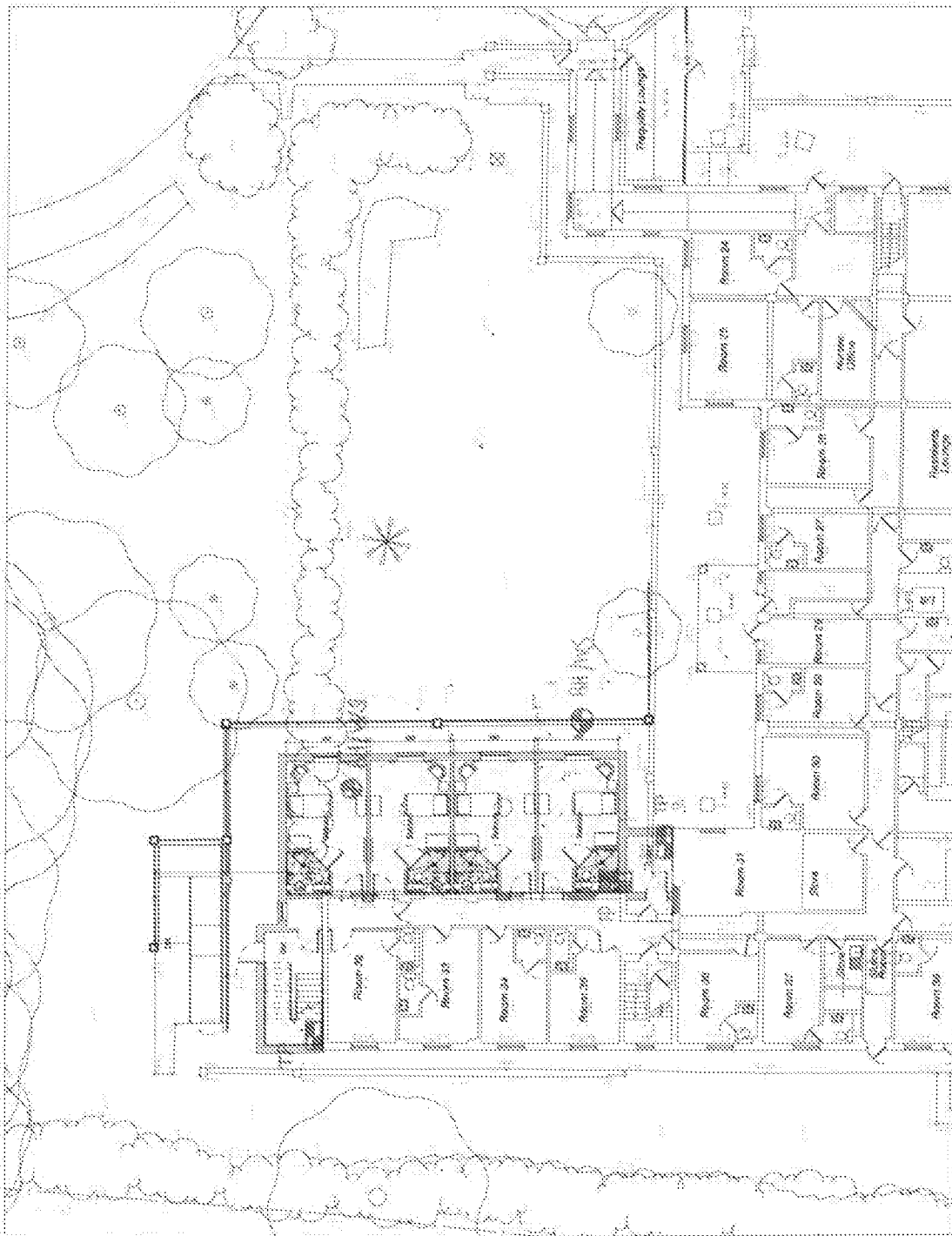
For Revision and Comment

HA Project Number	Scale @ A1	Exposure
2583	1 : 100	S3

Appendix B - Ground investigation data



SKOL
PROPOSED S.I. WORKS
TP/CH LOCATIONS

[illegible]

				Trial Pit Log			Trial Pit No TP01 Sheet 1 of 1		
Project Name: Barchester				Project No. YE6846		Co-ords: - Level:		Date 26/03/2019	
Location: Westergate, West Sussex						Dimensions (m): 1.50 1.20		Scale 1:25	
Client: GD Partnership Ltd						Depth 2.00		Logged NH	

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
				0.40			TOPSOIL: Brown slightly clayey, gravelly SILT. Gravels are fine to coarse of sub-rounded flint.	
				2.00			Light brown to orangish brown clayey, sandy GRAVEL. Sand is fine to coarse. Gravel is fine to coarse, of sub-rounded flint..	
							End of Pit at 2.00m	

Remarks:

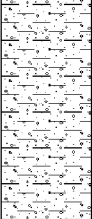
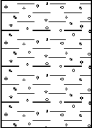
Stability:

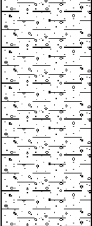
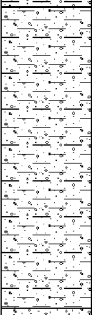
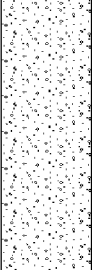
				Trial Pit Log			Trial Pit No TP02 Sheet 1 of 1		
Project Name: Barchester				Project No. YE6846		Co-ords: - Level:		Date 25/04/2019	
Location: Westergate, West Sussex						Dimensions (m): 1.50		Scale 1:25	
Client: GD Partnership Ltd						Depth 2.00		Logged NH	

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
				0.30			TOPSOIL: Brown slightly clayey, gravelly SILT. Gravels are fine to coarse, of sub-rounded flint.	
				2.00			Light brown to orangish brown clayey, sandy GRAVEL. Sand is medium to coarse. Gravel is fine to coarse, of sub-rounded flint.	1
							End of Pit at 2.00m	2
								3
								4
								5

Remarks:

Stability:

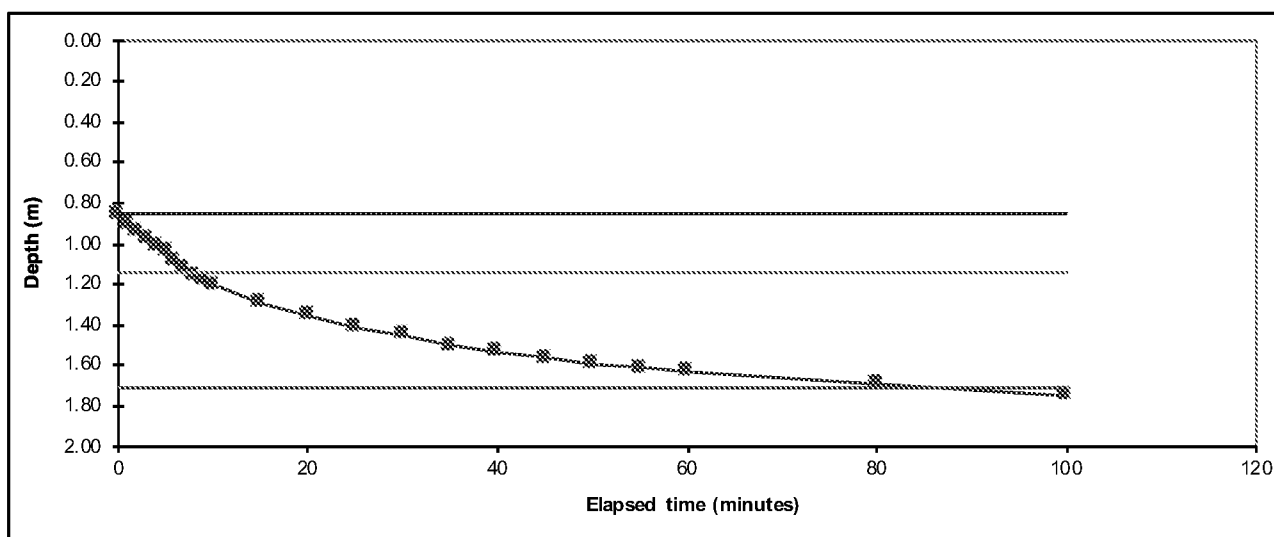
				Borehole Log				Borehole No. WS01 Sheet 1 of 1	
Project Name: Barchester				Project No. YE6846		Co-ords:		Hole Type WLS	
Location: Westergate, West Sussex						Level:		Scale 1:50	
Client: GD Partnership Ltd						Dates: 26/03/2019		Logged By DS	
Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.50			TOPSOIL: Grass overlying brown silty slightly gravelly CLAY. Gravel is fine to medium, sub-angular to rounded of flint and mixed lithology.	
		1.20		N=25 (4,4/6,7,8,4)				Yellowish brown slightly sandy, very gravelly CLAY. Sand is fine to coarse. Gravel is fine to coarse, angular to sub-rounded of flint.	1
		2.00		N=12 (1,2/3,3,3,3)	2.00			Soft yellowish brown gravelly CLAY. Gravel fine to coarse, angular to sub-rounded of flint.	2
		2.85		25 (20,23/25 for 40mm)	2.85		End of Borehole at 2.85m		3
									4
									5
									6
									7
									8
									9
									10
Remarks Core recovery: 0-1m 100%, 1-2m 100%, 2-3m 85%. Abrupt refusal at 2.85m depth.									

