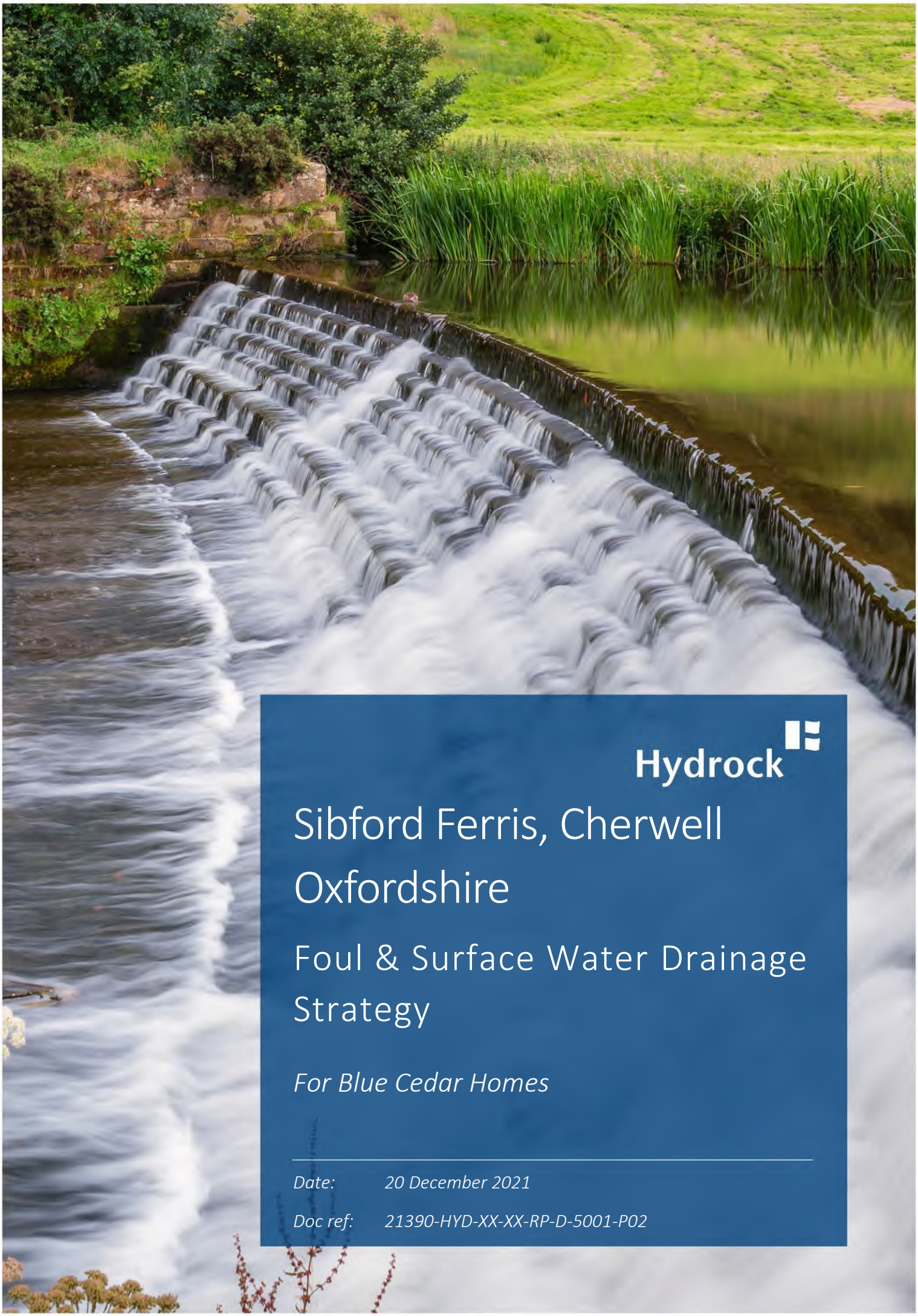

Hydrock

Sibford Ferris, Cherwell Oxfordshire

Foul & Surface Water Drainage Strategy

For Blue Cedar Homes

Date: *20 December 2021*

Doc ref: *21390-HYD-XX-XX-RP-D-5001-P02*

DOCUMENT CONTROL SHEET

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Client	Blue Cedar Homes	
Project name	Sibford Ferris, Cherwell Oxfordshire	
Title	Foul & Surface Water Drainage Strategy	
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P01	S2	14/12/2021	First Issue
P02	S2	20/12/2021	Drainage layout amended.

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Appendices

1. INTRODUCTION

This report has been prepared by Hydrock Consultants Limited (Hydrock) on behalf of Blue Cedar Homes in support of an outline planning application for a proposed residential development with associated access roads and public open space on a parcel of land located on the western side of the village of Sibford Ferris, some 6½ miles to the south-west of Banbury

This Drainage Strategy has been prepared to address the requirements of the NPPF, through:

- Assessing whether the proposed development is appropriate in the suggested location.
- Investigating existing drainage and ground infiltration potential.
- Identifying the main constraints and opportunities to facilitate a sustainable strategy for managing surface water.
- Identifying further work required to support a planning application.

The site is less than 1hectare in area and is located in Flood Zone 1 therefore a site specific Flood Risk Assessment is not considered necessary.

2. SITE INFORMATION

2.1 Location and Setting

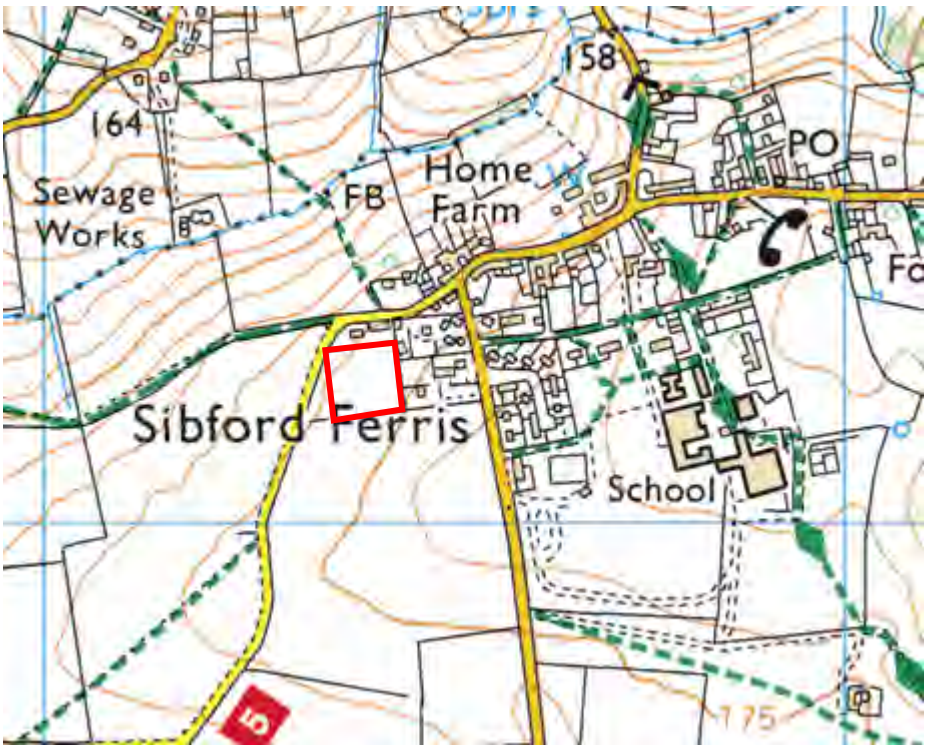
The site is located on the western side of the village with existing residential development to the north and east, and is bounded to the west by Woodway Road with open fields beyond. To the south is currently undeveloped land however it is understood that planning permission has been granted for residential development and that this will provide the access to the site

The site is currently undeveloped 'greenfield' land given over to agricultural use.

The site address and location are shown below in Table 1 and Figure 1 below.

Table 1: Site Address

Address	Land adjacent to Woodway Road, Sibford Ferris
Post Code	OX15 5QW
OS Grid Reference	E. 435397, N. 237173 SP353371 / SP3539737173



Contains OS data © Crown copyright (2019) and Environment Agency data under OGLv3

Figure 1: Site Location

2.2 Topography

A topographical survey of the site has been provided by the Client and indicates that the site generally falls from the south-east to the north-west at an average gradient of 1 in 16. The highest ground level is 174.7m AOD and the lowest ground level is 168.2m AOD.

Three overhead power lines cross the site in an approximate north/south direction.

A copy of the topographical survey is included in Appendix A.

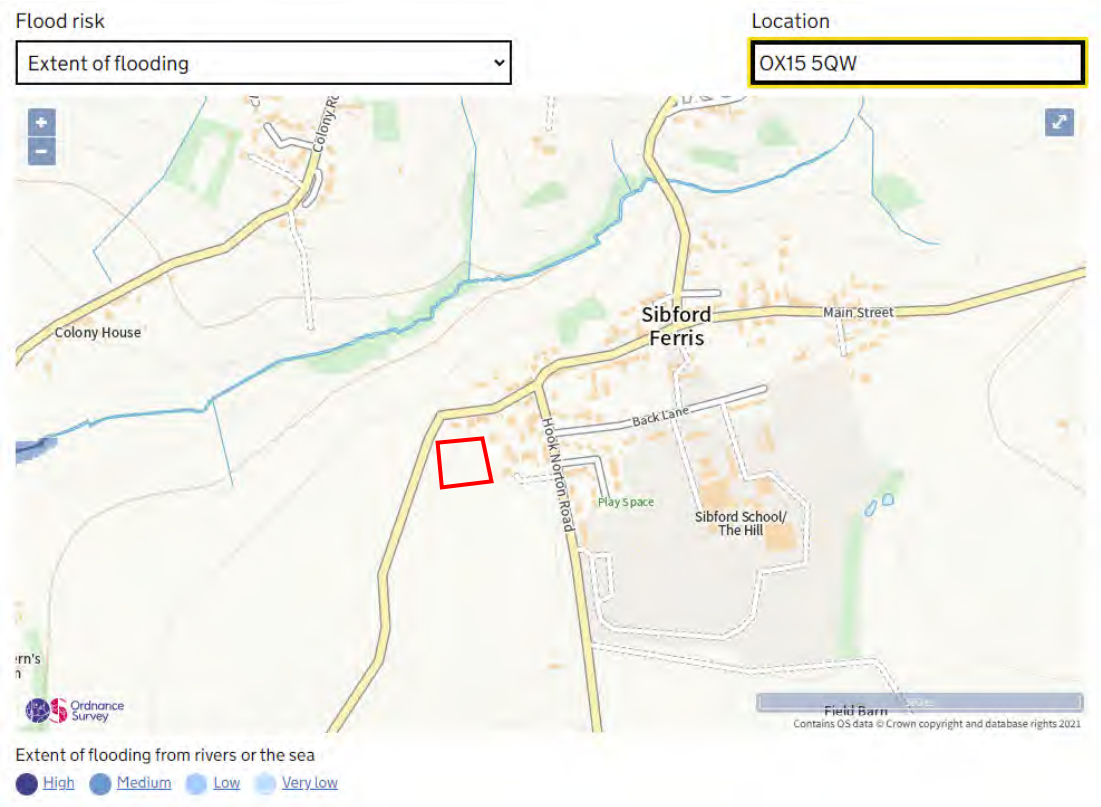
2.3 Proposed Development

The proposed development is residential in nature and covers an area of approximately 0.8ha of undeveloped land. The development will comprise 6 dwellings including an access road, driveways and open public space.

A copy of the proposed architectural layout is included in Appendix A.

2.4 Existing Flood Risk Information

The GOV.UK Long Term Flood Risk website provides the following mapping for the site.



Contains OS data © Crown copyright (2019) and Environment Agency data under OGLv3

Figure 2: Flood Risk Mapping

Contains OS data © Crown copyright (2019) and Environment Agency data under OGLv3

Figure 3: Surface Water Mapping

From the above information, it can be seen that the site falls within Flood Zone 1 and that there are no records of surface water flooding from overland flows.

3. SURFACE WATER MANAGEMENT

3.1 Pre-Development

Public sewerage in this area is provided by Severn Trent Water and copies of the sewer record plans have been obtained. No existing surface water sewers are shown in the vicinity of the site.

Given the relatively rural location and the fact that the site is undeveloped, no public surface water sewers are anticipated within the site boundary or in Woodway Road to the west.

As described in Section 2.1, the existing site is a vacant parcel of greenfield land and as such no private drainage systems are anticipated.

A copy of the sewer record plans is included in Appendix A.

There are no watercourses recorded within the site or in the immediate vicinity, the nearest body of water being an unnamed watercourse, approximately 190m to the north of the site.

Given the absence of existing drainage systems and watercourses, rainfall will infiltrate the ground until infiltration capacity is reached at which point flows will travel overland following the topography of the site. The British Geological Survey (BGS) online data indicates that there are no superficial soil deposits, with the underlying geology being Northampton Sand Formation, comprising sandstone, limestone and ironstone.

An intrusive ground investigation was undertaken by Geo Consulting Engineering Limited in December 2021 which included infiltration testing. The geology of the site has been described as;

"Ground conditions encountered within the exploratory holes typically comprised a covering of topsoil underlain by weathered Northampton Sand Formation, comprising a mix of clay, silt and sand deposits underlain by a grading sequence of gravel and/ or cobbles and/ or boulders of limestone. Beneath the weathered deposits in four locations, limestone bedrock of the Northampton Sand Formation was encountered".

The soakaway testing carried out indicated good to reasonable rates of infiltration. A summary of the test results, and the conclusions from the ground investigation report are included in Appendix A of this report. It should be noted that the full report is of significant size and it is not practical to include the full report in this document.

In view of the above it is assumed that the site is suitable for infiltration of surface water runoff however, it is recommended that in the next phase of the development, further geotechnical investigations are carried out in order to confirm the suitability of soakaways for use on the site.

3.2 Post-Development

3.2.1 In accordance with the Sustainable Drainage Systems (SUDS) hierarchy, rainfall run-off should be managed in the following preferential order:

1. Infiltrated to ground.
2. Discharged to local watercourse.
3. Discharged to a local surface water sewer network.

4. Discharged to a local combined water sewer network.

As described above, it is anticipated from the geotechnical investigations that the site is suitable for infiltration of surface water into the ground.

Given the advice contained within the geotechnical report, runoff from the individual plots will be collected via a positive piped system and conveyed to a communal soakaway feature in the proposed open space area to the west. This will ensure that concentrated volumes of water will be at an appropriate distance from buildings.

Areas of hardstanding will be formed using a permeable surface and will cater only for rainfall falling directly upon that area, no additional inflows will be included. In this way the surface will mimic the existing rainfall action. The access road and driveway areas will be split into self-contained 'cells' in order to ensure that runoff does not migrate across the site, keeping individual catchment areas relatively small. Where areas of significant hardstandings are immediately adjacent to a building, the area of permeable paving will be set away from the edge of the structure.

The paved areas will be underlain by a sub-base layer which also provide storage volume for the rainfall runoff.

All soakaway structures will be designed to accommodate up to and including the 1 in 100 year storm event plus an allowance of 40% for climate change in accordance with the upper end of the UKCP18 allowance.

3.2.2 Soakaway Design Principles

The proposed soakaways have been designed in accordance with the general requirement of BRE 365. Calculations have been carried out using the Source Control module within the industry standard Micro Drainage software package.

The infiltration testing has determined a range of results between 1.29 x 10^{-5}m/s and 1.68 x 10^{-1} m/s. The result closest to the area of soakaway under consideration has been used and where the soakaway feature is some distance from a test position the worst-case result of 1.29 x 10^{-5}m/s has been used.

Impermeable areas have been measured from the Illustrative Layout plan and an 'urban creep' factor of +10% has been applied to all area.

3.2.3 Soakaway Components

Communal House Soakaway

There is insufficient space to enable each plot to have its own soakaway unit. The geotechnical report recommends that a soakaway should be located at least 5m from a building, and ideally given the geology, up to 10m away. From the proposed layout it is apparent that this can be accommodated by providing a single soakaway in the western open space area so maintaining a 10m standoff distance.