					Borehole Log			Borehole No. WS02 Sheet 1 of 1	
Project Name: Barchester					Project No. YE6846		Co-ords:		Hole Type WLS
Location: Westergate, West Sussex					Level:		Scale 1:50		
Client: GD Partnership Ltd					Dates: 26/03/2019		Logged By DS		
Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.40			TOPSOIL: Grass overlying dark brown silty slightly gravelly CLAY. Gravel is fine to medium, sub-angular to rounded of flint and mixed lithology.	
		1.20		N=19 (2,4/5,4,4,6)				Firm brown slightly sandy, very gravelly CLAY. Sand is fine to coarse. Gravel is fine to coarse, angular to sub-rounded of flint.	1
		2.00		N=33 (2,7/10,7,10,6)	2.00			Soft yellowish brown sandy, slightly gravelly CLAY. Sand fine to coarse, becoming sandier with depth. Gravel is fine to coarse, angular to coarse of flint and mixed lithology.	2
		3.00		N=9 (3,4/3,3,1,2)				Loose brown gravelly SAND. Sand is fine to medium. Gravel is fine to coarse, angular to sub-rounded of flint	3
		4.00		N=6 (2,3/2,1,2,1)	4.00			Very soft reddish brown sandy CLAY. Sand is fine to medium.	4
		5.00		N=1 (1,0/1,0,0,0)					5
		6.00		N=4 (0,0/1,1,1,1)	5.90				6
					6.45			End of Borehole at 6.45m	
									7
									8
									9
									10
Remarks Core recovery: 0-1m 100%, 1-2m 100%, 2-3m 100%, 0-1m 90%, 4-5m 0%, 5-6m 20%.									

Your Environment

Soakaway Test

Trial Pit No:	TP1	Test No:	1	Date:	26.03.2019
Length (m):	1.200	Datum Height:			0.00 m agl
Width (m):	0.60	Granular infill:	None		
Depth (m):	2.00	Porosity of infill:	1	(assumed)	
Elapsed time (minutes)		Water Depth (m below datum)	Elapsed time (minutes)		Water Depth (m below datum)
0		0.850	30		1.450
1		0.900	35		1.500
2		0.940	40		1.530
3		0.980	45		1.560
4		1.010	50		1.590
5		1.040	55		1.610
6		1.080	60		1.630
7		1.120	80		1.690
8		1.150	100		1.750
9		1.180			
10		1.200			
15		1.290			
20		1.350			
25		1.410			



Start water depth for analysis (mbgl):	0.85	Elapsed time (mins):	7.7
75% effective depth (mbgl):	1.14	Elapsed time (mins):	86.7
50% effective depth (mbgl):	1.43		
25% effective depth (mbgl):	1.71		
Base of soakage zone (mbgl):	2.00		
Volume outflow between 75% and 25% effective depth (m ³):	0.410		
Mean surface area of outflow (m ²):	2.77		
(side area at 50% effective depth + base area)			
Time for outflow between 75% and 25% effective depth (mins):	79.0		

Soil infiltration rate (m/s):	3.1E-5
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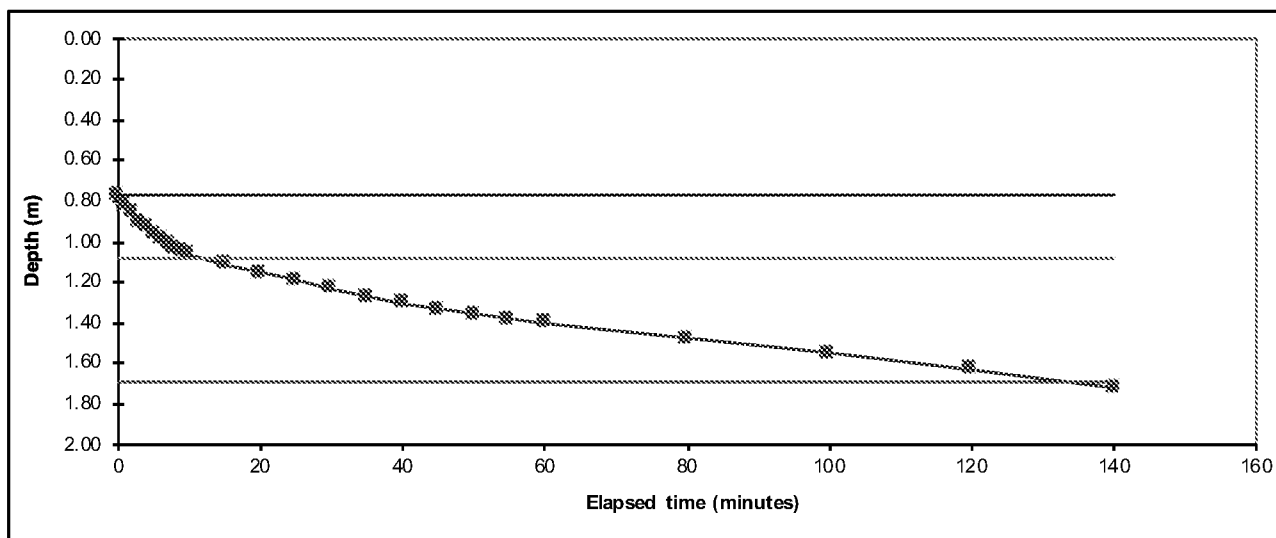
Remarks	Results processed following BRE 365 (2007).
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Client:	Westergate, Fontwell	TP1
Site:		

Your Environment

Soakaway Test

Trial Pit No:	TP1	Test No:	2	Date:	26.03.2019
Length (m):	1.200	Datum Height:			0.00 m agl
Width (m):	0.60	Granular infill:	None		
Depth (m):	2.00	Porosity of infill:	1	(assumed)	
Elapsed time (minutes)		Water Depth (m below datum)	Elapsed time (minutes)		Water Depth (m below datum)
0		0.770	30		1.230
1		0.820	35		1.270
2		0.860	40		1.300
3		0.900	45		1.330
4		0.930	50		1.360
5		0.960	55		1.380
6		0.990	60		1.400
7		1.010	80		1.480
8		1.030	100		1.550
9		1.050	120		1.630
10		1.060	140		1.720
15		1.110			
20		1.150			
25		1.190			