A Micro Drainage model has been run for the 1 in 100 year event plus a 40% climate change allowance, the 1 in 30 year event and the 1 in 10 year event.

Given the location of the soakaway in respect to the infiltration test positions, the 'worst-case' infiltration value of 1.29 x 10^{-5}m/s has been used. A factor of safety of 5 has been included due to the position of the soakaway being in open space and downslope of the houses in accordance with Table 25.2 of CIRIA C753 The SuDS Manual.

The soakaway structure will be a geocelluar 'crate', of dimensions 25.0m x 5.0m x 2.0m deep, in order to provide the required volume.

A full set of modelling results is included in Appendix B of this report and it will be noted that the soakaway achieves half drain down times of less than 24 hours for the Q10 and Q30 however, this is exceeded for the Q100 +40% event, although no flooding will occur. Section 13.4.1 of the SuDS Manual allows for this scenario provided that the consequences of any failure or exceedance are not severe. As described above, the soakaways will be located within open space and downslope of the buildings therefore any overflow from the unit will not have an adverse effect.

The location of the soakaway and a schematic surface water drainage layout can be seen on drawing 21390-HYD-XX-XX-DR-D-2001 included in Appendix C.

Hardstanding Areas

As described in section 3.2.1 above, areas of hardstanding will be constructed using permeable surfacing materials with Type 3 sub-base storage below. There will be no inflows from other areas and therefore the hardstandings will deal only with rainfall falling on the paved area only, thus mimicking the current greenfield situation.

The hardstanding areas have been split into smaller 'cells' in order to prevent water passing through the system and becoming concentrated in any one location.

As the hardstanding areas are located relatively close to the proposed buildings, a safety factor of 10 has been employed in accordance with Table 25.2 of CIRIA C753 The SuDS Manual.

Each 'cell' has been modelled for a Q100 +40% climate change event and a full set of the results are included in Appendix B of this report. The various 'cells' have been modelled using the infiltration rate from the nearest test location. Where a test is not in the immediate vicinity the 'worst-case' infiltration value of 1.29 x 10^{-5}m/s has been used.

It will be noted from the results that all of the 'cells' achieve a half drain down time of less than 24 hours and that the maximum depth of storage required is 450mm and, in most cases, is significantly less.

The locations of the hardstanding 'cells' are shown on the Drainage Strategy plan, drawing 21390-HYD-XX-XX-DR-D-2001, included in Appendix C.

3.2.4 Sustainable Drainage Systems

In accordance with NPPF requirements, Sustainable Drainage Systems (SuDS) have been applied across the site where practicable.

These include the provision of permeable paving to significant areas of private hardstanding and discharging surface water to ground via soakaways.

CIRIA document C753, Chapter 26, recommends the use of the 'Simple Index Approach' for assessing the minimum water quality management requirements and this method has been used to check the suitability of the above proposals as follows;

(i) From table 26.2, residential roads and roof runoff is classified as 'low' pollution hazard.

(ii) From Table 26.2, the following hazard indices are applicable

Total suspended solids	- 0.5
Metals	- 0.4
Hydrocarbons	- 0.4

(iii) From Table 26.3, the indicative SuDS mitigation indices for permeable paving is as follows

Total suspended solids	- 0.7
Metals	- 0.6
Hydrocarbons	- 0.6

From the above it can be seen that the provision of permeable paving alone achieves the minimum pollution mitigation requirements.

3.2.5 Maintenance

It is anticipated that all drainage systems will remain private and will therefore be the joint responsibility of the householders. The residents will be issued with an information pack on purchase of the properties containing details for the various drainage features together with recommendations for maintenance.

3.2.6 Overland and Exceedance Flows

As demonstrated by the overland flows and exceedance drawing, drawing 21390-HYD-XX-XX-DR-D-2002, located in Appendix C, overland flows are directed towards the attenuation basin, swale, and open space areas.

4. FOUL WATER MANAGEMENT

4.1 Pre-Development

Public sewer maps obtained from Severn Trent Water shows that there are no public foul water sewers within the site boundaries however there is a 150mm diameter sewer located in Woodway Road some 35m to the north and a 150mm diameter sewer in Hook Norton Road some 125m to the east of the site.

As described in Section 2.1 above, the development area is an existing greenfield site and therefore no foul flows are likely to be generated by the site in the pre-development scenario.

4.2 Post-Development

In accordance with the Sewerage Sector Guidance as published by Water UK peak foul effluent flows should be calculated based on 4000l/dwelling/day.

As such peak foul effluent flows have been calculated based on 6 residential units giving a maximum rate of 0.3 l/s.

From an examination of the sewer record plan and the site levels, it is evident that a gravity connection will not be possible and therefore a pumped solution will be required. It is proposed that a private foul pumping station be located on the western side of the site and a rising main will be required to connect to the public sewer network. The shortest distance will be via Woodway Road to the west going north to discharge to the Severn Trent manhole reference 4202 outside the property known as Faraday House. A break manhole will be required prior to the final connection to the existing manhole.

The rising main is likely to remain as a private element of plant and it is therefore likely that a licence will be required from the Highway Authority to permit the construction of the pipework and associated chambers. It is assumed that the verge associated with Woodway Road is public highway however this is not proven at the time of writing and land ownership should be checked at an early stage. The existing public manhole which will be the discharge point is also located in the verge and again, land ownership in this area should be confirmed.

In order to maintain a minimum velocity of 0.75m/s in the proposed rising main, and assuming a minimum main diameter of 80mm, the minimum pump rate will need to be 3.8 l/s.

Given that this is a greenfield site, the site will generate additional flows and a Pre-Development Enquiry will need to be submitted to Severn Trent Water to confirm capacity is available.

Access will be required to the pumping station for maintenance purposes and is assumed that this can be combined with the general access necessary to maintain the open space.

A copy of the proposed Drainage Strategy layout plan, drawing 21390-HYD-XX-XX-DR-D-2001, is included in Appendix C.

5. CONCLUSIONS

This report demonstrates that provided a suitable, sustainable drainage system is employed, as described in this document, the proposed scheme:

- Is suitable in the location proposed.
- Can be adequately drained
- Will not place additional persons or properties at risk of flooding.
- Will put in place measures to ensure that surface water is appropriately managed.
- Will put in place measures to ensure that foul water drainage is appropriately managed.

As such, the proposals are concluded to meet the surface water flood risk and management requirements of the NPPF.

Appendix A

Existing Site Information

Reference	Title	Type	Originator
134/4918/1A	Topographic Survey	Drawing	Clifton Surveys Limited
4349-3-03 Rev L	Proposed Site Plan	Drawing	BBA Architects
No Reference	Asset Location Sewer Map	Plan	Severn Trent Water
GCE01141/Fig3	Exploratory Hole Location Plan	Drawing	Geo Consulting
GCE01141/R1	Infiltration Test Results	Report	Geo Consulting
GCE01141/R1	Infiltration Testing Conclusions	Report	Geo Consulting

237260.00 N

237220.00 N

237180.00 N

237140.00 N

435320.00 E

435360.00 E

435400.00 E

435440.00 E

435480.00 E

NORTH

STANDARD REFERENCES

ABBREVIATIONS

bl	bollard	lp	lamp post
bb	belisha beacon	mk	marker post
bs	bus stop	mh	manhole
bt	telecoms	nb	notice board
catv	cable TV cover	np	nameplate (road)
cl	cover level	p	post
conc	concrete	pb	post box
cws	combined sewer	ret.	retaining wall
dk	drop kerb	re	rodding eye
elc	electricity ic	rg	road gully
ESS	Elec. Sub-Station	rs	road sign
ep	electricity pole	rwp	rainwater pipe
fb	flower bed	sp	signpost
fh	fire hydrant	sv	stop valve
fl	floor level	svp	soil vent pipe
fp	footpath	sws	storm water sewer
fl.p	flagpole	tcb	telephone callbox
fws	foul water sewer	tp	telegraph pole
g	gully	tl	traffic light
gav	gas valve	utr	unable to raise
ic	inspection cover	vp	vent pipe
il	invert level	w'tap	woodtap fence
irf	iron railing fence	wm	water tap
jb	junction box	wp	wood post
ko	kerb outlet	wt	water tap

Notes

1. This survey has been computed and drawn about the Ordnance Survey National Grid.
2. All levels are in metres and relate to the Ordnance Survey active GPS stations.
3. This survey was measured for a scale of 1:200, any subsequent enlargements should be verified on site.

Revisions

Clifton Surveys Ltd
Topographical and Measured Building Surveyors
1 Wellington Park
Clifton
Bristol
BS8 2UR
TEL: (0117) 9735898
e-mail: info@cliftonsurveys.com
web: www.cliftonsurveys.com

Surveyed	L Wakeford	Date	August 2021
Drawn	L Wakeford	Checked	August 2021

Drawing Title: Topographical Survey
Land Of Woodway Road
Banbury
OX15 5RF

Client: Blue Cedar Homes
220 Park Ave, Aztec West
Bristol
BS32 4SY

Drawing No.: 134/4918/1A

Scale A0 @ 1:200

Rev	Date	Details

Project	Stage	Drawing	Rev	Status
4349	3	03	L	PLANNING

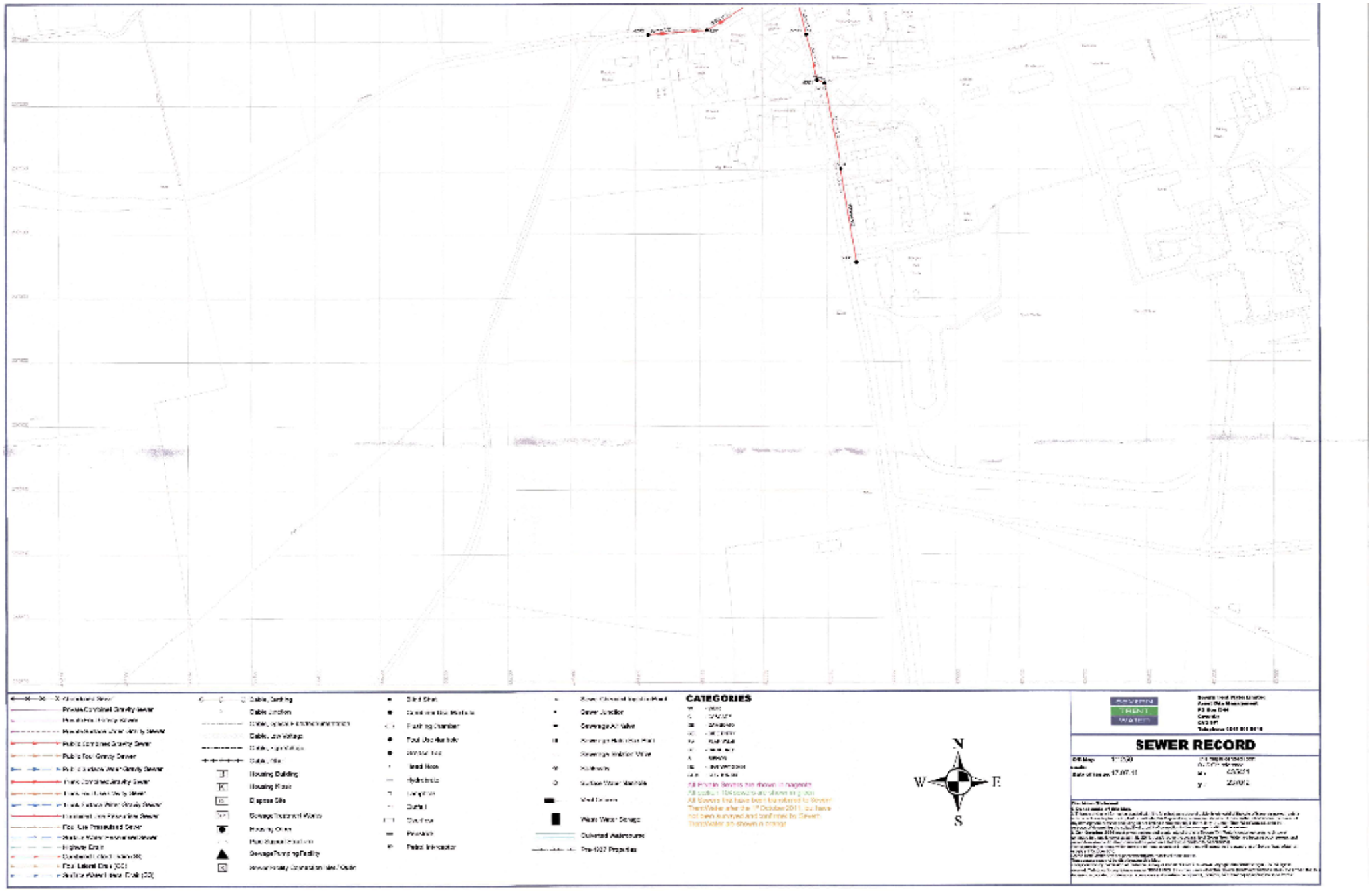
Scale	Size	Drawn	Check	Creation
1:500	A3 L	RL	MB	

5 10 20 30 m

Sibford Ferris
OX15 5QW

Site Plan
As Proposed

bba architects & planners



SEWER RECORD

CATEGORIES

All Public Sewers not shown in magenta
All public / adoptable Sewers are shown in green
All Sewers that have been transferred to Severn Trent Water after the 1st October 2011, but have not been surveyed and confirmed by Severn Trent Water, are shown in orange

Sewer Node / Sewer Pipe Data

REFERENCE	COVER LEVEL	INV LEVEL UPSTR	INV LEVEL DOWNSTR	PURP	MATL	SHAPE	MAX SIZE	MIN SIZE	GRADIENT	YEAR LAID
[illegible]	[illegible]	[illegible]	167.09	C	VC	C	[illegible]	[illegible]	211.59	[illegible]
[illegible]	[illegible]	162.59	157.93	[illegible]	VC	C	150	nil	[illegible]	nil
[illegible]	169.72	[illegible]	[illegible]	C	VC	C	150	nil	3.84	nil
[illegible]	[illegible]	[illegible]	161.45	C	VC	C	150	nil	[illegible]	nil
[illegible]	[illegible]	[illegible]	170.52	C	VC	C	150	nil	[illegible]	nil
SP85375131	179.69	[illegible]	174.75	C	VC	C	150	nil	[illegible]	nil
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[illegible]	179.06	[illegible]	[illegible]	C	VC	C	[illegible]	nil	[illegible]	nil
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SP95376203	172.22	168.44	167.99	C	VC	C	150	nil	[illegible]	nil
[illegible]	174.23	172.96	171.49	C	VC	C	150	nil	25.98	nil
[illegible]	172.70	171.41	169.70	C	VC	C	150	nil	27.78	nil
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MATERIALS

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SHAPE

[illegible]

PURPOSE

[illegible]

SEWER RECORD DATA TABLE

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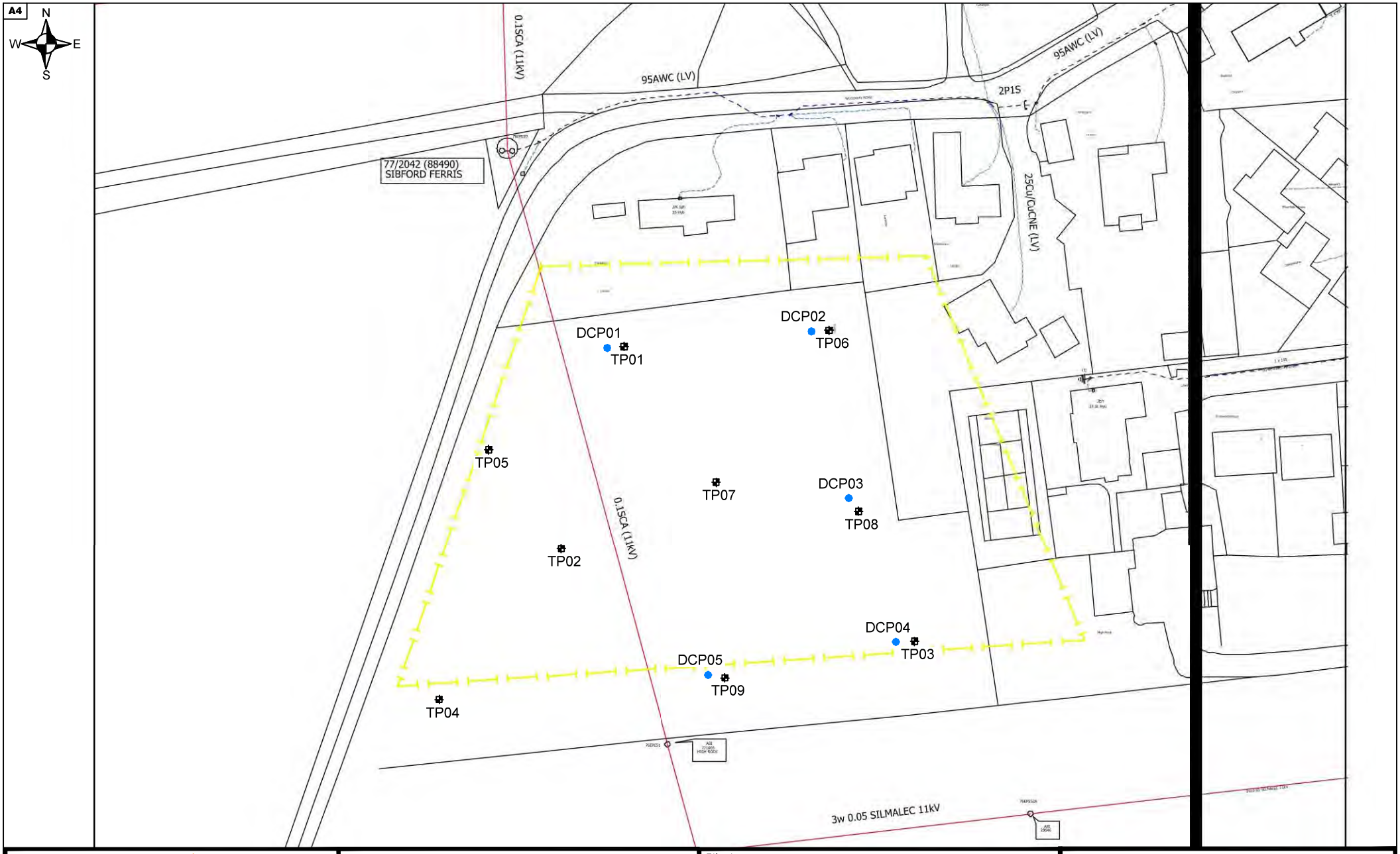

geoconsulting engineering ltd

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W: www.geoconsultingeng.co.uk

Client: **Blue Cedar Homes Ltd**

Drawing Status: **For Information**

Job Title: **Woodway Road Sibford Ferris**

Dwg Title: **Exporatory Hole Location Plan (Existing Layout)**

Scale: 1:1000 @ A4 Drawn: TB

Date: October 2021 Checked: DLJ

Drawing no: **GCE01141/Fig3** Rev:

Appendix G – Infiltration Test Results

Soakaway Test:

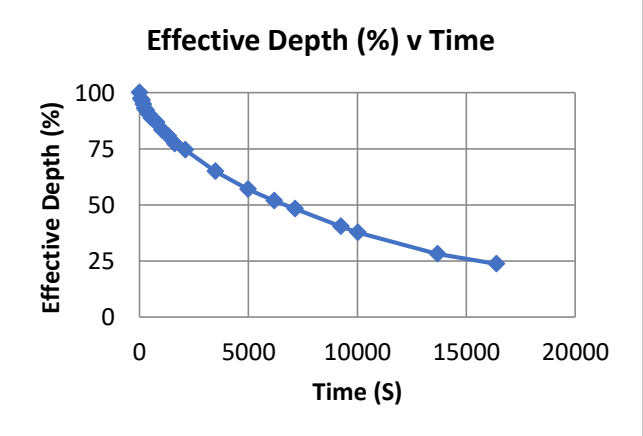
Trial Pit.	TP01
Test No.	1

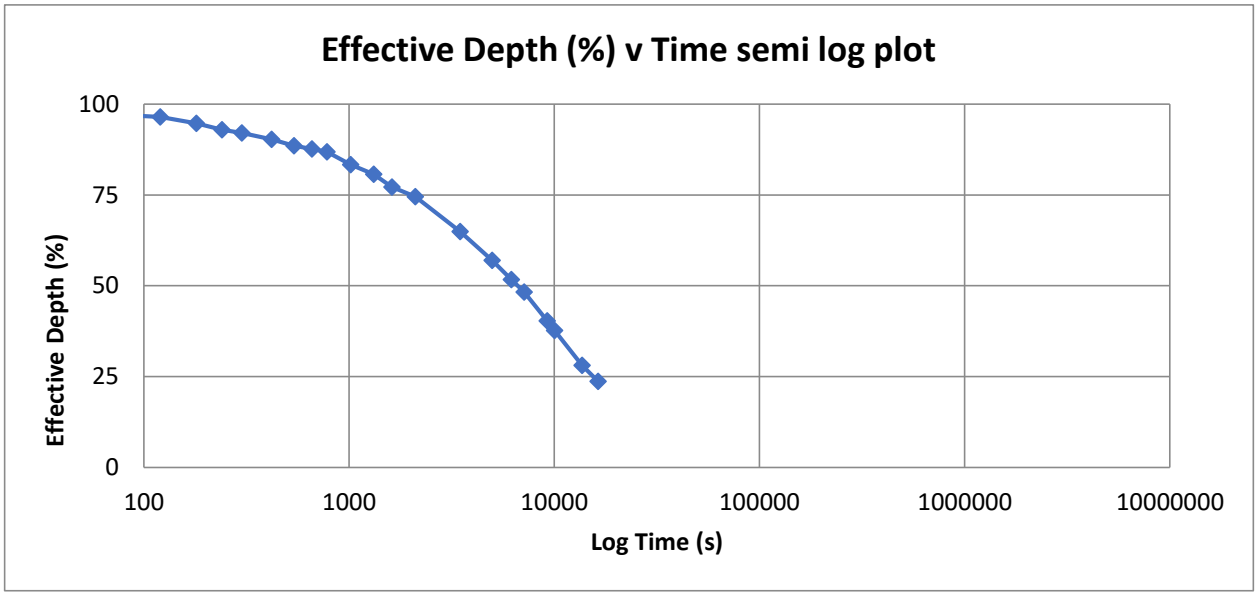
Dimensions:

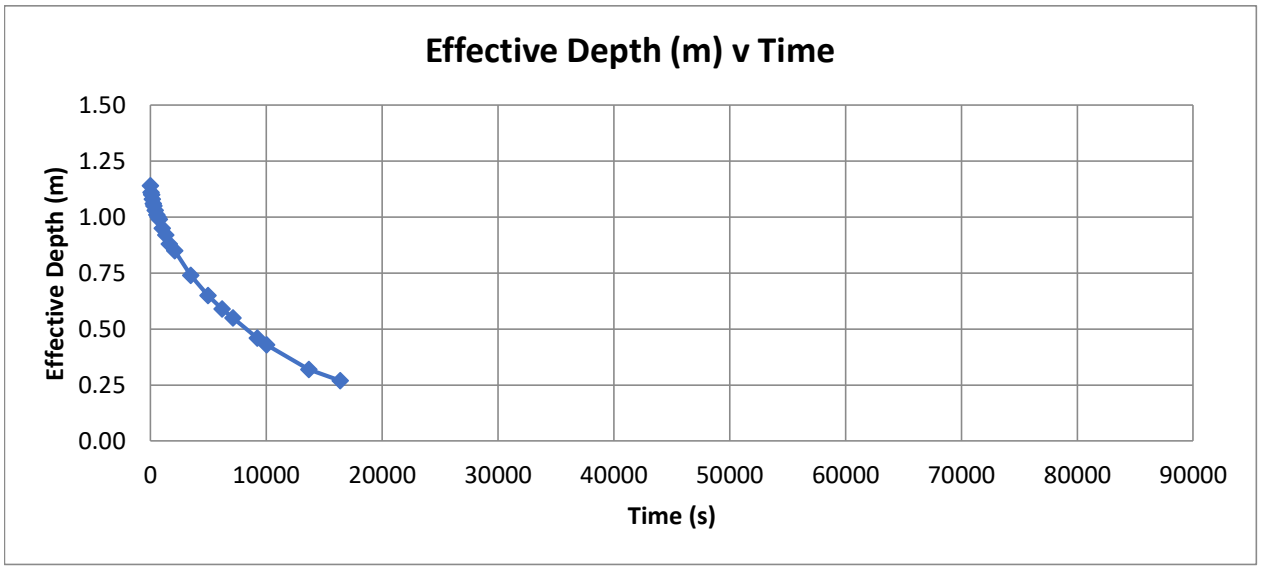
Length	2.10	m
Width	0.70	m
Depth	2.16	m
Start water depth	1.02	m
Effective Depth	1.14	m

Date	Time		Depth (mBGL)	Head/ Effective Depth (m)	Effective Depth (%)
	Hour	Seconds			
19 October 2021	09:32:00	0	1.02	1.14	100
19 October 2021	09:33:00	60	1.05	1.11	97
19 October 2021	09:34:00	120	1.06	1.1	96
19 October 2021	09:35:00	180	1.08	1.08	95
19 October 2021	09:36:00	240	1.10	1.06	93
19 October 2021	09:37:00	300	1.11	1.05	92
19 October 2021	09:39:00	420	1.13	1.03	90
19 October 2021	09:41:00	540	1.15	1.01	89
19 October 2021	09:43:00	660	1.16	1	88
19 October 2021	09:45:00	780	1.17	0.99	87
19 October 2021	09:49:00	1020	1.21	0.95	83
19 October 2021	09:54:00	1320	1.24	0.92	81
19 October 2021	09:59:00	1620	1.28	0.88	77
19 October 2021	10:07:00	2100	1.31	0.85	75
19 October 2021	10:30:00	3480	1.42	0.74	65
19 October 2021	10:55:00	4980	1.51	0.65	57
19 October 2021	11:15:00	6180	1.57	0.59	52
19 October 2021	11:31:00	7140	1.61	0.55	48
19 October 2021	12:06:00	9240	1.70	0.46	40
19 October 2021	12:19:00	10020	1.73	0.43	38
19 October 2021	13:20:00	13680	1.84	0.32	28
19 October 2021	14:05:00	16380	1.89	0.27	24

Effective Depth %	Depth (m)	Time (s)
75	0.855	2100
25	0.285	16000
	Vp75-25	tp75-25
Sum	0.8379	13900
Base	1.47	m2
Side long	1.197	m
Side short	0.399	m
ap50	4.662	m2
Soil Infiltration Rate	**1.29E-05**	**m/s**




Effective Depth (%) v Time semi log plot
Effective Depth (%)
100
75
50
25
0
100
1000
10000
100000
1000000
10000000
Log Time (s)


Effective Depth (m) v Time
Effective Depth (m)
1.50
1.25
1.00
0.75
0.50
0.25
0.00
0
10000
20000
30000
40000
50000
60000
70000
80000
90000
Time (s)

Soakaway Test:

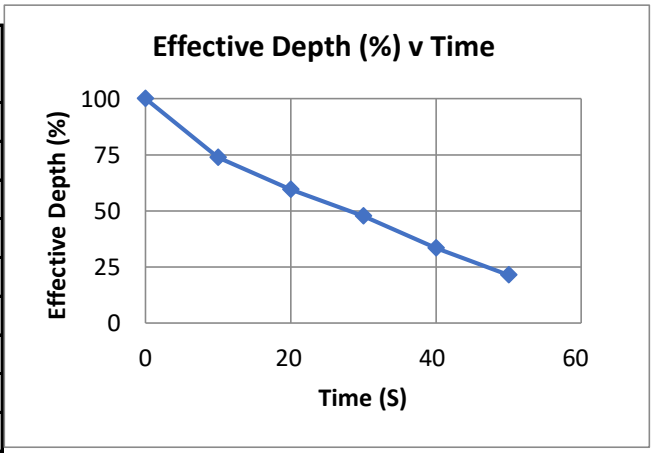
Trial Pit.	TP03
Test No.	1

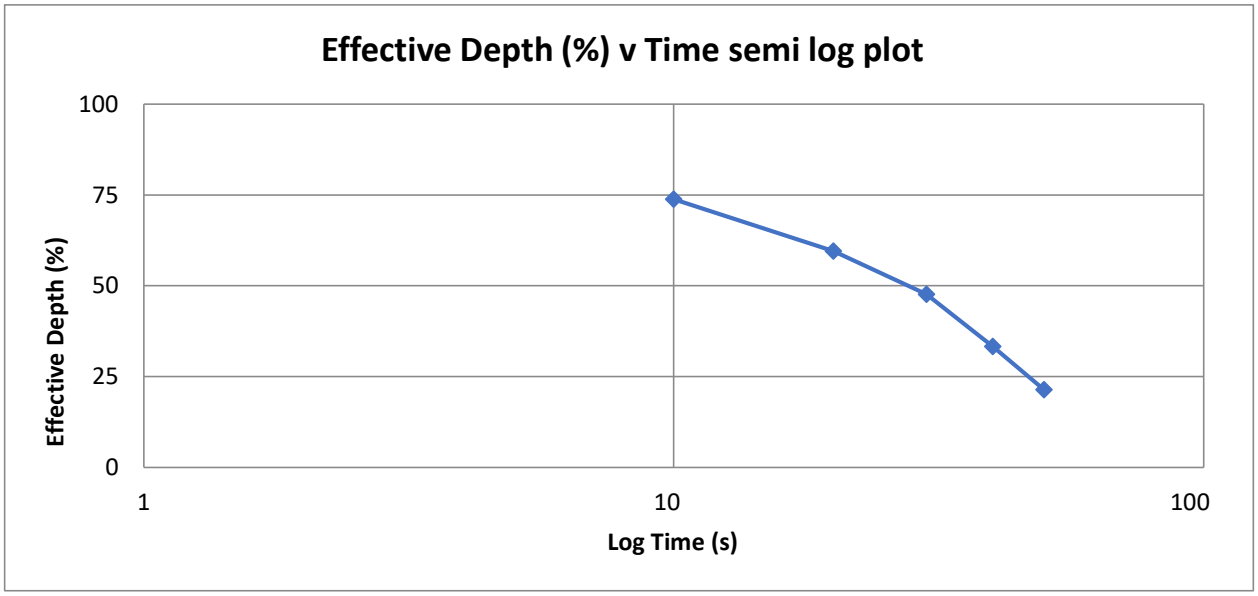
Dimensions:

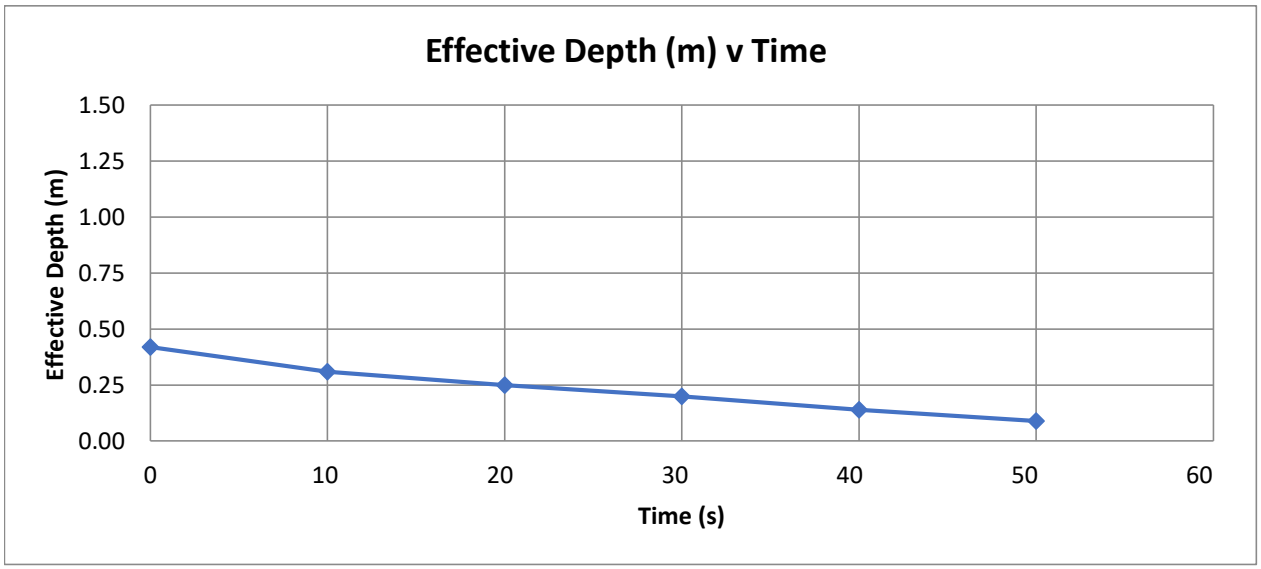
Length	2.00	m
Width	0.70	m
Depth	1.89	m
Start water depth	1.47	m
Effective Depth	0.42	m