Start water depth for analysis (mbgl):	0.77	Elapsed time (mins):	12.0
75% effective depth (mbgl):	1.08		
50% effective depth (mbgl):	1.39	Elapsed time (mins):	133.3
25% effective depth (mbgl):	1.69		
Base of soakage zone (mbgl):	2.00		
Volume outflow between 75% and 25% effective depth (m ³):	0.439		
Mean surface area of outflow (m ²):	2.92		
(side area at 50% effective depth + base area)			
Time for outflow between 75% and 25% effective depth (mins):	121.3		

Soil infiltration rate (m/s):	2.1E-5
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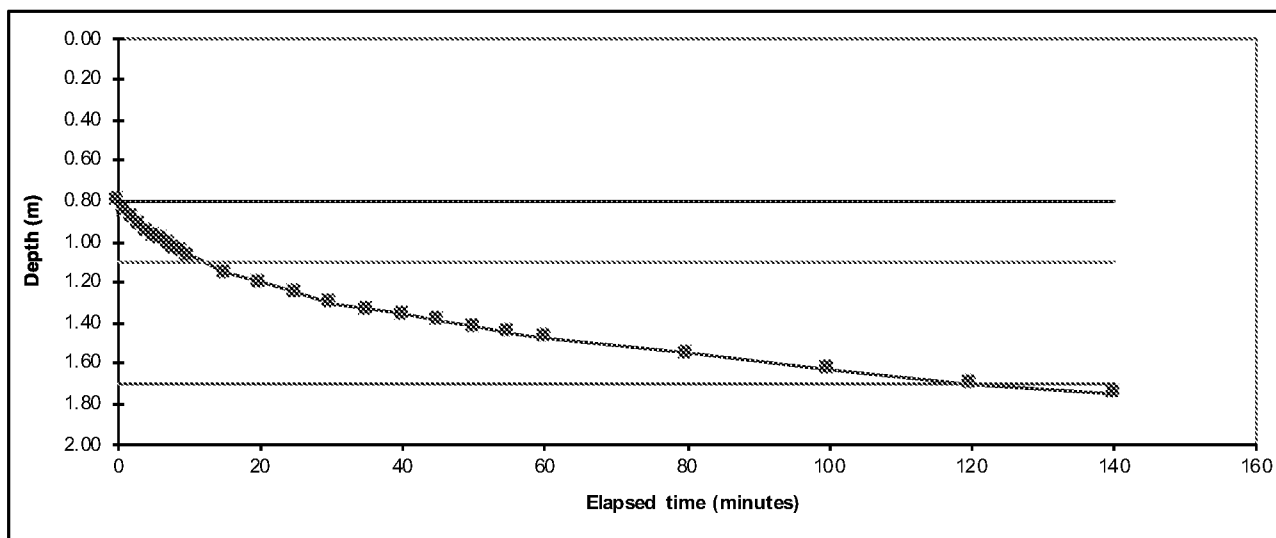
Remarks	Results processed following BRE 365 (2007).
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Client:		
Site:	Westergate, Fontwell	TP1

Your Environment

Soakaway Test

Trial Pit No:	TP1	Test No:	3	Date:	26.03.2019
Length (m):	1.200	Datum Height:			0.00 m agl
Width (m):	0.60	Granular infill:	None		
Depth (m):	2.00	Porosity of infill:	1	(assumed)	
Elapsed time (minutes)	Water Depth (m below datum)	Elapsed time (minutes)	Water Depth (m below datum)		
0	0.800	30	1.300		
1	0.840	35	1.330		
2	0.880	40	1.360		
3	0.920	45	1.390		
4	0.950	50	1.420		
5	0.970	55	1.450		
6	0.990	60	1.470		
7	1.010	80	1.550		
8	1.030	100	1.630		
9	1.050	120	1.700		
10	1.070	140	1.750		
15	1.150				
20	1.200				
25	1.250				



Start water depth for analysis (mbgl):	0.80	Elapsed time (mins):	11.9
75% effective depth (mbgl):	1.10		
50% effective depth (mbgl):	1.40	Elapsed time (mins):	120.0
25% effective depth (mbgl):	1.70		
Base of soakage zone (mbgl):	2.00		
Volume outflow between 75% and 25% effective depth (m ³):	0.432		
Mean surface area of outflow (m ²):	2.88		
(side area at 50% effective depth + base area)			
Time for outflow between 75% and 25% effective depth (mins):	108.1		

Soil infiltration rate (m/s):	2.3E-5
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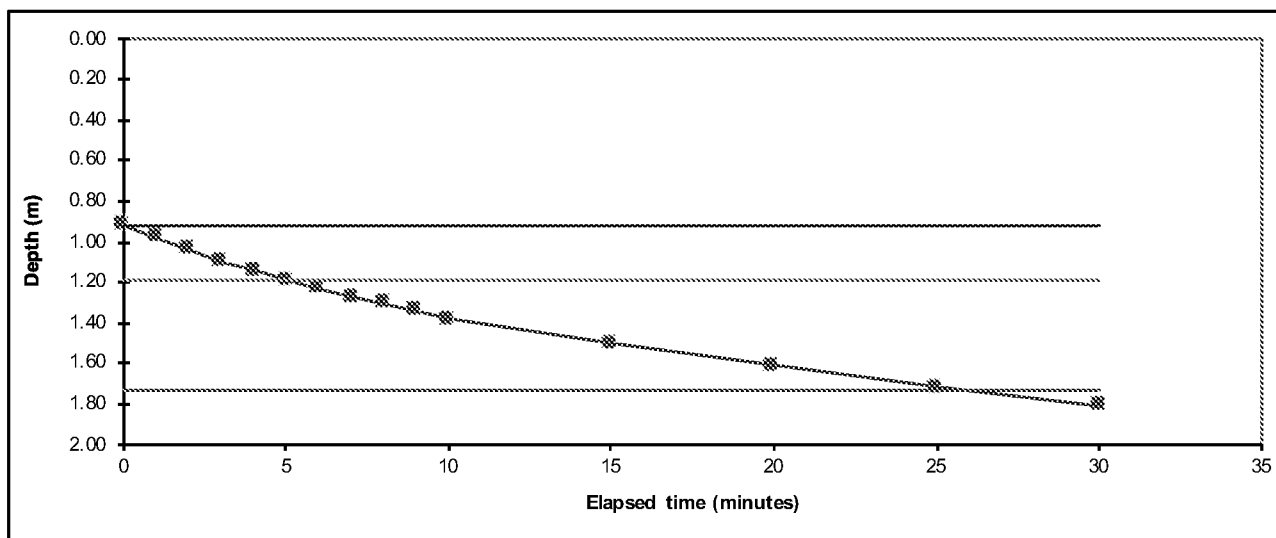
Remarks	Results processed following BRE 365 (2007).
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Client:		
Site:	Westergate, Fontwell	TP1

Your Environment

Soakaway Test

Trial Pit No:	TP2	Test No:	1	Date:	26.03.2019
Length (m):	1.500	Datum Height:		0.00 m agl	
Width (m):	0.60	Granular infill:	None		
Depth (m):	2.00	Porosity of infill:	1	(assumed)	
		Elapsed time (minutes)	Water Depth (m below datum)	Elapsed time (minutes)	Water Depth (m below datum)
		0	0.920	30	1.810
		1	0.980		
		2	1.040		
		3	1.100		
		4	1.140		
		5	1.190		
		6	1.230		
		7	1.270		
		8	1.300		
		9	1.340		
		10	1.380		
		15	1.500		
		20	1.610		
		25	1.720		



Start water depth for analysis (mbgl):	0.92	Elapsed time (mins):	5.0
75% effective depth (mbgl):	1.19	Elapsed time (mins):	25.6
50% effective depth (mbgl):	1.46		
25% effective depth (mbgl):	1.73		
Base of soakage zone (mbgl):	2.00		
Volume outflow between 75% and 25% effective depth (m ³):	0.486		
Mean surface area of outflow (m ²):	3.17		
(side area at 50% effective depth + base area)			
Time for outflow between 75% and 25% effective depth (mins):	20.6		