Date	Time		Depth (mBGL)	Head/ Effective Depth (m)	Effective Depth (%)
	Hour	Seconds			
19 October 2021	-	0	1.47	0.42	100
19 October 2021	-	10	1.58	0.31	74
19 October 2021	-	20	1.64	0.25	60
19 October 2021	-	30	1.69	0.2	48
19 October 2021	-	40	1.75	0.14	33
19 October 2021	-	50	1.80	0.09	21

Effective Depth %	Depth (m)	Time (s)
75	0.315	10
25	0.105	48
	Vp75-25	tp75-25
Sum	0.294	38
Base	1.4	m2
Side long	0.42	m
Side short	0.147	m
ap50	2.534	m2
Soil Infiltration Rate	**3.05E-03**	**m/s**




Effective Depth (%) v Time semi log plot
100
75
50
25
0
Effective Depth (%)
1
10
100
Log Time (s)


Effective Depth (m) v Time
1.50
1.25
1.00
0.75
0.50
0.25
0.00
Effective Depth (m)
0
10
20
30
40
50
60
Time (s)

Soakaway Test:

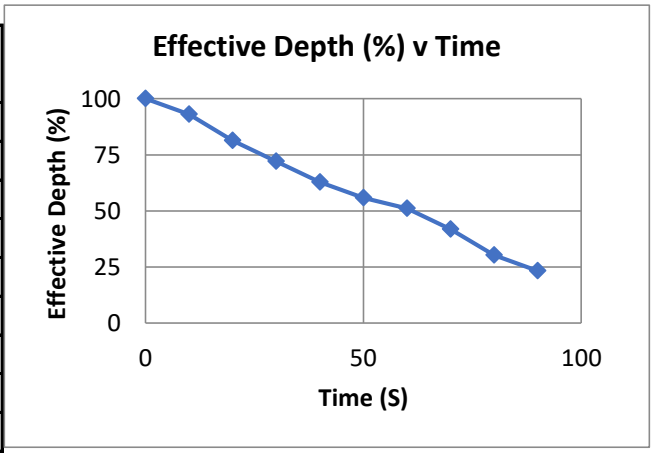
Trial Pit.	TP03
Test No.	2

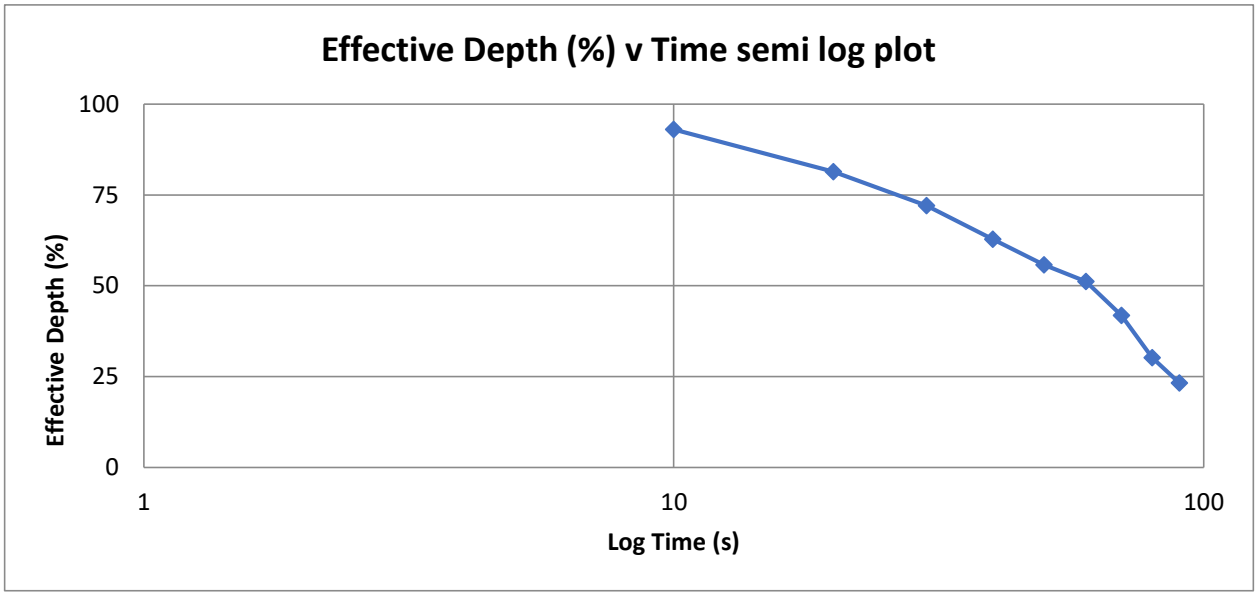
Dimensions:

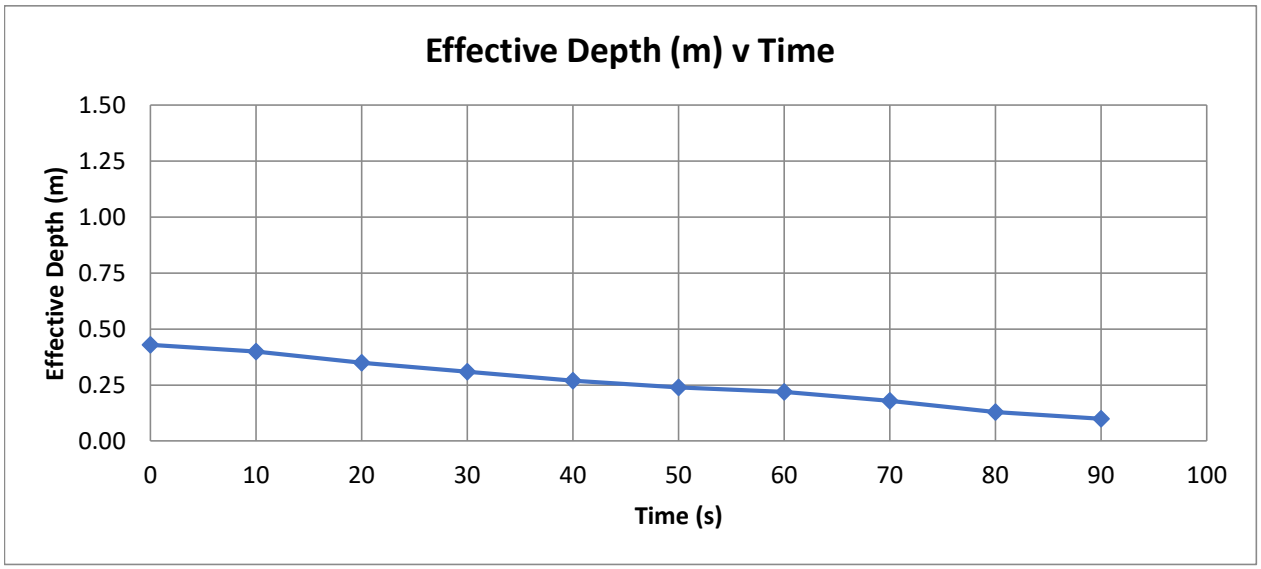
Length	2.00	m
Width	0.70	m
Depth	1.89	m
Start water depth	1.47	m
Effective Depth	0.42	m

Date	Time		Depth (mBGL)	Head/ Effective Depth (m)	Effective Depth (%)
	Hour	Seconds			
19 October 2021	-	0	1.46	0.43	100
19 October 2021	-	10	1.49	0.4	93
19 October 2021	-	20	1.54	0.35	81
19 October 2021	-	30	1.58	0.31	72
19 October 2021	-	40	1.62	0.27	63
19 October 2021	-	50	1.65	0.24	56
19 October 2021	-	60	1.67	0.22	51
19 October 2021	-	70	1.71	0.18	42
19 October 2021	-	80	1.76	0.13	30
19 October 2021	-	90	1.79	0.1	23

Effective Depth %	Depth (m)	Time (s)
75	0.315	26
25	0.105	88
	Vp75-25	tp75-25
Sum	0.294	62
Base	1.4	m2
Side long	0.42	m
Side short	0.147	m
ap50	2.534	m2
Soil Infiltration Rate	**1.87E-03**	**m/s**




Effective Depth (%) v Time semi log plot
100
75
50
25
0
Effective Depth (%)
1
10
100
Log Time (s)


Effective Depth (m) v Time
1.50
1.25
1.00
0.75
0.50
0.25
0.00
Effective Depth (m)
0
10
20
30
40
50
60
70
80
90
100
Time (s)

Soakaway Test:

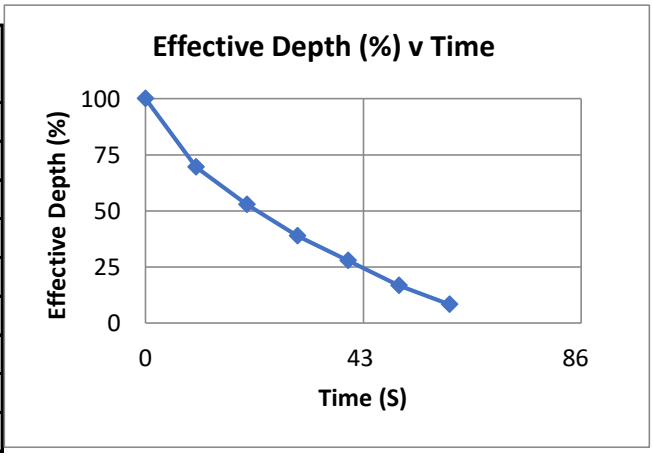
Trial Pit.	TP03
Test No.	3

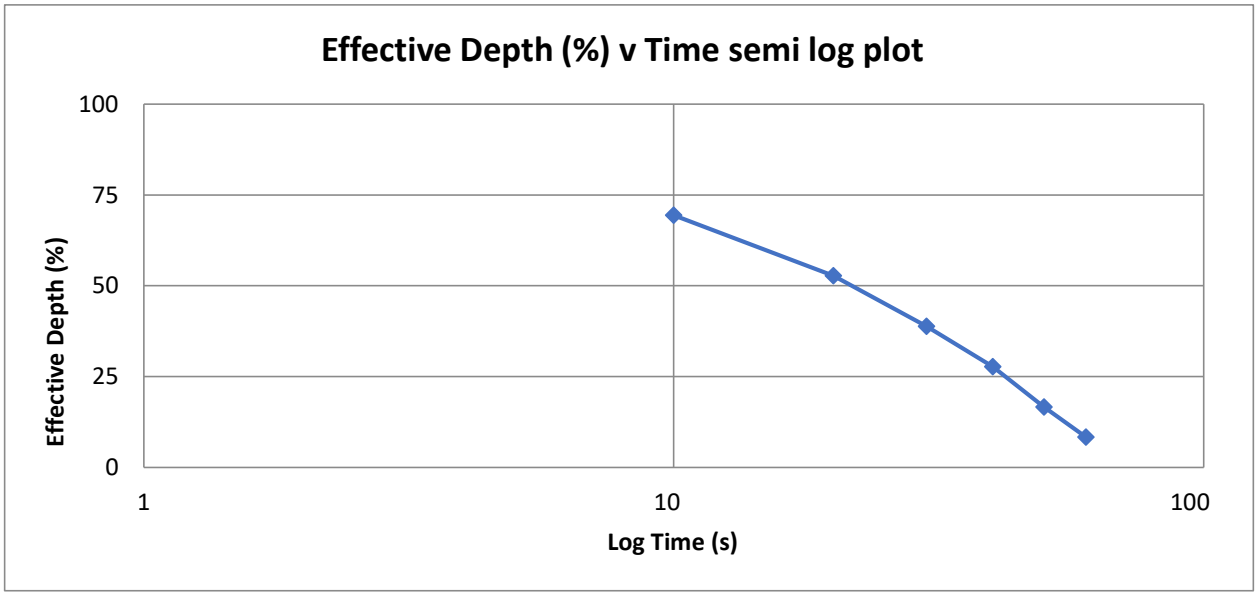
Dimensions:

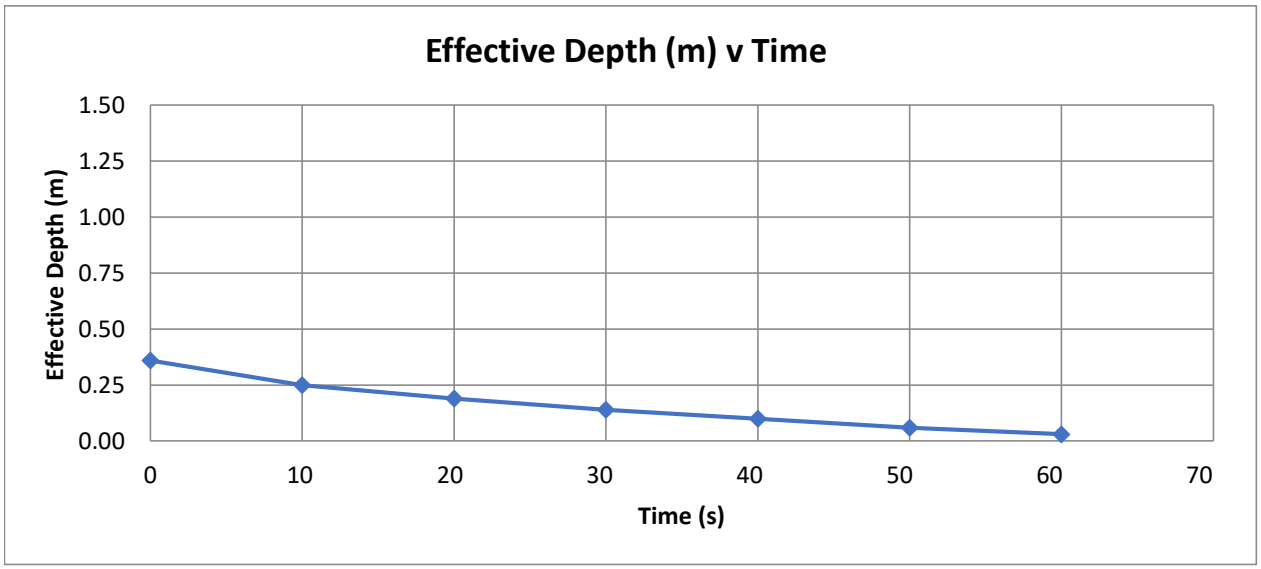
Length	2.00	m
Width	0.70	m
Depth	1.89	m
Start water depth	1.47	m
Effective Depth	0.42	m

Date	Time		Depth (mBGL)	Head/ Effective Depth (m)	Effective Depth (%)
	Hour	Seconds			
19 October 2021	-	0	1.53	0.36	100
19 October 2021	-	10	1.64	0.25	69
19 October 2021	-	20	1.70	0.19	53
19 October 2021	-	30	1.75	0.14	39
19 October 2021	-	40	1.79	0.1	28
19 October 2021	-	50	1.83	0.06	17
19 October 2021	-	60	1.86	0.03	8

Effective Depth %	Depth (m)	Time (s)
75	0.315	8
25	0.105	43
	Vp75-25	tp75-25
Sum	0.294	35
Base	1.4	m2
Side long	0.42	m
Side short	0.147	m
ap50	2.534	m2
Soil Infiltration Rate	**3.31E-03**	**m/s**




Effective Depth (%) v Time semi log plot
100
75
50
25
0
Effective Depth (%)
1
10
100
Log Time (s)


Effective Depth (m) v Time
1.50
1.25
1.00
0.75
0.50
0.25
0.00
Effective Depth (m)
0
10
20
30
40
50
60
70
Time (s)

8.7 Buried Concrete

The pH and Sulphate results indicate that buried concrete can be designed in accordance with design sulphate class DS-1 ACEC class AC-1 of BRE Special Digest 1(2005), assuming mobile groundwater is present.

8.8 Infiltration Testing

Large-scale infiltration testing was carried out in TP01, TP02 and TP03. The following table summarises the results of the testing undertaken within TP01 and TP03:

Location	Test Range (mBGL)	Infiltration Rate (ms^{-1})		
		Test 1	Test 2	Test 3
TP01	1.00 – 2.16	$1.29x10^{-5}$	-(1)	-(1)
TP03	1.50 – 1.89	$3.05x10^{-3}$	$1.87x10^{-3}$	$3.31x10^{-3}$

(1) Trial not undertaken.

Due to the rates of infiltration encountered, only one trial was undertaken within TP01 during the course of the investigation. This is not in accordance with BRE 365 guidance.

Rapid rates of infiltration encountered within TP03 resulted in a maximum head of only 0.39m being achieved within the excavation.

Rapid rates of infiltration encountered within TP02 resulted in no head being able to be achieved, i.e. water drained within the excavation as quickly as it was introduced, and therefore 'standard' calculation of infiltration rate is not possible.

A full water bowser of size 2,600 gallons was emptied into the excavation over a period of 7 minutes and 16 seconds, indicating an outflow rate of at least 0.27m^3/second. The base dimensions of the pit have been taken to produce an infiltration test area of 1.61m^2. The outflow rate combined with the hypothetical test area has produced an approximate infiltration rate of $1.68x10^{-1}$m/s.

It is noted that the speed of infiltration is attributed to water discharging within the cobbles and boulders and/ or underlying weathered limestone bedrock.

The concentration of water discharge into weathered limestone bedrock has the potential to wash out fines which previously filled fractures/ voids as well as creating new dissolution features within the bedrock. Both of these instances could lead to potentially significant settlement/ collapse within the near-surface.

As a result, careful consideration should be given to the use and design of soakaway drainage within the weathered limestone at this site.

In the absence of specific industry guidance on the placement of soakaway drainage within weathered limestone, as a minimum it is considered that guidance provided within CIRIA C574, Engineering in Chalk, should be followed. This guidance states that:

'In designing shallow foundations for structures, concentrations of rainwater percolating into the ground should be avoided by careful detailing of the structure. Soakaways should be avoided if at all possible. If unavoidable, they should be sited at least 5-10m away from and structure, depending on the chalk density. '

Based on the above, a precautionary approach of siting soakaways 10m from any existing or proposed structures should be adopted as a minimum if soakaway drainage is to be used.

It is also recommended that flexible drainage runs are used within the drainage construction to limit the potential for settlement damage which may lead to additional erosion and therefore increased settlement.

The local drainage authority should be contacted for further guidance on their acceptance of soakaway drainage within weathered limestone geology.

Appendix B

Surface Water Calculations

Reference	Title	Type	Originator
Communal Q10.SRCX	Communal House Soakaway Q10	Calculation	Hydrock
Communal Q30.SRCX	Communal House Soakaway Q30	Calculation	Hydrock
Communal Q100 +40%.SRCX	Communal House Soakaway Q100 +40%	Calculation	Hydrock
Paving P1.SCRX	Permeable Paving Area P1	Calculation	Hydrock
Paving P2.SCRX	Permeable Paving Area P2	Calculation	Hydrock
Paving P3.SCRX	Permeable Paving Area P3	Calculation	Hydrock
Paving P4.SCRX	Permeable Paving Area P4	Calculation	Hydrock
Paving P5.SCRX	Permeable Paving Area P5	Calculation	Hydrock
Paving P6.SCRX	Permeable Paving Area P6	Calculation	Hydrock
Paving P7.SCRX	Permeable Paving Area P7	Calculation	Hydrock
Paving P8.SCRX	Permeable Paving Area P8	Calculation	Hydrock
Paving P9.SCRX	Permeable Paving Area P9	Calculation	Hydrock
Paving P10.SCRX	Permeable Paving Area P10	Calculation	Hydrock

Summary of Results for 10 year Return Period

Half Drain Time : 1125 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	167.735	0.235	0.3	18.0	O K
30 min Summer	167.779	0.279	0.3	23.2	O K
60 min Summer	167.823	0.323	0.4	28.4	O K
120 min Summer	167.866	0.366	0.4	33.6	O K
180 min Summer	167.891	0.391	0.4	36.5	O K
240 min Summer	167.906	0.406	0.4	38.3	O K
360 min Summer	167.925	0.425	0.4	40.6	O K
480 min Summer	167.935	0.435	0.4	41.8	O K
600 min Summer	167.940	0.440	0.4	42.4	O K
720 min Summer	167.942	0.442	0.4	42.6	O K
960 min Summer	167.940	0.440	0.4	42.4	O K
1440 min Summer	167.933	0.433	0.4	41.5	O K
2160 min Summer	167.918	0.418	0.4	39.7	O K
2880 min Summer	167.901	0.401	0.4	37.7	O K
4320 min Summer	167.868	0.368	0.4	33.8	O K
5760 min Summer	167.836	0.336	0.4	30.0	O K
7200 min Summer	167.808	0.308	0.4	26.6	O K
8640 min Summer	167.782	0.282	0.3	23.5	O K
10080 min Summer	167.758	0.258	0.3	20.8	O K
15 min Winter	167.754	0.254	0.3	20.3	O K
30 min Winter	167.803	0.303	0.4	26.0	O K
60 min Winter	167.853	0.353	0.4	32.0	O K
120 min Winter	167.902	0.402	0.4	37.9	O K
180 min Winter	167.930	0.430	0.4	41.2	O K
240 min Winter	167.949	0.449	0.4	43.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	57.788	0.0	26
30 min Summer	37.337	0.0	41
60 min Summer	23.155	0.0	70
120 min Summer	14.006	0.0	130
180 min Summer	10.357	0.0	188
240 min Summer	8.337	0.0	248
360 min Summer	6.125	0.0	366
480 min Summer	4.918	0.0	484
600 min Summer	4.147	0.0	602
720 min Summer	3.607	0.0	722
960 min Summer	2.892	0.0	880
1440 min Summer	2.118	0.0	1116
2160 min Summer	1.549	0.0	1512
2880 min Summer	1.241	0.0	1928
4320 min Summer	0.907	0.0	2732
5760 min Summer	0.726	0.0	3528
7200 min Summer	0.611	0.0	4328
8640 min Summer	0.530	0.0	5096
10080 min Summer	0.470	0.0	5840
15 min Winter	57.788	0.0	26
30 min Winter	37.337	0.0	41
60 min Winter	23.155	0.0	70
120 min Winter	14.006	0.0	128
180 min Winter	10.357	0.0	186
240 min Winter	8.337	0.0	244

Summary of Results for 10 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
360 min Winter	167.972	0.472	0.4	46.1	O K
480 min Winter	167.985	0.485	0.4	47.7	O K
600 min Winter	167.993	0.493	0.4	48.6	O K
720 min Winter	167.997	0.497	0.4	49.1	O K
960 min Winter	167.998	0.498	0.4	49.2	O K
1440 min Winter	167.987	0.487	0.4	47.9	O K
2160 min Winter	167.967	0.467	0.4	45.6	O K
2880 min Winter	167.943	0.443	0.4	42.7	O K
4320 min Winter	167.892	0.392	0.4	36.7	O K
5760 min Winter	167.845	0.345	0.4	31.0	O K
7200 min Winter	167.801	0.301	0.4	25.9	O K
8640 min Winter	167.763	0.263	0.3	21.3	O K
10080 min Winter	167.730	0.230	0.3	17.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
360 min Winter	6.125	0.0	360
480 min Winter	4.918	0.0	474
600 min Winter	4.147	0.0	588
720 min Winter	3.607	0.0	700
960 min Winter	2.892	0.0	920
1440 min Winter	2.118	0.0	1190
2160 min Winter	1.549	0.0	1628
2880 min Winter	1.241	0.0	2084
4320 min Winter	0.907	0.0	2984
5760 min Winter	0.726	0.0	3808
7200 min Winter	0.611	0.0	4608
8640 min Winter	0.530	0.0	5360
10080 min Winter	0.470	0.0	6056

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	10	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.300	Shortest Storm (mins)	15
Ratio R	0.400	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 0.170

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.057	4	8	0.057	8	12	0.056

Time Area Diagram

Total Area (ha) 0.000

Time From:	(mins) To:	Area (ha)
0	4	0.000

Model Details

Storage is Online Cover Level (m) 169.500

Trench Soakaway Structure

Infiltration Coefficient Base (m/hr)	0.04600	Trench Width (m)	5.0
Infiltration Coefficient Side (m/hr)	0.04600	Trench Length (m)	25.0
Safety Factor	5.0	Slope (1:X)	150.0
Porosity	0.95	Cap Volume Depth (m)	0.000
Invert Level (m)	167.500	Cap Infiltration Depth (m)	0.000

Summary of Results for 30 year Return Period

Half Drain Time : 1431 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	167.777	0.277	0.3	22.9	O K
30 min Summer	167.834	0.334	0.4	29.8	O K
60 min Summer	167.893	0.393	0.4	36.7	O K
120 min Summer	167.951	0.451	0.4	43.6	O K
180 min Summer	167.983	0.483	0.4	47.4	O K
240 min Summer	168.003	0.503	0.4	49.9	O K
360 min Summer	168.028	0.528	0.4	52.8	O K
480 min Summer	168.043	0.543	0.4	54.6	O K
600 min Summer	168.051	0.551	0.4	55.6	O K
720 min Summer	168.055	0.555	0.4	56.1	O K
960 min Summer	168.056	0.556	0.4	56.1	O K
1440 min Summer	168.046	0.546	0.4	54.9	O K
2160 min Summer	168.027	0.527	0.4	52.7	O K
2880 min Summer	168.008	0.508	0.4	50.4	O K
4320 min Summer	167.968	0.468	0.4	45.7	O K
5760 min Summer	167.931	0.431	0.4	41.3	O K
7200 min Summer	167.897	0.397	0.4	37.3	O K
8640 min Summer	167.866	0.366	0.4	33.5	O K
10080 min Summer	167.837	0.337	0.4	30.1	O K
15 min Winter	167.800	0.300	0.4	25.7	O K
30 min Winter	167.865	0.365	0.4	33.4	O K
60 min Winter	167.931	0.431	0.4	41.3	O K
120 min Winter	167.997	0.497	0.4	49.1	O K
180 min Winter	168.034	0.534	0.4	53.5	O K
240 min Winter	168.058	0.558	0.4	56.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	73.219	0.0	27
30 min Summer	47.686	0.0	41
60 min Summer	29.711	0.0	70
120 min Summer	17.979	0.0	130
180 min Summer	13.265	0.0	188
240 min Summer	10.647	0.0	248
360 min Summer	7.777	0.0	366
480 min Summer	6.223	0.0	486
600 min Summer	5.232	0.0	604
720 min Summer	4.539	0.0	722
960 min Summer	3.626	0.0	960
1440 min Summer	2.638	0.0	1212
2160 min Summer	1.918	0.0	1584
2880 min Summer	1.528	0.0	1992
4320 min Summer	1.109	0.0	2812
5760 min Summer	0.883	0.0	3632
7200 min Summer	0.739	0.0	4400
8640 min Summer	0.639	0.0	5192
10080 min Summer	0.565	0.0	5952
15 min Winter	73.219	0.0	26
30 min Winter	47.686	0.0	41
60 min Winter	29.711	0.0	70
120 min Winter	17.979	0.0	128
180 min Winter	13.265	0.0	186
240 min Winter	10.647	0.0	244

Summary of Results for 30 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
360 min Winter	168.088	0.588	0.4	59.9	O K
480 min Winter	168.106	0.606	0.4	62.1	O K
600 min Winter	168.118	0.618	0.4	63.5	O K
720 min Winter	168.125	0.625	0.4	64.3	O K
960 min Winter	168.130	0.630	0.4	64.9	O K
1440 min Winter	168.121	0.621	0.4	63.9	O K
2160 min Winter	168.096	0.596	0.4	60.9	O K
2880 min Winter	168.070	0.570	0.4	57.8	O K
4320 min Winter	168.013	0.513	0.4	51.0	O K
5760 min Winter	167.958	0.458	0.4	44.5	O K
7200 min Winter	167.907	0.407	0.4	38.4	O K
8640 min Winter	167.860	0.360	0.4	32.8	O K
10080 min Winter	167.817	0.317	0.4	27.8	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
360 min Winter	7.777	0.0	360
480 min Winter	6.223	0.0	476
600 min Winter	5.232	0.0	592
720 min Winter	4.539	0.0	706
960 min Winter	3.626	0.0	930
1440 min Winter	2.638	0.0	1356
2160 min Winter	1.918	0.0	1692
2880 min Winter	1.528	0.0	2144
4320 min Winter	1.109	0.0	3068
5760 min Winter	0.883	0.0	3920
7200 min Winter	0.739	0.0	4760
8640 min Winter	0.639	0.0	5536
10080 min Winter	0.565	0.0	6264

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	30	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.300	Shortest Storm (mins)	15
Ratio R	0.400	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 0.170

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.057	4	8	0.057	8	12	0.056

Time Area Diagram

Total Area (ha) 0.000

Time From:	(mins) To:	Area (ha)
0	4	0.000

Model Details

Storage is Online Cover Level (m) 169.500

Trench Soakaway Structure

Infiltration Coefficient Base (m/hr)	0.04600	Trench Width (m)	5.0
Infiltration Coefficient Side (m/hr)	0.04600	Trench Length (m)	25.0
Safety Factor	5.0	Slope (1:X)	150.0
Porosity	0.95	Cap Volume Depth (m)	0.000
Invert Level (m)	167.500	Cap Infiltration Depth (m)	0.000

Summary of Results for 100 year Return Period (+40%)

Half Drain Time : 2423 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	167.936	0.436	0.4	41.9	O K
30 min Summer	168.046	0.546	0.4	54.9	O K
60 min Summer	168.159	0.659	0.4	68.4	O K
120 min Summer	168.272	0.772	0.4	81.8	O K
180 min Summer	168.335	0.835	0.4	89.3	O K
240 min Summer	168.377	0.877	0.4	94.2	O K
360 min Summer	168.429	0.929	0.4	100.4	O K
480 min Summer	168.464	0.964	0.5	104.5	O K
600 min Summer	168.487	0.987	0.5	107.3	O K
720 min Summer	168.504	1.004	0.5	109.3	O K
960 min Summer	168.522	1.022	0.5	111.5	O K
1440 min Summer	168.527	1.027	0.5	112.1	O K
2160 min Summer	168.502	1.002	0.5	109.1	O K
2880 min Summer	168.474	0.974	0.5	105.8	O K
4320 min Summer	168.419	0.919	0.4	99.2	O K
5760 min Summer	168.367	0.867	0.4	93.0	O K
7200 min Summer	168.318	0.818	0.4	87.3	O K
8640 min Summer	168.273	0.773	0.4	81.9	O K
10080 min Summer	168.230	0.730	0.4	76.8	O K
15 min Winter	167.979	0.479	0.4	47.0	O K
30 min Winter	168.102	0.602	0.4	61.6	O K
60 min Winter	168.229	0.729	0.4	76.7	O K
120 min Winter	168.357	0.857	0.4	91.9	O K
180 min Winter	168.429	0.929	0.4	100.5	O K
240 min Winter	168.477	0.977	0.5	106.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	132.861	0.0	27
30 min Summer	87.290	0.0	42
60 min Summer	54.663	0.0	72
120 min Summer	33.095	0.0	130
180 min Summer	24.358	0.0	190
240 min Summer	19.485	0.0	250
360 min Summer	14.144	0.0	368
480 min Summer	11.275	0.0	488
600 min Summer	9.449	0.0	606
720 min Summer	8.176	0.0	726
960 min Summer	6.502	0.0	964
1440 min Summer	4.700	0.0	1442
2160 min Summer	3.392	0.0	1888
2880 min Summer	2.689	0.0	2276
4320 min Summer	1.935	0.0	3032
5760 min Summer	1.531	0.0	3864
7200 min Summer	1.276	0.0	4688
8640 min Summer	1.099	0.0	5528
10080 min Summer	0.968	0.0	6352
15 min Winter	132.861	0.0	27
30 min Winter	87.290	0.0	41
60 min Winter	54.663	0.0	70
120 min Winter	33.095	0.0	128
180 min Winter	24.358	0.0	188
240 min Winter	19.485	0.0	246