Soil infiltration rate (m/s):	1.2E-4
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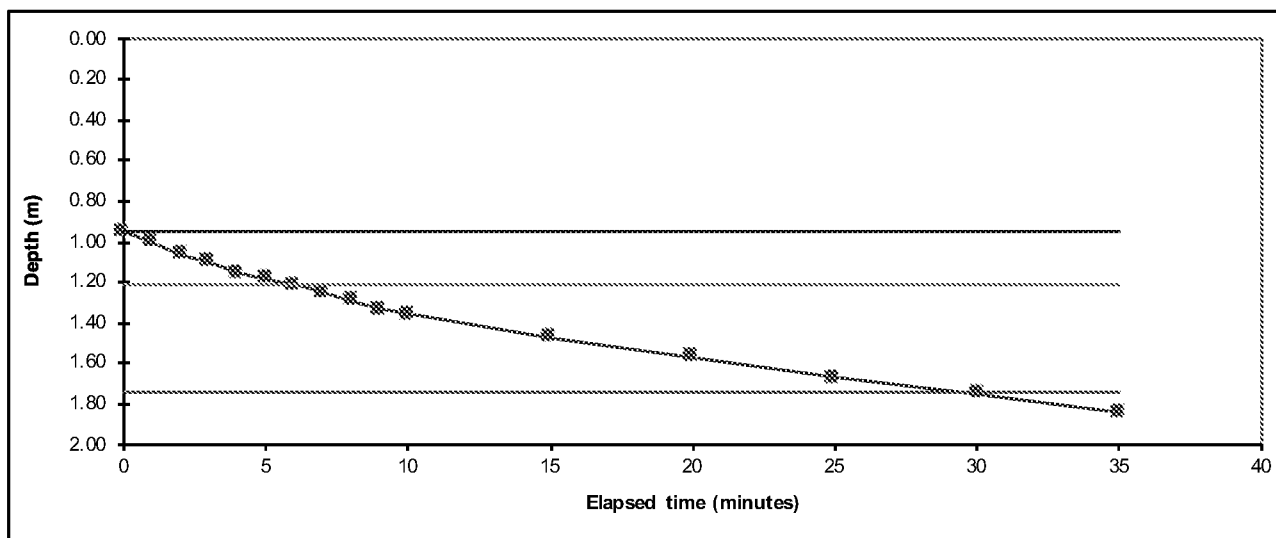
Remarks	Results processed following BRE 365 (2007).
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Client:	Westergate, Fontwell	TP2
Site:		

Your Environment

Soakaway Test

Trial Pit No:	TP2	Test No:	2	Date:	26.03.2019
Length (m):	1.500	Datum Height:			0.00 m agl
Width (m):	0.60	Granular infill:	None		
Depth (m):	2.00	Porosity of infill:	1	(assumed)	
Elapsed time (minutes)		Water Depth (m below datum)	Elapsed time (minutes)		Water Depth (m below datum)
0		0.950	30		1.750
1		1.000	35		1.840
2		1.060			
3		1.100			
4		1.150			
5		1.180			
6		1.210			
7		1.250			
8		1.290			
9		1.330			
10		1.360			
15		1.470			
20		1.570			
25		1.670			



Start water depth for analysis (mbgl):	0.95	Elapsed time (mins):	6.0
75% effective depth (mbgl):	1.21		
50% effective depth (mbgl):	1.48	Elapsed time (mins):	29.4
25% effective depth (mbgl):	1.74		
Base of soakage zone (mbgl):	2.00		
Volume outflow between 75% and 25% effective depth (m ³):	0.477		
Mean surface area of outflow (m ²):	3.08		
(side area at 50% effective depth + base area)			
Time for outflow between 75% and 25% effective depth (mins):	23.4		

Soil infiltration rate (m/s):	1.1E-4
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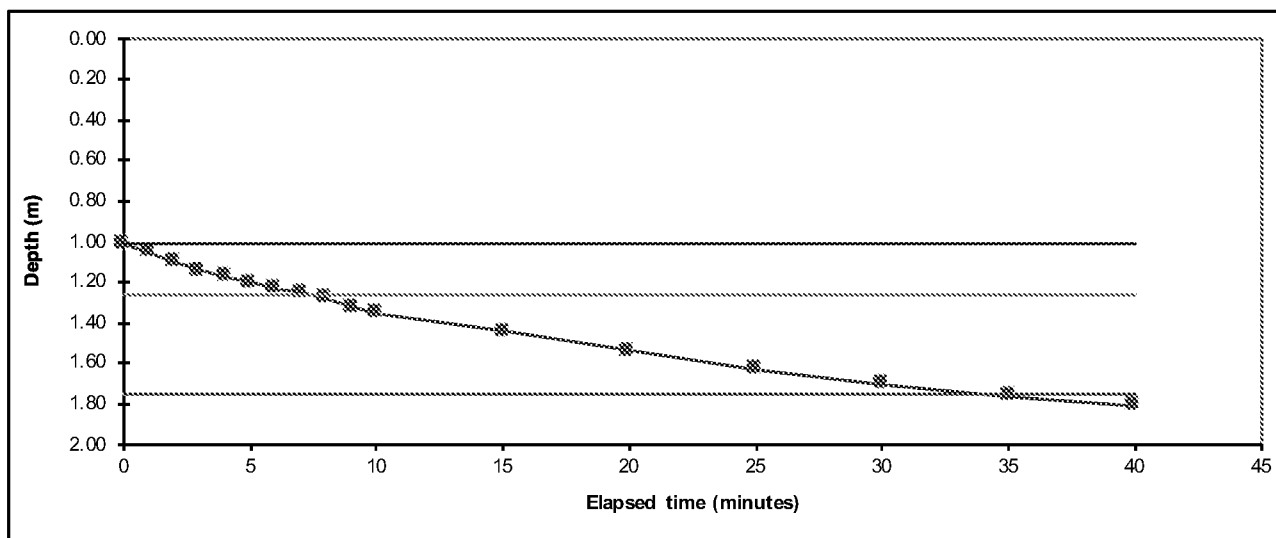
Remarks	Results processed following BRE 365 (2007).
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Client:		TP2
Site:	Westergate, Fontwell	

Your Environment

Soakaway Test

Trial Pit No:	TP2	Test No:	3	Date:	26.03.2019
Length (m):	1.500	Datum Height:			0.00 m agl
Width (m):	0.60	Granular infill:	None		
Depth (m):	2.00	Porosity of infill:	1	(assumed)	
Elapsed time (minutes)		Water Depth (m below datum)	Elapsed time (minutes)		Water Depth (m below datum)
0		1.010	30		1.700
1		1.050	35		1.760
2		1.100	40		1.810
3		1.140			
4		1.170			
5		1.200			
6		1.230			
7		1.250			
8		1.280			
9		1.320			
10		1.350			
15		1.440			
20		1.540			
25		1.630			



Start water depth for analysis (mbgl):	1.01	Elapsed time (mins):	7.3
75% effective depth (mbgl):	1.26		
50% effective depth (mbgl):	1.51	Elapsed time (mins):	34.2
25% effective depth (mbgl):	1.75		
Base of soakage zone (mbgl):	2.00		
Volume outflow between 75% and 25% effective depth (m ³):	0.441		
Mean surface area of outflow (m ²):	2.96		
(side area at 50% effective depth + base area)			
Time for outflow between 75% and 25% effective depth (mins):	26.9		

Soil infiltration rate (m/s):	9.2E-5
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Remarks	Results processed following BRE 365 (2007).
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Client:		TP2
Site:	Westergate, Fontwell	

JOB DETAILS:

Client: Westergate
Site: 10.04.2019
Date:

Job No: YE6846
Visit No: 1 of 3
Operator: Nick H

[illegible]

ND - Not detected

NR - Not recorded

NA - Non applicable

Where no flow (ND) recorded, GSVs are calculated using equipment limit of detection (0.1 l/hr). Where negative flows recorded, these are converted to positive values for calculation of GSVs.