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
360 min Winter	168.538	1.038	0.5	113.3	O K
480 min Winter	168.579	1.079	0.5	118.3	O K
600 min Winter	168.608	1.108	0.5	121.7	O K
720 min Winter	168.629	1.129	0.5	124.2	O K
960 min Winter	168.655	1.155	0.5	127.2	O K
1440 min Winter	168.670	1.170	0.5	129.1	O K
2160 min Winter	168.653	1.153	0.5	127.0	O K
2880 min Winter	168.615	1.115	0.5	122.5	O K
4320 min Winter	168.548	1.048	0.5	114.5	O K
5760 min Winter	168.477	0.977	0.5	106.1	O K
7200 min Winter	168.408	0.908	0.4	97.9	O K
8640 min Winter	168.342	0.842	0.4	90.1	O K
10080 min Winter	168.280	0.780	0.4	82.7	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
360 min Winter	14.144	0.0	362
480 min Winter	11.275	0.0	480
600 min Winter	9.449	0.0	596
720 min Winter	8.176	0.0	714
960 min Winter	6.502	0.0	944
1440 min Winter	4.700	0.0	1398
2160 min Winter	3.392	0.0	2052
2880 min Winter	2.689	0.0	2400
4320 min Winter	1.935	0.0	3252
5760 min Winter	1.531	0.0	4200
7200 min Winter	1.276	0.0	5112
8640 min Winter	1.099	0.0	5968
10080 min Winter	0.968	0.0	6848

Rainfall Details

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)	19.300	Shortest Storm (mins)	15
Ratio R	0.400	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.170

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.057	4	8	0.057	8	12	0.056

Time Area Diagram

Total Area (ha) 0.000

Time From:	(mins) To:	Area (ha)
0	4	0.000

Model Details

Storage is Online Cover Level (m) 169.500

Trench Soakaway Structure

Infiltration Coefficient Base (m/hr)	0.04600	Trench Width (m)	5.0
Infiltration Coefficient Side (m/hr)	0.04600	Trench Length (m)	25.0
Safety Factor	5.0	Slope (1:X)	150.0
Porosity	0.95	Cap Volume Depth (m)	0.000
Invert Level (m)	167.500	Cap Infiltration Depth (m)	0.000

Summary of Results for 100 year Return Period (+40%)

Half Drain Time : 673 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	168.241	0.241	0.2	6.9	O K
30 min Summer	168.284	0.284	0.2	9.3	O K
60 min Summer	168.328	0.328	0.2	11.6	Flood Risk
120 min Summer	168.368	0.368	0.2	13.8	Flood Risk
180 min Summer	168.388	0.388	0.2	14.9	Flood Risk
240 min Summer	168.398	0.398	0.2	15.4	Flood Risk
360 min Summer	168.406	0.406	0.2	15.8	Flood Risk
480 min Summer	168.407	0.407	0.2	15.9	Flood Risk
600 min Summer	168.404	0.404	0.2	15.8	Flood Risk
720 min Summer	168.401	0.401	0.2	15.6	Flood Risk
960 min Summer	168.395	0.395	0.2	15.2	Flood Risk
1440 min Summer	168.378	0.378	0.2	14.3	Flood Risk
2160 min Summer	168.350	0.350	0.2	12.8	Flood Risk
2880 min Summer	168.324	0.324	0.2	11.4	Flood Risk
4320 min Summer	168.278	0.278	0.2	9.0	O K
5760 min Summer	168.243	0.243	0.2	7.0	O K
7200 min Summer	168.219	0.219	0.2	5.8	O K
8640 min Summer	168.202	0.202	0.2	4.9	O K
10080 min Summer	168.187	0.187	0.2	4.2	O K
15 min Winter	168.258	0.258	0.2	7.9	O K
30 min Winter	168.308	0.308	0.2	10.5	Flood Risk
60 min Winter	168.357	0.357	0.2	13.2	Flood Risk
120 min Winter	168.403	0.403	0.2	15.7	Flood Risk
180 min Winter	168.426	0.426	0.2	16.9	Flood Risk
240 min Winter	168.438	0.438	0.2	17.6	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	132.861	0.0	19
30 min Summer	87.290	0.0	34
60 min Summer	54.663	0.0	64
120 min Summer	33.095	0.0	122
180 min Summer	24.358	0.0	182
240 min Summer	19.485	0.0	242
360 min Summer	14.144	0.0	360
480 min Summer	11.275	0.0	480
600 min Summer	9.449	0.0	536
720 min Summer	8.176	0.0	594
960 min Summer	6.502	0.0	714
1440 min Summer	4.700	0.0	980
2160 min Summer	3.392	0.0	1384
2880 min Summer	2.689	0.0	1788
4320 min Summer	1.935	0.0	2548
5760 min Summer	1.531	0.0	3232
7200 min Summer	1.276	0.0	3960
8640 min Summer	1.099	0.0	4664
10080 min Summer	0.968	0.0	5352
15 min Winter	132.861	0.0	19
30 min Winter	87.290	0.0	33
60 min Winter	54.663	0.0	62
120 min Winter	33.095	0.0	120
180 min Winter	24.358	0.0	180
240 min Winter	19.485	0.0	238

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
360 min Winter	168.450	0.450	0.2	18.2	Flood Risk
480 min Winter	168.453	0.453	0.2	18.4	Flood Risk
600 min Winter	168.452	0.452	0.2	18.3	Flood Risk
720 min Winter	168.448	0.448	0.2	18.1	Flood Risk
960 min Winter	168.437	0.437	0.2	17.5	Flood Risk
1440 min Winter	168.414	0.414	0.2	16.3	Flood Risk
2160 min Winter	168.374	0.374	0.2	14.1	Flood Risk
2880 min Winter	168.335	0.335	0.2	12.0	Flood Risk
4320 min Winter	168.267	0.267	0.2	8.4	O K
5760 min Winter	168.223	0.223	0.2	6.0	O K
7200 min Winter	168.197	0.197	0.2	4.7	O K
8640 min Winter	168.177	0.177	0.2	3.7	O K
10080 min Winter	168.159	0.159	0.2	3.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
360 min Winter	14.144	0.0	352
480 min Winter	11.275	0.0	464
600 min Winter	9.449	0.0	572
720 min Winter	8.176	0.0	678
960 min Winter	6.502	0.0	768
1440 min Winter	4.700	0.0	1068
2160 min Winter	3.392	0.0	1512
2880 min Winter	2.689	0.0	1928
4320 min Winter	1.935	0.0	2680
5760 min Winter	1.531	0.0	3344
7200 min Winter	1.276	0.0	4040
8640 min Winter	1.099	0.0	4760
10080 min Winter	0.968	0.0	5448

Rainfall Details

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)	19.300	Shortest Storm (mins)	15
Ratio R	0.400	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.032

Time (mins) From:	To:	Area (ha)
0	4	0.032

Time Area Diagram

Total Area (ha) 0.000

Time (mins) From:	To:	Area (ha)
0	4	0.000

Model Details

Storage is Online Cover Level (m) 168.600

Porous Car Park Structure

Infiltration Coefficient Base (m/hr)	0.04600	Width (m)	8.0
Membrane Percolation (mm/hr)	1000	Length (m)	22.5
Max Percolation (l/s)	50.0	Slope (1:X)	100.0
Safety Factor	10.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	168.000	Membrane Depth (m)	0

Summary of Results for 100 year Return Period (+40%)

Half Drain Time : 365 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	169.554	0.154	0.1	1.8	O K
30 min Summer	169.581	0.181	0.1	2.4	O K
60 min Summer	169.606	0.206	0.1	3.0	O K
120 min Summer	169.628	0.228	0.1	3.6	O K
180 min Summer	169.637	0.237	0.1	3.8	O K
240 min Summer	169.640	0.240	0.1	3.9	O K
360 min Summer	169.639	0.239	0.1	3.8	O K
480 min Summer	169.638	0.238	0.1	3.8	O K
600 min Summer	169.635	0.235	0.1	3.8	O K
720 min Summer	169.632	0.232	0.1	3.7	O K
960 min Summer	169.625	0.225	0.1	3.5	O K
1440 min Summer	169.610	0.210	0.1	3.1	O K
2160 min Summer	169.587	0.187	0.1	2.6	O K
2880 min Summer	169.569	0.169	0.1	2.1	O K
4320 min Summer	169.545	0.145	0.1	1.6	O K
5760 min Summer	169.528	0.128	0.1	1.2	O K
7200 min Summer	169.514	0.114	0.1	1.0	O K
8640 min Summer	169.503	0.103	0.1	0.8	O K
10080 min Summer	169.494	0.094	0.1	0.7	O K
15 min Winter	169.565	0.165	0.1	2.0	O K
30 min Winter	169.595	0.195	0.1	2.8	O K
60 min Winter	169.624	0.224	0.1	3.5	O K
120 min Winter	169.650	0.250	0.1	4.1	O K
180 min Winter	169.660	0.260	0.1	4.4	O K
240 min Winter	169.665	0.265	0.1	4.5	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	132.861	0.0	19
30 min Summer	87.290	0.0	33
60 min Summer	54.663	0.0	62
120 min Summer	33.095	0.0	122
180 min Summer	24.358	0.0	182
240 min Summer	19.485	0.0	240
360 min Summer	14.144	0.0	310
480 min Summer	11.275	0.0	372
600 min Summer	9.449	0.0	434
720 min Summer	8.176	0.0	500
960 min Summer	6.502	0.0	636
1440 min Summer	4.700	0.0	908
2160 min Summer	3.392	0.0	1296
2880 min Summer	2.689	0.0	1648
4320 min Summer	1.935	0.0	2376
5760 min Summer	1.531	0.0	3112
7200 min Summer	1.276	0.0	3816
8640 min Summer	1.099	0.0	4504
10080 min Summer	0.968	0.0	5248
15 min Winter	132.861	0.0	18
30 min Winter	87.290	0.0	33
60 min Winter	54.663	0.0	62
120 min Winter	33.095	0.0	120
180 min Winter	24.358	0.0	178
240 min Winter	19.485	0.0	234

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
360 min Winter	169.665	0.265	0.1	4.5	O K
480 min Winter	169.662	0.262	0.1	4.4	O K
600 min Winter	169.658	0.258	0.1	4.3	O K
720 min Winter	169.654	0.254	0.1	4.2	O K
960 min Winter	169.643	0.243	0.1	3.9	O K
1440 min Winter	169.619	0.219	0.1	3.4	O K
2160 min Winter	169.586	0.186	0.1	2.5	O K
2880 min Winter	169.561	0.161	0.1	1.9	O K
4320 min Winter	169.532	0.132	0.1	1.3	O K
5760 min Winter	169.511	0.111	0.1	0.9	O K
7200 min Winter	169.495	0.095	0.1	0.7	O K
8640 min Winter	169.483	0.083	0.1	0.5	O K
10080 min Winter	169.474	0.074	0.0	0.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
360 min Winter	14.144	0.0	342
480 min Winter	11.275	0.0	400
600 min Winter	9.449	0.0	466
720 min Winter	8.176	0.0	542
960 min Winter	6.502	0.0	694
1440 min Winter	4.700	0.0	980
2160 min Winter	3.392	0.0	1364
2880 min Winter	2.689	0.0	1728
4320 min Winter	1.935	0.0	2460
5760 min Winter	1.531	0.0	3168
7200 min Winter	1.276	0.0	3888
8640 min Winter	1.099	0.0	4584
10080 min Winter	0.968	0.0	5248

Rainfall Details

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)	19.300	Shortest Storm (mins)	15
Ratio R	0.400	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.009

Time (mins) From:	To:	Area (ha)
0	4	0.009

Time Area Diagram

Total Area (ha) 0.000

Time (mins) From:	To:	Area (ha)
0	4	0.000

Model Details

Storage is Online Cover Level (m) 170.000

Porous Car Park Structure

Infiltration Coefficient Base (m/hr)	0.04600	Width (m)	5.0
Membrane Percolation (mm/hr)	1000	Length (m)	16.2
Max Percolation (l/s)	22.5	Slope (1:X)	100.0
Safety Factor	10.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	169.400	Membrane Depth (m)	0

Summary of Results for 100 year Return Period (+40%)

Half Drain Time : 0 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	169.907	0.007	6.9	0.0	O K
30 min Summer	169.906	0.006	5.9	0.0	O K
60 min Summer	169.905	0.005	4.2	0.0	O K
120 min Summer	169.904	0.004	2.1	0.0	O K
180 min Summer	169.903	0.003	1.6	0.0	O K
240 min Summer	169.903	0.003	1.6	0.0	O K
360 min Summer	169.903	0.003	1.1	0.0	O K
480 min Summer	169.903	0.003	1.1	0.0	O K
600 min Summer	169.902	0.002	0.8	0.0	O K
720 min Summer	169.902	0.002	0.8	0.0	O K
960 min Summer	169.902	0.002	0.5	0.0	O K
1440 min Summer	169.902	0.002	0.5	0.0	O K
2160 min Summer	169.901	0.001	0.2	0.0	O K
2880 min Summer	169.901	0.001	0.2	0.0	O K
4320 min Summer	169.901	0.001	0.2	0.0	O K
5760 min Summer	169.901	0.001	0.1	0.0	O K
7200 min Summer	169.901	0.001	0.1	0.0	O K
8640 min Summer	169.901	0.001	0.1	0.0	O K
10080 min Summer	169.901	0.001	0.1	0.0	O K
15 min Winter	169.907	0.007	6.9	0.0	O K
30 min Winter	169.905	0.005	4.2	0.0	O K
60 min Winter	169.905	0.005	3.4	0.0	O K
120 min Winter	169.904	0.004	2.1	0.0	O K
180 min Winter	169.903	0.003	1.6	0.0	O K
240 min Winter	169.903	0.003	1.1	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	132.861	0.0	9
30 min Summer	87.290	0.0	16
60 min Summer	54.663	0.0	38
120 min Summer	33.095	0.0	60
180 min Summer	24.358	0.0	108
240 min Summer	19.485	0.0	128
360 min Summer	14.144	0.0	168
480 min Summer	11.275	0.0	222
600 min Summer	9.449	0.0	334
720 min Summer	8.176	0.0	372
960 min Summer	6.502	0.0	502
1440 min Summer	4.700	0.0	750
2160 min Summer	3.392	0.0	1112
2880 min Summer	2.689	0.0	1712
4320 min Summer	1.935	0.0	1896
5760 min Summer	1.531	0.0	2688
7200 min Summer	1.276	0.0	3736
8640 min Summer	1.099	0.0	4408
10080 min Summer	0.968	0.0	7032
15 min Winter	132.861	0.0	8
30 min Winter	87.290	0.0	21
60 min Winter	54.663	0.0	32
120 min Winter	33.095	0.0	62
180 min Winter	24.358	0.0	98
240 min Winter	19.485	0.0	140

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
360 min Winter	169.902	0.002	0.8	0.0	O K
480 min Winter	169.902	0.002	0.8	0.0	O K
600 min Winter	169.902	0.002	0.5	0.0	O K
720 min Winter	169.902	0.002	0.5	0.0	O K
960 min Winter	169.902	0.002	0.5	0.0	O K
1440 min Winter	169.901	0.001	0.2	0.0	O K
2160 min Winter	169.901	0.001	0.2	0.0	O K
2880 min Winter	169.901	0.001	0.2	0.0	O K
4320 min Winter	169.901	0.001	0.1	0.0	O K
5760 min Winter	169.901	0.001	0.1	0.0	O K
7200 min Winter	169.901	0.001	0.1	0.0	O K
8640 min Winter	169.901	0.001	0.1	0.0	O K
10080 min Winter	169.901	0.001	0.1	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
360 min Winter	14.144	0.0	180
480 min Winter	11.275	0.0	230
600 min Winter	9.449	0.0	344
720 min Winter	8.176	0.0	370
960 min Winter	6.502	0.0	532
1440 min Winter	4.700	0.0	788
2160 min Winter	3.392	0.0	888
2880 min Winter	2.689	0.0	1500
4320 min Winter	1.935	0.0	1932
5760 min Winter	1.531	0.0	2920
7200 min Winter	1.276	0.0	1528
8640 min Winter	1.099	0.0	6816
10080 min Winter	0.968	0.0	2624