METEOROLOGICAL AND SITE INFORMATION:

State of ground:

Wind:

Cloud cover:

Precipitation:

Time monitoring performed:

Barometric pressure (mbar):

Pressure trend (Daily):

Source:

Air Temperature (Deg. C):

TITION:		(Select correct box with X or enter data, as applicable)									
Dry	x	Moist	Wet		Snow						
Calm	x	Light	Moderate		Strong						
None		Slight	Cloudy		Overcast						
x		Slight	Moderate		Heavy						
	08:30	Start			End						
	1013	Start			End						
		Falling			Rising						
			Steady								
	7	Before	7				After				

Appendix C - Proposed Drainage Strategy

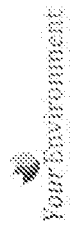


Key:

Soleway

Chamber / Silt Trap

Surface Water drain



Project:

Westgate House, Barchester,
Fortwell, BS18 0SU

Drawing:

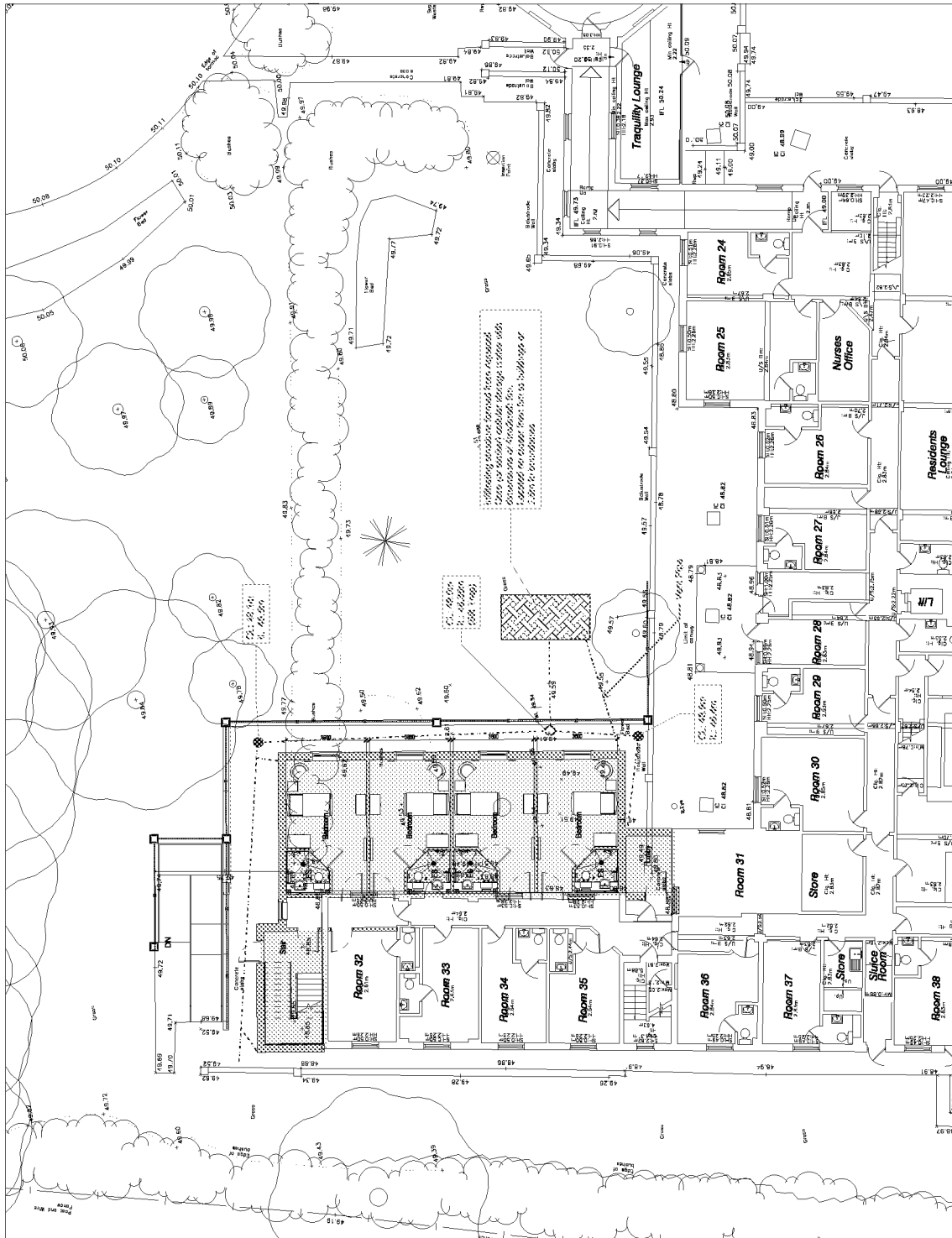
Drainage Strategy

Status:

Final

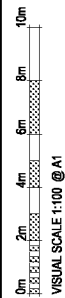
Date:

April 2019



Notes:

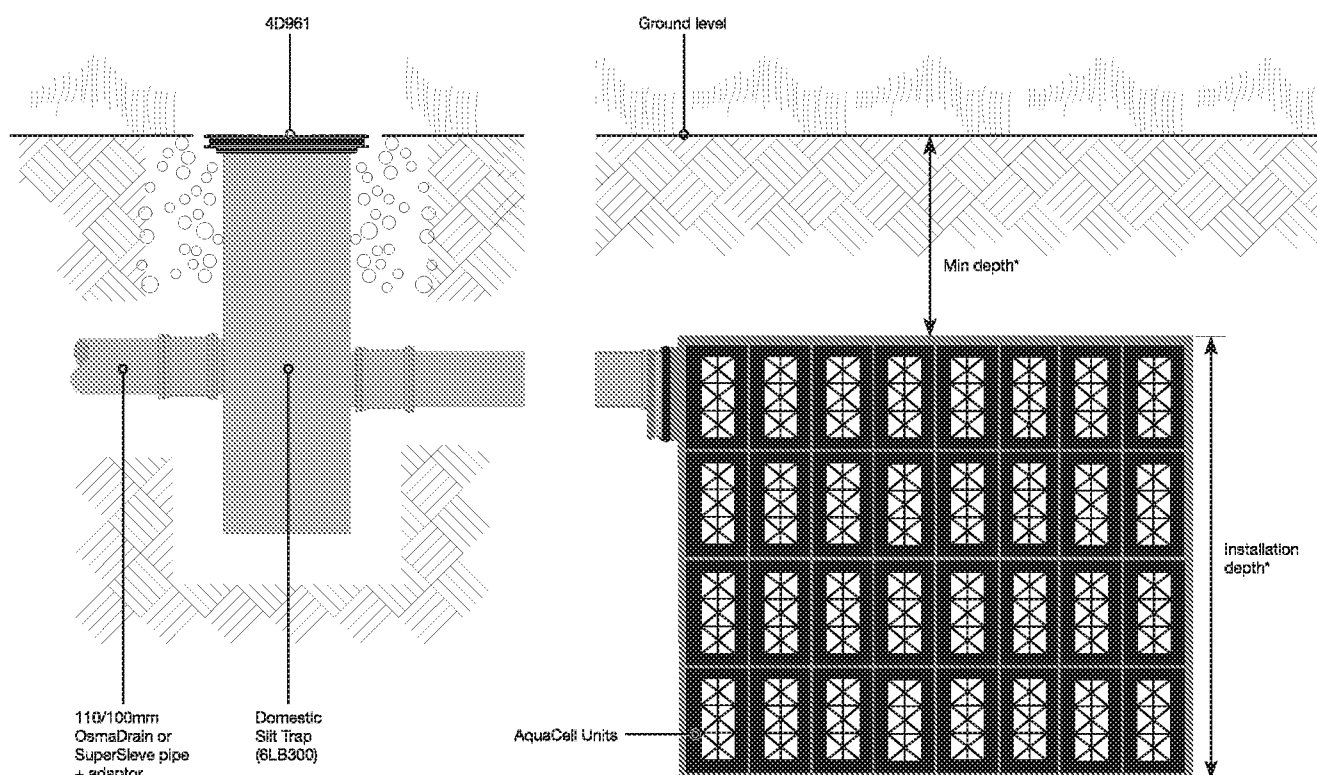
- All existing structures formed from concrete, steel or masonry shall be replaced with a new structure of concrete, steel or masonry to be built up to 2.0m above ground level.
- All inspection chambers to be 600mm dia cast-iron to BS 5951, with a minimum of 1 in 100 gradient. (Refer to BS 5951 for details)
- All silt traps to be 600mm dia cast-iron to BS 5951, with a minimum of 1 in 100 gradient. (Refer to BS 5951 for details)
- All structures detailed in this drainage layout are to be installed as per the manufacturer's instructions.



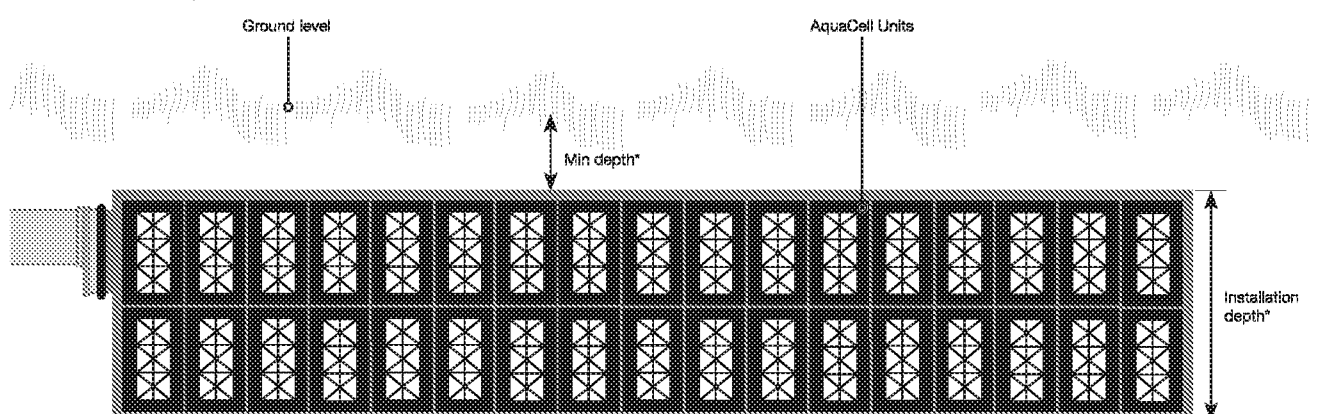
Typical Details AquaCell Units

Soakaway - Non-Traffic Loading

Synthesis

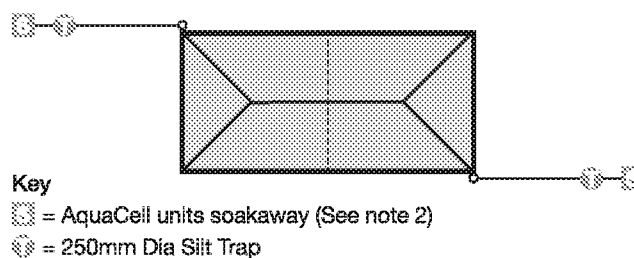


Trench soakaway



Notes

1. Soakaways should be sited at least 5m away from the building (Ref BS EN 752-4).
 2. The exact size and shape of the soakaways are to be determined once all the necessary calculations have been produced.
- *For information regarding cover depths and installation depths, see page 17.