Rainfall Details

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)	19.300	Shortest Storm (mins)	15
Ratio R	0.400	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.010

Time (mins) From:	To:	Area (ha)
0	4	0.010

Time Area Diagram

Total Area (ha) 0.000

Time (mins) From:	To:	Area (ha)
0	4	0.000

Model Details

Storage is Online Cover Level (m) 170.500

Porous Car Park Structure

Infiltration Coefficient Base (m/hr)	604.80000	Width (m)	4.5
Membrane Percolation (mm/hr)	1000	Length (m)	19.5
Max Percolation (l/s)	24.4	Slope (1:X)	100.0
Safety Factor	10.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	169.900	Membrane Depth (m)	0

Summary of Results for 100 year Return Period (+40%)

Half Drain Time : 0 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	170.404	0.004	3.0	0.0	O K
30 min Summer	170.403	0.003	2.3	0.0	O K
60 min Summer	170.403	0.003	1.6	0.0	O K
120 min Summer	170.402	0.002	1.1	0.0	O K
180 min Summer	170.402	0.002	1.1	0.0	O K
240 min Summer	170.402	0.002	0.7	0.0	O K
360 min Summer	170.402	0.002	0.7	0.0	O K
480 min Summer	170.402	0.002	0.7	0.0	O K
600 min Summer	170.401	0.001	0.3	0.0	O K
720 min Summer	170.401	0.001	0.3	0.0	O K
960 min Summer	170.401	0.001	0.3	0.0	O K
1440 min Summer	170.401	0.001	0.1	0.0	O K
2160 min Summer	170.401	0.001	0.1	0.0	O K
2880 min Summer	170.401	0.001	0.1	0.0	O K
4320 min Summer	170.401	0.001	0.1	0.0	O K
5760 min Summer	170.401	0.001	0.1	0.0	O K
7200 min Summer	170.401	0.001	0.1	0.0	O K
8640 min Summer	170.400	0.000	0.0	0.0	O K
10080 min Summer	170.400	0.000	0.0	0.0	O K
15 min Winter	170.404	0.004	3.0	0.0	O K
30 min Winter	170.403	0.003	2.3	0.0	O K
60 min Winter	170.402	0.002	1.1	0.0	O K
120 min Winter	170.402	0.002	1.1	0.0	O K
180 min Winter	170.402	0.002	0.7	0.0	O K
240 min Winter	170.402	0.002	0.7	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	132.861	0.0	11
30 min Summer	87.290	0.0	18
60 min Summer	54.663	0.0	28
120 min Summer	33.095	0.0	66
180 min Summer	24.358	0.0	86
240 min Summer	19.485	0.0	112
360 min Summer	14.144	0.0	178
480 min Summer	11.275	0.0	256
600 min Summer	9.449	0.0	302
720 min Summer	8.176	0.0	438
960 min Summer	6.502	0.0	510
1440 min Summer	4.700	0.0	658
2160 min Summer	3.392	0.0	1080
2880 min Summer	2.689	0.0	812
4320 min Summer	1.935	0.0	2364
5760 min Summer	1.531	0.0	2768
7200 min Summer	1.276	0.0	2888
8640 min Summer	1.099	0.0	3472
10080 min Summer	0.968	0.0	6048
15 min Winter	132.861	0.0	13
30 min Winter	87.290	0.0	14
60 min Winter	54.663	0.0	22
120 min Winter	33.095	0.0	52
180 min Winter	24.358	0.0	98
240 min Winter	19.485	0.0	138

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
360 min Winter	170.401	0.001	0.3	0.0	O K
480 min Winter	170.401	0.001	0.3	0.0	O K
600 min Winter	170.401	0.001	0.3	0.0	O K
720 min Winter	170.401	0.001	0.3	0.0	O K
960 min Winter	170.401	0.001	0.1	0.0	O K
1440 min Winter	170.401	0.001	0.1	0.0	O K
2160 min Winter	170.401	0.001	0.1	0.0	O K
2880 min Winter	170.401	0.001	0.1	0.0	O K
4320 min Winter	170.401	0.001	0.1	0.0	O K
5760 min Winter	170.400	0.000	0.0	0.0	O K
7200 min Winter	170.400	0.000	0.0	0.0	O K
8640 min Winter	170.400	0.000	0.0	0.0	O K
10080 min Winter	170.400	0.000	0.0	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
360 min Winter	14.144	0.0	208
480 min Winter	11.275	0.0	198
600 min Winter	9.449	0.0	352
720 min Winter	8.176	0.0	356
960 min Winter	6.502	0.0	560
1440 min Winter	4.700	0.0	698
2160 min Winter	3.392	0.0	1728
2880 min Winter	2.689	0.0	2228
4320 min Winter	1.935	0.0	2276
5760 min Winter	1.531	0.0	4016
7200 min Winter	1.276	0.0	2568
8640 min Winter	1.099	0.0	3416
10080 min Winter	0.968	0.0	4944

Rainfall Details

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)	19.300	Shortest Storm (mins)	15
Ratio R	0.400	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.005

Time (mins) From:	To:	Area (ha)
0	4	0.005

Time Area Diagram

Total Area (ha) 0.000

Time (mins) From:	To:	Area (ha)
0	4	0.000

Model Details

Storage is Online Cover Level (m) 171.000

Porous Car Park Structure

Infiltration Coefficient Base (m/hr)	604.80000	Width (m)	6.4
Membrane Percolation (mm/hr)	1000	Length (m)	6.4
Max Percolation (l/s)	11.4	Slope (1:X)	100.0
Safety Factor	10.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	170.400	Membrane Depth (m)	0

Summary of Results for 100 year Return Period (+40%)

Half Drain Time : 0 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	170.911	0.011	9.7	0.0	O K
30 min Summer	170.910	0.010	7.3	0.0	O K
60 min Summer	170.909	0.009	5.9	0.0	O K
120 min Summer	170.907	0.007	3.5	0.0	O K
180 min Summer	170.906	0.006	2.5	0.0	O K
240 min Summer	170.905	0.005	2.1	0.0	O K
360 min Summer	170.905	0.005	2.1	0.0	O K
480 min Summer	170.904	0.004	1.4	0.0	O K
600 min Summer	170.904	0.004	1.1	0.0	O K
720 min Summer	170.904	0.004	1.1	0.0	O K
960 min Summer	170.903	0.003	0.8	0.0	O K
1440 min Summer	170.903	0.003	0.6	0.0	O K
2160 min Summer	170.902	0.002	0.4	0.0	O K
2880 min Summer	170.902	0.002	0.4	0.0	O K
4320 min Summer	170.902	0.002	0.2	0.0	O K
5760 min Summer	170.902	0.002	0.2	0.0	O K
7200 min Summer	170.901	0.001	0.1	0.0	O K
8640 min Summer	170.901	0.001	0.1	0.0	O K
10080 min Summer	170.901	0.001	0.1	0.0	O K
15 min Winter	170.911	0.011	9.7	0.0	O K
30 min Winter	170.910	0.010	8.0	0.0	O K
60 min Winter	170.908	0.008	4.6	0.0	O K
120 min Winter	170.906	0.006	3.0	0.0	O K
180 min Winter	170.905	0.005	2.1	0.0	O K
240 min Winter	170.905	0.005	1.7	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	132.861	0.0	8
30 min Summer	87.290	0.0	16
60 min Summer	54.663	0.0	32
120 min Summer	33.095	0.0	70
180 min Summer	24.358	0.0	86
240 min Summer	19.485	0.0	124
360 min Summer	14.144	0.0	178
480 min Summer	11.275	0.0	230
600 min Summer	9.449	0.0	298
720 min Summer	8.176	0.0	384
960 min Summer	6.502	0.0	464
1440 min Summer	4.700	0.0	666
2160 min Summer	3.392	0.0	1020
2880 min Summer	2.689	0.0	1248
4320 min Summer	1.935	0.0	2476
5760 min Summer	1.531	0.0	2824
7200 min Summer	1.276	0.0	3416
8640 min Summer	1.099	0.0	4384
10080 min Summer	0.968	0.0	4120
15 min Winter	132.861	0.0	9
30 min Winter	87.290	0.0	16
60 min Winter	54.663	0.0	36
120 min Winter	33.095	0.0	66
180 min Winter	24.358	0.0	86
240 min Winter	19.485	0.0	112

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
360 min Winter	170.904	0.004	1.4	0.0	O K
480 min Winter	170.904	0.004	1.1	0.0	O K
600 min Winter	170.903	0.003	0.8	0.0	O K
720 min Winter	170.903	0.003	0.8	0.0	O K
960 min Winter	170.903	0.003	0.6	0.0	O K
1440 min Winter	170.902	0.002	0.4	0.0	O K
2160 min Winter	170.902	0.002	0.4	0.0	O K
2880 min Winter	170.902	0.002	0.2	0.0	O K
4320 min Winter	170.902	0.002	0.2	0.0	O K
5760 min Winter	170.901	0.001	0.1	0.0	O K
7200 min Winter	170.901	0.001	0.1	0.0	O K
8640 min Winter	170.901	0.001	0.1	0.0	O K
10080 min Winter	170.901	0.001	0.1	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
360 min Winter	14.144	0.0	188
480 min Winter	11.275	0.0	230
600 min Winter	9.449	0.0	298
720 min Winter	8.176	0.0	380
960 min Winter	6.502	0.0	428
1440 min Winter	4.700	0.0	696
2160 min Winter	3.392	0.0	1236
2880 min Winter	2.689	0.0	1704
4320 min Winter	1.935	0.0	2572
5760 min Winter	1.531	0.0	2840
7200 min Winter	1.276	0.0	4904
8640 min Winter	1.099	0.0	3016
10080 min Winter	0.968	0.0	4696

Rainfall Details

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)	19.300	Shortest Storm (mins)	15
Ratio R	0.400	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.015

Time (mins) From:	To:	Area (ha)
0	4	0.015

Time Area Diagram

Total Area (ha) 0.000

Time (mins) From:	To:	Area (ha)
0	4	0.000

Model Details

Storage is Online Cover Level (m) 171.500

Porous Car Park Structure

Infiltration Coefficient Base (m/hr)	305.80000	Width (m)	4.5
Membrane Percolation (mm/hr)	1000	Length (m)	31.1
Max Percolation (l/s)	38.9	Slope (1:X)	100.0
Safety Factor	10.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	170.900	Membrane Depth (m)	0

Summary of Results for 100 year Return Period (+40%)

Half Drain Time : 0 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	171.917	0.017	8.3	0.0	O K
30 min Summer	171.915	0.015	6.5	0.0	O K
60 min Summer	171.914	0.014	5.3	0.0	O K
120 min Summer	171.911	0.011	3.2	0.0	O K
180 min Summer	171.909	0.009	2.4	0.0	O K
240 min Summer	171.909	0.009	2.1	0.0	O K
360 min Summer	171.907	0.007	1.5	0.0	O K
480 min Summer	171.906	0.006	1.1	0.0	O K
600 min Summer	171.906	0.006	0.9	0.0	O K
720 min Summer	171.905	0.005	0.8	0.0	O K
960 min Summer	171.905	0.005	0.8	0.0	O K
1440 min Summer	171.904	0.004	0.5	0.0	O K
2160 min Summer	171.903	0.003	0.3	0.0	O K
2880 min Summer	171.903	0.003	0.2	0.0	O K
4320 min Summer	171.903	0.003	0.2	0.0	O K
5760 min Summer	171.902	0.002	0.1	0.0	O K
7200 min Summer	171.902	0.002	0.1	0.0	O K
8640 min Summer	171.902	0.002	0.1	0.0	O K
10080 min Summer	171.902	0.002	0.1	0.0	O K
15 min Winter	171.917	0.017	7.9	0.0	O K
30 min Winter	171.915	0.015	6.1	0.0	O K
60 min Winter	171.912	0.012	3.9	0.0	O K
120 min Winter	171.909	0.009	2.4	0.0	O K
180 min Winter	171.908	0.008	1.9	0.0	O K
240 min Winter	171.907	0.007	1.5	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	132.861	0.0	11
30 min Summer	87.290	0.0	18
60 min Summer	54.663	0.0	32
120 min Summer	33.095	0.0	64
180 min Summer	24.358	0.0	86
240 min Summer	19.485	0.0	112
360 min Summer	14.144	0.0	186
480 min Summer	11.275	0.0	268
600 min Summer	9.449	0.0	310
720 min Summer	8.176	0.0	388
960 min Summer	6.502	0.0	500
1440 min Summer	4.700	0.0	708
2160 min Summer	3.392	0.0	1176
2880 min Summer	2.689	0.0	1448
4320 min Summer	1.935	0.0	2256
5760 min Summer	1.531	0.0	2624
7200 min Summer	1.276	0.0	3120
8640 min Summer	1.099	0.0	3896
10080 min Summer	0.968	0.0	4992
15 min Winter	132.861	0.0	10
30 min Winter	87.290	0.0	17
60 min Winter	54.663	0.0	34
120 min Winter	33.095	0.0	72
180 min Winter	24.358	0.0	94
240 min Winter	19.485	0.0	118

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
360 min Winter	171.907	0.007	1.3	0.0	O K
480 min Winter	171.906	0.006	0.9	0.0	O K
600 min Winter	171.905	0.005	0.8	0.0	O K
720 min Winter	171.905	0.005	0.6	0.0	O K
960 min Winter	171.904	0.004	0.5	0.0	O K
1440 min Winter	171.904	0.004	0.4	0.0	O K
2160 min Winter	171.903	0.003	0.2	0.0	O K
2880 min Winter	171.903	0.003	0.2	0.0	O K
4320 min Winter	171.902	0.002	0.1	0.0	O K
5760 min Winter	171.902	0.002	0.1	0.0	O K
7200 min Winter	171.902	0.002	0.1	0.0	O K
8640 min Winter	171.902	0.002	0.1	0.0	O K
10080 min Winter	171.902	0.002	0.1	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
360 min Winter	14.144	0.0	162
480 min Winter	11.275	0.0	230
600 min Winter	9.449	0.0	264
720 min Winter	8.176	0.0	336
960 min Winter	6.502	0.0	480
1440 min Winter	4.700	0.0	760
2160 min Winter	3.392	0.0	1184
2880 min Winter	2.689	0.0	1508
4320 min Winter	1.935	0.0	1912
5760 min Winter	1.531	0.0	2520
7200 min Winter	1.276	0.0	3680
8640 min Winter	1.099	0.0	3912
10080 min Winter	0.968	0.0	4904

Rainfall Details

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)	19.300	Shortest Storm (mins)	15
Ratio R	0.400	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.012

Time (mins) From:	To:	Area (ha)
0	4	0.012

Time Area Diagram

Total Area (ha) 0.000

Time (mins) From:	To:	Area (ha)
0	4	0.000

Model Details

Storage is Online Cover Level (m) 172.500

Porous Car Park Structure

Infiltration Coefficient Base (m/hr)	67.30000	Width (m)	7.5
Membrane Percolation (mm/hr)	1000	Length (m)	14.5
Max Percolation (l/s)	30.2	Slope (1:X)	100.0
Safety Factor	10.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	171.900	Membrane Depth (m)	0

Summary of Results for 100 year Return Period (+40%)