Appendix D - Microdrainage Model outputs



KPT Properties				Page 1																																																																																																																																																																																																																			
19 Lonsdale Avenue Hutton Essex CM13 1NH		Westergate House Fontwell BN18 0SU																																																																																																																																																																																																																					
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XP Solutions		Source Control 2018.1.1																																																																																																																																																																																																																					
<u>Summary of Results for 10 year Return Period</u> Half Drain Time : 157 minutes. <table><tr><th>Storm Event</th><th>Max Level (m)</th><th>Max Depth (m)</th><th>Max Infiltration (l/s)</th><th>Max Volume (m³)</th><th>Status</th></tr><tr><td>15 min Summer</td><td>47.770</td><td>0.170</td><td>0.1</td><td>1.3</td><td>O K</td></tr><tr><td>30 min Summer</td><td>47.821</td><td>0.221</td><td>0.1</td><td>1.7</td><td>O K</td></tr><tr><td>60 min Summer</td><td>47.868</td><td>0.268</td><td>0.1</td><td>2.0</td><td>O K</td></tr><tr><td>120 min Summer</td><td>47.901</td><td>0.301</td><td>0.2</td><td>2.3</td><td>O K</td></tr><tr><td>180 min Summer</td><td>47.916</td><td>0.316</td><td>0.2</td><td>2.4</td><td>O K</td></tr><tr><td>240 min Summer</td><td>47.924</td><td>0.324</td><td>0.2</td><td>2.5</td><td>O K</td></tr><tr><td>360 min Summer</td><td>47.930</td><td>0.330</td><td>0.2</td><td>2.5</td><td>O K</td></tr><tr><td>480 min Summer</td><td>47.928</td><td>0.328</td><td>0.2</td><td>2.5</td><td>O K</td></tr><tr><td>600 min Summer</td><td>47.924</td><td>0.324</td><td>0.2</td><td>2.5</td><td>O K</td></tr><tr><td>720 min Summer</td><td>47.917</td><td>0.317</td><td>0.2</td><td>2.4</td><td>O K</td></tr><tr><td>960 min Summer</td><td>47.903</td><td>0.303</td><td>0.2</td><td>2.3</td><td>O K</td></tr><tr><td>1440 min Summer</td><td>47.876</td><td>0.276</td><td>0.2</td><td>2.1</td><td>O K</td></tr><tr><td>2160 min Summer</td><td>47.843</td><td>0.243</td><td>0.1</td><td>1.8</td><td>O K</td></tr><tr><td>2880 min Summer</td><td>47.817</td><td>0.217</td><td>0.1</td><td>1.7</td><td>O K</td></tr><tr><td>4320 min Summer</td><td>47.781</td><td>0.181</td><td>0.1</td><td>1.4</td><td>O K</td></tr><tr><td>5760 min Summer</td><td>47.756</td><td>0.156</td><td>0.1</td><td>1.2</td><td>O K</td></tr><tr><td>7200 min Summer</td><td>47.739</td><td>0.139</td><td>0.1</td><td>1.1</td><td>O K</td></tr><tr><td>8640 min Summer</td><td>47.725</td><td>0.125</td><td>0.1</td><td>1.0</td><td>O K</td></tr><tr><td>10080 min Summer</td><td>47.714</td><td>0.114</td><td>0.1</td><td>0.9</td><td>O K</td></tr><tr><td>15 min Winter</td><td>47.791</td><td>0.191</td><td>0.1</td><td>1.4</td><td>O K</td></tr></table> <table><tr><th>Storm Event</th><th>Rain (mm/hr)</th><th>Flooded Volume (m³)</th><th>Time-Peak (mins)</th></tr><tr><td>15 min Summer</td><td>55.208</td><td>0.0</td><td>18</td></tr><tr><td>30 min Summer</td><td>37.013</td><td>0.0</td><td>33</td></tr><tr><td>60 min Summer</td><td>23.882</td><td>0.0</td><td>62</td></tr><tr><td>120 min Summer</td><td>15.031</td><td>0.0</td><td>104</td></tr><tr><td>180 min Summer</td><td>11.365</td><td>0.0</td><td>134</td></tr><tr><td>240 min Summer</td><td>9.296</td><td>0.0</td><td>168</td></tr><tr><td>360 min Summer</td><td>6.996</td><td>0.0</td><td>236</td></tr><tr><td>480 min Summer</td><td>5.712</td><td>0.0</td><td>304</td></tr><tr><td>600 min Summer</td><td>4.878</td><td>0.0</td><td>372</td></tr><tr><td>720 min Summer</td><td>4.287</td><td>0.0</td><td>438</td></tr><tr><td>960 min Summer</td><td>3.495</td><td>0.0</td><td>568</td></tr><tr><td>1440 min Summer</td><td>2.618</td><td>0.0</td><td>824</td></tr><tr><td>2160 min Summer</td><td>1.959</td><td>0.0</td><td>1192</td></tr><tr><td>2880 min Summer</td><td>1.594</td><td>0.0</td><td>1560</td></tr><tr><td>4320 min Summer</td><td>1.192</td><td>0.0</td><td>2292</td></tr><tr><td>5760 min Summer</td><td>0.970</td><td>0.0</td><td>3008</td></tr><tr><td>7200 min Summer</td><td>0.826</td><td>0.0</td><td>3752</td></tr><tr><td>8640 min Summer</td><td>0.725</td><td>0.0</td><td>4488</td></tr><tr><td>10080 min Summer</td><td>0.649</td><td>0.0</td><td>5152</td></tr><tr><td>15 min Winter</td><td>55.208</td><td>0.0</td><td>18</td></tr></table>						Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status	15 min Summer	47.770	0.170	0.1	1.3	O K	30 min Summer	47.821	0.221	0.1	1.7	O K	60 min Summer	47.868	0.268	0.1	2.0	O K	120 min Summer	47.901	0.301	0.2	2.3	O K	180 min Summer	47.916	0.316	0.2	2.4	O K	240 min Summer	47.924	0.324	0.2	2.5	O K	360 min Summer	47.930	0.330	0.2	2.5	O K	480 min Summer	47.928	0.328	0.2	2.5	O K	600 min Summer	47.924	0.324	0.2	2.5	O K	720 min Summer	47.917	0.317	0.2	2.4	O K	960 min Summer	47.903	0.303	0.2	2.3	O K	1440 min Summer	47.876	0.276	0.2	2.1	O K	2160 min Summer	47.843	0.243	0.1	1.8	O K	2880 min Summer	47.817	0.217	0.1	1.7	O K	4320 min Summer	47.781	0.181	0.1	1.4	O K	5760 min Summer	47.756	0.156	0.1	1.2	O K	7200 min Summer	47.739	0.139	0.1	1.1	O K	8640 min Summer	47.725	0.125	0.1	1.0	O K	10080 min Summer	47.714	0.114	0.1	0.9	O K	15 min Winter	47.791	0.191	0.1	1.4	O K	Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)	15 min Summer	55.208	0.0	18	30 min Summer	37.013	0.0	33	60 min Summer	23.882	0.0	62	120 min Summer	15.031	0.0	104	180 min Summer	11.365	0.0	134	240 min Summer	9.296	0.0	168	360 min Summer	6.996	0.0	236	480 min Summer	5.712	0.0	304	600 min Summer	4.878	0.0	372	720 min Summer	4.287	0.0	438	960 min Summer	3.495	0.0	568	1440 min Summer	2.618	0.0	824	2160 min Summer	1.959	0.0	1192	2880 min Summer	1.594	0.0	1560	4320 min Summer	1.192	0.0	2292	5760 min Summer	0.970	0.0	3008	7200 min Summer	0.826	0.0	3752	8640 min Summer	0.725	0.0	4488	10080 min Summer	0.649	0.0	5152	15 min Winter	55.208	0.0	18
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<u>Model Details</u> Storage is Online Cover Level (m) 49.600 <u>Cellular Storage Structure</u> Invert Level (m) 47.600 Safety Factor 2.0 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95 Infiltration Coefficient Side (m/hr) 0.33120 <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>Depth (m)</th> <th>Area (m²)</th> <th>Inf. Area (m²)</th> <th>Depth (m)</th> <th>Area (m²)</th> <th>Inf. Area (m²)</th> </tr> </thead> <tbody> <tr> <td>0.000</td> <td>8.0</td> <td>8.0</td> <td>0.900</td> <td>0.0</td> <td>17.6</td> </tr> <tr> <td>0.800</td> <td>8.0</td> <td>17.6</td> <td></td> <td></td> <td></td> </tr> </tbody> </table>			Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)	0.000	8.0	8.0	0.900	0.0	17.6	0.800	8.0	17.6			
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Summer</td><td>48.339</td><td>0.739</td><td>0.4</td><td>5.6</td><td>○ K</td></tr><tr><td>600 min Summer</td><td>48.323</td><td>0.723</td><td>0.4</td><td>5.5</td><td>○ K</td></tr><tr><td>720 min Summer</td><td>48.303</td><td>0.703</td><td>0.4</td><td>5.3</td><td>○ K</td></tr><tr><td>960 min Summer</td><td>48.264</td><td>0.664</td><td>0.4</td><td>5.0</td><td>○ K</td></tr><tr><td>1440 min Summer</td><td>48.193</td><td>0.593</td><td>0.3</td><td>4.5</td><td>○ K</td></tr><tr><td>2160 min Summer</td><td>48.111</td><td>0.511</td><td>0.3</td><td>3.9</td><td>○ K</td></tr><tr><td>2880 min Summer</td><td>48.050</td><td>0.450</td><td>0.2</td><td>3.4</td><td>○ K</td></tr><tr><td>4320 min Summer</td><td>47.967</td><td>0.367</td><td>0.2</td><td>2.8</td><td>○ K</td></tr><tr><td>5760 min Summer</td><td>47.912</td><td>0.312</td><td>0.2</td><td>2.4</td><td>○ K</td></tr><tr><td>7200 min Summer</td><td>47.874</td><td>0.274</td><td>0.2</td><td>2.1</td><td>○ K</td></tr><tr><td>8640 min Summer</td><td>47.844</td><td>0.244</td><td>0.1</td><td>1.9</td><td>○ K</td></tr><tr><td>10080 min Summer</td><td>47.821</td><td>0.221</td><td>0.1</td><td>1.7</td><td>○ K</td></tr><tr><td>15 min Winter</td><td>48.037</td><td>0.437</td><td>0.2</td><td>3.3</td><td>○ K</td></tr></table> <table><tr><th>Storm Event</th><th>Rain (mm/hr)</th><th>Flooded Volume (m³)</th><th>Time-Peak (mins)</th></tr><tr><td>15 min Summer</td><td>126.521</td><td>0.0</td><td>18</td></tr><tr><td>30 min Summer</td><td>86.489</td><td>0.0</td><td>33</td></tr><tr><td>60 min Summer</td><td>56.422</td><td>0.0</td><td>62</td></tr><tr><td>120 min Summer</td><td>35.422</td><td>0.0</td><td>104</td></tr><tr><td>180 min Summer</td><td>26.491</td><td>0.0</td><td>134</td></tr><tr><td>240 min Summer</td><td>21.442</td><td>0.0</td><td>168</td></tr><tr><td>360 min Summer</td><td>15.918</td><td>0.0</td><td>236</td></tr><tr><td>480 min Summer</td><td>12.861</td><td>0.0</td><td>304</td></tr><tr><td>600 min Summer</td><td>10.890</td><td>0.0</td><td>372</td></tr><tr><td>720 min Summer</td><td>9.499</td><td>0.0</td><td>438</td></tr><tr><td>960 min Summer</td><td>7.649</td><td>0.0</td><td>568</td></tr><tr><td>1440 min Summer</td><td>5.623</td><td>0.0</td><td>824</td></tr><tr><td>2160 min Summer</td><td>4.123</td><td>0.0</td><td>1192</td></tr><tr><td>2880 min Summer</td><td>3.303</td><td>0.0</td><td>1560</td></tr><tr><td>4320 min Summer</td><td>2.412</td><td>0.0</td><td>2292</td></tr><tr><td>5760 min Summer</td><td>1.933</td><td>0.0</td><td>3008</td></tr><tr><td>7200 min Summer</td><td>1.628</td><td>0.0</td><td>3752</td></tr><tr><td>8640 min Summer</td><td>1.415</td><td>0.0</td><td>4496</td></tr><tr><td>10080 min Summer</td><td>1.257</td><td>0.0</td><td>5240</td></tr><tr><td>15 min Winter</td><td>126.521</td><td>0.0</td><td>18</td></tr></table>						Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status	15 min Summer	47.990	0.390	0.2	3.0	○ K	30 min Summer	48.117	0.517	0.3	3.9	○ K	60 min Summer	48.234	0.634	0.3	4.8	○ K	120 min Summer	48.310	0.710	0.4	5.4	○ K	180 min Summer	48.336	0.736	0.4	5.6	○ K	240 min Summer	48.347	0.747	0.4	5.7	○ K	360 min Summer	48.350	0.750	0.4	5.7	○ K	480 min Summer	48.339	0.739	0.4	5.6	○ K	600 min Summer	48.323	0.723	0.4	5.5	○ K	720 min Summer	48.303	0.703	0.4	5.3	○ K	960 min Summer	48.264	0.664	0.4	5.0	○ K	1440 min Summer	48.193	0.593	0.3	4.5	○ K	2160 min Summer	48.111	0.511	0.3	3.9	○ K	2880 min Summer	48.050	0.450	0.2	3.4	○ K	4320 min Summer	47.967	0.367	0.2	2.8	○ K	5760 min Summer	47.912	0.312	0.2	2.4	○ K	7200 min Summer	47.874	0.274	0.2	2.1	○ K	8640 min Summer	47.844	0.244	0.1	1.9	○ K	10080 min Summer	47.821	0.221	0.1	1.7	○ K	15 min Winter	48.037	0.437	0.2	3.3	○ K	Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)	15 min Summer	126.521	0.0	18	30 min Summer	86.489	0.0	33	60 min Summer	56.422	0.0	62	120 min Summer	35.422	0.0	104	180 min Summer	26.491	0.0	134	240 min Summer	21.442	0.0	168	360 min Summer	15.918	0.0	236	480 min Summer	12.861	0.0	304	600 min Summer	10.890	0.0	372	720 min Summer	9.499	0.0	438	960 min Summer	7.649	0.0	568	1440 min Summer	5.623	0.0	824	2160 min Summer	4.123	0.0	1192	2880 min Summer	3.303	0.0	1560	4320 min Summer	2.412	0.0	2292	5760 min Summer	1.933	0.0	3008	7200 min Summer	1.628	0.0	3752	8640 min Summer	1.415	0.0	4496	10080 min Summer	1.257	0.0	5240	15 min Winter	126.521	0.0	18
Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status																																																																																																																																																																																																																		
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240 min Summer	48.347	0.747	0.4	5.7	○ K																																																																																																																																																																																																																		
360 min Summer	48.350	0.750	0.4	5.7	○ K																																																																																																																																																																																																																		
480 min Summer	48.339	0.739	0.4	5.6	○ K																																																																																																																																																																																																																		
600 min Summer	48.323	0.723	0.4	5.5	○ K																																																																																																																																																																																																																		
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19 Lonsdale Avenue Hutton Essex CM13 1NH			Westergate House Fontwell BN18 0SU			
Date 14/04/2019 17:39 File cellstor_1%+40%.SRCX			Designed by Paul Checked by			
XP Solutions			Source Control 2018.1.1			
<u>Summary of Results for 100 year Return Period (+40%)</u>						
Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status	
30 min Winter	48.180	0.580	0.3	4.4	O K	
60 min Winter	48.313	0.713	0.4	5.4	O K	
120 min Winter	48.399	0.799	0.4	6.1	O K	
180 min Winter	48.435	0.835	0.4	6.3	O K	
240 min Winter	48.454	0.854	0.4	6.3	O K	
360 min Winter	48.422	0.822	0.4	6.2	O K	
480 min Winter	48.390	0.790	0.4	6.0	O K	
600 min Winter	48.360	0.760	0.4	5.8	O K	
720 min Winter	48.329	0.729	0.4	5.5	O K	
960 min Winter	48.271	0.671	0.4	5.1	O K	
1440 min Winter	48.174	0.574	0.3	4.4	O K	
2160 min Winter	48.071	0.471	0.3	3.6	O K	
2880 min Winter	48.000	0.400	0.2	3.0	O K	
4320 min Winter	47.910	0.310	0.2	2.4	O K	
5760 min Winter	47.855	0.255	0.1	1.9	O K	
7200 min Winter	47.818	0.218	0.1	1.7	O K	
8640 min Winter	47.791	0.191	0.1	1.5	O K	
10080 min Winter	47.771	0.171	0.1	1.3	O K	
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)			
30 min Winter	86.489	0.0	32			
60 min Winter	56.422	0.0	60			
120 min Winter	35.422	0.0	112			
180 min Winter	26.491	0.0	140			
240 min Winter	21.442	0.0	180			
360 min Winter	15.918	0.0	254			
480 min Winter	12.861	0.0	326			
600 min Winter	10.890	0.0	396			
720 min Winter	9.499	0.0	464			
960 min Winter	7.649	0.0	598			
1440 min Winter	5.623	0.0	864			
2160 min Winter	4.123	0.0	1236			
2880 min Winter	3.303	0.0	1616			
4320 min Winter	2.412	0.0	2336			
5760 min Winter	1.933	0.0	3064			
7200 min Winter	1.628	0.0	3816			
8640 min Winter	1.415	0.0	4504			
10080 min Winter	1.257	0.0	5240			
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KPT Properties		Page 3																																	
19 Lonsdale Avenue Hutton Essex CM13 1NH	Westergate House Fontwell BN18 0SU																																		
Date 14/04/2019 17:39 File cellstor_1%+40%.SRCX	Designed by Paul Checked by																																		
XP Solutions Source Control 2018.1.1																																			
<u>Rainfall Details</u> <table> <tr> <td>Rainfall Model</td> <td>FSR</td> <td>Winter Storms</td> <td>Yes</td> </tr> <tr> <td>Return Period (years)</td> <td>100</td> <td>Cv (Summer)</td> <td>0.750</td> </tr> <tr> <td>Region</td> <td>England and Wales</td> <td>Cv (Winter)</td> <td>0.840</td> </tr> <tr> <td>M5-60 (mm)</td> <td>19.900</td> <td>Shortest Storm (mins)</td> <td>15</td> </tr> <tr> <td>Ratio R</td> <td>0.316</td> <td>Longest Storm (mins)</td> <td>10080</td> </tr> <tr> <td>Summer Storms</td> <td>Yes</td> <td>Climate Change %</td> <td>+40</td> </tr> </table> <u>Time Area Diagram</u> Total Area (ha) 0.013 <table> <tr> <th colspan="2">Time (mins)</th> <th>Area</th> </tr> <tr> <th>From:</th> <th>To:</th> <th>(ha)</th> </tr> <tr> <td>0</td> <td>4</td> <td>0.013</td> </tr> </table>			Rainfall Model	FSR	Winter Storms	Yes	Return Period (years)	100	Cv (Summer)	0.750	Region	England and Wales	Cv (Winter)	0.840	M5-60 (mm)	19.900	Shortest Storm (mins)	15	Ratio R	0.316	Longest Storm (mins)	10080	Summer Storms	Yes	Climate Change %	+40	Time (mins)		Area	From:	To:	(ha)	0	4	0.013
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Date 14/04/2019 17:39 File cellstor_1%+40%.SRCX	Designed by Paul Checked by	
XP Solutions Source Control 2018.1.1		

Model Details

Storage is Online Cover Level (m) 49.600

Cellular Storage Structure

Invert Level (m) 47.600 Safety Factor 2.0
 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
 Infiltration Coefficient Side (m/hr) 0.33120

Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)
0.000	8.0	8.0	0.900	0.0	17.6
0.800	8.0	17.6			

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