Half Drain Time : 0 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	172.922	0.022	20.7	0.1	O K
30 min Summer	172.920	0.020	17.2	0.1	O K
60 min Summer	172.918	0.018	13.2	0.1	O K
120 min Summer	172.914	0.014	8.5	0.0	O K
180 min Summer	172.913	0.013	6.8	0.0	O K
240 min Summer	172.911	0.011	5.3	0.0	O K
360 min Summer	172.910	0.010	4.0	0.0	O K
480 min Summer	172.909	0.009	3.2	0.0	O K
600 min Summer	172.908	0.008	2.5	0.0	O K
720 min Summer	172.908	0.008	2.9	0.0	O K
960 min Summer	172.906	0.006	1.6	0.0	O K
1440 min Summer	172.906	0.006	1.6	0.0	O K
2160 min Summer	172.905	0.005	0.9	0.0	O K
2880 min Summer	172.904	0.004	0.8	0.0	O K
4320 min Summer	172.903	0.003	0.4	0.0	O K
5760 min Summer	172.903	0.003	0.4	0.0	O K
7200 min Summer	172.903	0.003	0.3	0.0	O K
8640 min Summer	172.903	0.003	0.3	0.0	O K
10080 min Summer	172.902	0.002	0.2	0.0	O K
15 min Winter	172.923	0.023	21.7	0.1	O K
30 min Winter	172.919	0.019	15.5	0.1	O K
60 min Winter	172.916	0.016	10.4	0.1	O K
120 min Winter	172.912	0.012	6.3	0.0	O K
180 min Winter	172.911	0.011	4.8	0.0	O K
240 min Winter	172.910	0.010	4.4	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	132.861	0.0	9
30 min Summer	87.290	0.0	18
60 min Summer	54.663	0.0	30
120 min Summer	33.095	0.0	64
180 min Summer	24.358	0.0	90
240 min Summer	19.485	0.0	118
360 min Summer	14.144	0.0	182
480 min Summer	11.275	0.0	234
600 min Summer	9.449	0.0	288
720 min Summer	8.176	0.0	362
960 min Summer	6.502	0.0	500
1440 min Summer	4.700	0.0	730
2160 min Summer	3.392	0.0	1052
2880 min Summer	2.689	0.0	1260
4320 min Summer	1.935	0.0	2040
5760 min Summer	1.531	0.0	2856
7200 min Summer	1.276	0.0	3952
8640 min Summer	1.099	0.0	4288
10080 min Summer	0.968	0.0	5192
15 min Winter	132.861	0.0	9
30 min Winter	87.290	0.0	18
60 min Winter	54.663	0.0	30
120 min Winter	33.095	0.0	64
180 min Winter	24.358	0.0	94
240 min Winter	19.485	0.0	124

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
360 min Winter	172.908	0.008	2.9	0.0	O K
480 min Winter	172.908	0.008	2.5	0.0	O K
600 min Winter	172.907	0.007	2.2	0.0	O K
720 min Winter	172.906	0.006	1.6	0.0	O K
960 min Winter	172.906	0.006	1.4	0.0	O K
1440 min Winter	172.905	0.005	1.2	0.0	O K
2160 min Winter	172.904	0.004	0.6	0.0	O K
2880 min Winter	172.903	0.003	0.4	0.0	O K
4320 min Winter	172.903	0.003	0.3	0.0	O K
5760 min Winter	172.903	0.003	0.3	0.0	O K
7200 min Winter	172.902	0.002	0.2	0.0	O K
8640 min Winter	172.902	0.002	0.2	0.0	O K
10080 min Winter	172.902	0.002	0.2	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
360 min Winter	14.144	0.0	170
480 min Winter	11.275	0.0	236
600 min Winter	9.449	0.0	334
720 min Winter	8.176	0.0	348
960 min Winter	6.502	0.0	450
1440 min Winter	4.700	0.0	816
2160 min Winter	3.392	0.0	1216
2880 min Winter	2.689	0.0	1548
4320 min Winter	1.935	0.0	2604
5760 min Winter	1.531	0.0	2840
7200 min Winter	1.276	0.0	3784
8640 min Winter	1.099	0.0	3920
10080 min Winter	0.968	0.0	4256

Rainfall Details

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)	19.300	Shortest Storm (mins)	15
Ratio R	0.400	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.031

Time (mins) From:	To:	Area (ha)
0	4	0.031

Time Area Diagram

Total Area (ha) 0.000

Time (mins) From:	To:	Area (ha)
0	4	0.000

Model Details

Storage is Online Cover Level (m) 173.500

Porous Car Park Structure

Infiltration Coefficient Base (m/hr)	67.30000	Width (m)	11.2
Membrane Percolation (mm/hr)	1000	Length (m)	25.0
Max Percolation (l/s)	77.8	Slope (1:X)	100.0
Safety Factor	10.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	172.900	Membrane Depth (m)	0

Summary of Results for 100 year Return Period (+40%)

Half Drain Time : 0 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	171.917	0.017	7.9	0.0	O K
30 min Summer	171.916	0.016	6.6	0.0	O K
60 min Summer	171.914	0.014	5.0	0.0	O K
120 min Summer	171.911	0.011	3.4	0.0	O K
180 min Summer	171.909	0.009	2.3	0.0	O K
240 min Summer	171.909	0.009	2.0	0.0	O K
360 min Summer	171.908	0.008	1.6	0.0	O K
480 min Summer	171.907	0.007	1.4	0.0	O K
600 min Summer	171.906	0.006	1.0	0.0	O K
720 min Summer	171.906	0.006	0.9	0.0	O K
960 min Summer	171.906	0.006	0.9	0.0	O K
1440 min Summer	171.905	0.005	0.6	0.0	O K
2160 min Summer	171.904	0.004	0.4	0.0	O K
2880 min Summer	171.903	0.003	0.3	0.0	O K
4320 min Summer	171.903	0.003	0.2	0.0	O K
5760 min Summer	171.902	0.002	0.1	0.0	O K
7200 min Summer	171.902	0.002	0.1	0.0	O K
8640 min Summer	171.902	0.002	0.1	0.0	O K
10080 min Summer	171.902	0.002	0.1	0.0	O K
15 min Winter	171.917	0.017	7.9	0.0	O K
30 min Winter	171.915	0.015	6.2	0.0	O K
60 min Winter	171.912	0.012	4.0	0.0	O K
120 min Winter	171.910	0.010	2.5	0.0	O K
180 min Winter	171.908	0.008	1.8	0.0	O K
240 min Winter	171.908	0.008	1.6	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	132.861	0.0	8
30 min Summer	87.290	0.0	16
60 min Summer	54.663	0.0	30
120 min Summer	33.095	0.0	64
180 min Summer	24.358	0.0	94
240 min Summer	19.485	0.0	116
360 min Summer	14.144	0.0	200
480 min Summer	11.275	0.0	242
600 min Summer	9.449	0.0	304
720 min Summer	8.176	0.0	348
960 min Summer	6.502	0.0	494
1440 min Summer	4.700	0.0	710
2160 min Summer	3.392	0.0	1116
2880 min Summer	2.689	0.0	1416
4320 min Summer	1.935	0.0	2236
5760 min Summer	1.531	0.0	2672
7200 min Summer	1.276	0.0	3896
8640 min Summer	1.099	0.0	4432
10080 min Summer	0.968	0.0	5216
15 min Winter	132.861	0.0	9
30 min Winter	87.290	0.0	16
60 min Winter	54.663	0.0	32
120 min Winter	33.095	0.0	64
180 min Winter	24.358	0.0	118
240 min Winter	19.485	0.0	126

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
360 min Winter	171.907	0.007	1.2	0.0	O K
480 min Winter	171.906	0.006	1.0	0.0	O K
600 min Winter	171.905	0.005	0.7	0.0	O K
720 min Winter	171.905	0.005	0.7	0.0	O K
960 min Winter	171.905	0.005	0.6	0.0	O K
1440 min Winter	171.904	0.004	0.4	0.0	O K
2160 min Winter	171.903	0.003	0.3	0.0	O K
2880 min Winter	171.903	0.003	0.2	0.0	O K
4320 min Winter	171.902	0.002	0.1	0.0	O K
5760 min Winter	171.902	0.002	0.1	0.0	O K
7200 min Winter	171.902	0.002	0.1	0.0	O K
8640 min Winter	171.902	0.002	0.1	0.0	O K
10080 min Winter	171.902	0.002	0.1	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
360 min Winter	14.144	0.0	200
480 min Winter	11.275	0.0	230
600 min Winter	9.449	0.0	290
720 min Winter	8.176	0.0	358
960 min Winter	6.502	0.0	454
1440 min Winter	4.700	0.0	792
2160 min Winter	3.392	0.0	1212
2880 min Winter	2.689	0.0	1172
4320 min Winter	1.935	0.0	1860
5760 min Winter	1.531	0.0	3240
7200 min Winter	1.276	0.0	3824
8640 min Winter	1.099	0.0	4936
10080 min Winter	0.968	0.0	5448

Rainfall Details

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)	19.300	Shortest Storm (mins)	15
Ratio R	0.400	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.012

Time (mins) From:	To:	Area (ha)
0	4	0.012

Time Area Diagram

Total Area (ha) 0.000

Time (mins) From:	To:	Area (ha)
0	4	0.000

Model Details

Storage is Online Cover Level (m) 172.500

Porous Car Park Structure

Infiltration Coefficient Base (m/hr)	67.30000	Width (m)	7.1
Membrane Percolation (mm/hr)	1000	Length (m)	12.0
Max Percolation (l/s)	23.7	Slope (1:X)	100.0
Safety Factor	10.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	171.900	Membrane Depth (m)	0

Summary of Results for 100 year Return Period (+40%)

Half Drain Time : 0 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	170.423	0.023	11.1	0.0	O K
30 min Summer	170.422	0.022	9.7	0.0	O K
60 min Summer	170.418	0.018	6.8	0.0	O K
120 min Summer	170.415	0.015	4.8	0.0	O K
180 min Summer	170.413	0.013	3.3	0.0	O K
240 min Summer	170.412	0.012	2.8	0.0	O K
360 min Summer	170.410	0.010	2.2	0.0	O K
480 min Summer	170.409	0.009	1.6	0.0	O K
600 min Summer	170.408	0.008	1.4	0.0	O K
720 min Summer	170.408	0.008	1.2	0.0	O K
960 min Summer	170.407	0.007	1.1	0.0	O K
1440 min Summer	170.406	0.006	0.8	0.0	O K
2160 min Summer	170.405	0.005	0.5	0.0	O K
2880 min Summer	170.404	0.004	0.4	0.0	O K
4320 min Summer	170.404	0.004	0.3	0.0	O K
5760 min Summer	170.403	0.003	0.2	0.0	O K
7200 min Summer	170.403	0.003	0.2	0.0	O K
8640 min Summer	170.403	0.003	0.2	0.0	O K
10080 min Summer	170.403	0.003	0.2	0.0	O K
15 min Winter	170.423	0.023	11.1	0.0	O K
30 min Winter	170.420	0.020	8.0	0.0	O K
60 min Winter	170.417	0.017	5.8	0.0	O K
120 min Winter	170.413	0.013	3.3	0.0	O K
180 min Winter	170.411	0.011	2.6	0.0	O K
240 min Winter	170.410	0.010	2.2	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	132.861	0.0	8
30 min Summer	87.290	0.0	17
60 min Summer	54.663	0.0	32
120 min Summer	33.095	0.0	62
180 min Summer	24.358	0.0	94
240 min Summer	19.485	0.0	118
360 min Summer	14.144	0.0	188
480 min Summer	11.275	0.0	228
600 min Summer	9.449	0.0	314
720 min Summer	8.176	0.0	380
960 min Summer	6.502	0.0	508
1440 min Summer	4.700	0.0	716
2160 min Summer	3.392	0.0	1124
2880 min Summer	2.689	0.0	1396
4320 min Summer	1.935	0.0	2204
5760 min Summer	1.531	0.0	2696
7200 min Summer	1.276	0.0	3728
8640 min Summer	1.099	0.0	4168
10080 min Summer	0.968	0.0	5032
15 min Winter	132.861	0.0	9
30 min Winter	87.290	0.0	18
60 min Winter	54.663	0.0	28
120 min Winter	33.095	0.0	66
180 min Winter	24.358	0.0	78
240 min Winter	19.485	0.0	128

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
360 min Winter	170.409	0.009	1.6	0.0	O K
480 min Winter	170.408	0.008	1.4	0.0	O K
600 min Winter	170.407	0.007	1.1	0.0	O K
720 min Winter	170.407	0.007	0.9	0.0	O K
960 min Winter	170.406	0.006	0.8	0.0	O K
1440 min Winter	170.405	0.005	0.6	0.0	O K
2160 min Winter	170.404	0.004	0.4	0.0	O K
2880 min Winter	170.404	0.004	0.3	0.0	O K
4320 min Winter	170.403	0.003	0.2	0.0	O K
5760 min Winter	170.403	0.003	0.2	0.0	O K
7200 min Winter	170.403	0.003	0.2	0.0	O K
8640 min Winter	170.402	0.002	0.1	0.0	O K
10080 min Winter	170.402	0.002	0.1	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
360 min Winter	14.144	0.0	168
480 min Winter	11.275	0.0	266
600 min Winter	9.449	0.0	348
720 min Winter	8.176	0.0	364
960 min Winter	6.502	0.0	496
1440 min Winter	4.700	0.0	732
2160 min Winter	3.392	0.0	900
2880 min Winter	2.689	0.0	1376
4320 min Winter	1.935	0.0	2152
5760 min Winter	1.531	0.0	3232
7200 min Winter	1.276	0.0	3176
8640 min Winter	1.099	0.0	4264
10080 min Winter	0.968	0.0	4000

Rainfall Details

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)	19.300	Shortest Storm (mins)	15
Ratio R	0.400	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.017

Time (mins) From:	To:	Area (ha)
0	4	0.017

Time Area Diagram

Total Area (ha) 0.000

Time (mins) From:	To:	Area (ha)
0	4	0.000

Model Details

Storage is Online Cover Level (m) 171.000

Porous Car Park Structure

Infiltration Coefficient Base (m/hr)	67.30000	Width (m)	5.5
Membrane Percolation (mm/hr)	1000	Length (m)	21.0
Max Percolation (l/s)	32.1	Slope (1:X)	100.0
Safety Factor	10.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	170.400	Membrane Depth (m)	0

Summary of Results for 100 year Return Period (+40%)

Half Drain Time : 0 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	170.423	0.023	11.1	0.0	O K
30 min Summer	170.422	0.022	9.7	0.0	O K
60 min Summer	170.418	0.018	6.8	0.0	O K
120 min Summer	170.415	0.015	4.8	0.0	O K
180 min Summer	170.413	0.013	3.3	0.0	O K
240 min Summer	170.412	0.012	2.8	0.0	O K
360 min Summer	170.410	0.010	2.2	0.0	O K
480 min Summer	170.409	0.009	1.6	0.0	O K
600 min Summer	170.408	0.008	1.4	0.0	O K
720 min Summer	170.408	0.008	1.2	0.0	O K
960 min Summer	170.407	0.007	1.1	0.0	O K
1440 min Summer	170.406	0.006	0.8	0.0	O K
2160 min Summer	170.405	0.005	0.5	0.0	O K
2880 min Summer	170.404	0.004	0.4	0.0	O K
4320 min Summer	170.404	0.004	0.3	0.0	O K
5760 min Summer	170.403	0.003	0.2	0.0	O K
7200 min Summer	170.403	0.003	0.2	0.0	O K
8640 min Summer	170.403	0.003	0.2	0.0	O K
10080 min Summer	170.403	0.003	0.2	0.0	O K
15 min Winter	170.423	0.023	11.1	0.0	O K
30 min Winter	170.420	0.020	8.0	0.0	O K
60 min Winter	170.417	0.017	5.8	0.0	O K
120 min Winter	170.413	0.013	3.3	0.0	O K
180 min Winter	170.411	0.011	2.6	0.0	O K
240 min Winter	170.410	0.010	2.2	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	132.861	0.0	8
30 min Summer	87.290	0.0	17
60 min Summer	54.663	0.0	32
120 min Summer	33.095	0.0	62
180 min Summer	24.358	0.0	94
240 min Summer	19.485	0.0	118
360 min Summer	14.144	0.0	188
480 min Summer	11.275	0.0	228
600 min Summer	9.449	0.0	314
720 min Summer	8.176	0.0	380
960 min Summer	6.502	0.0	508
1440 min Summer	4.700	0.0	716
2160 min Summer	3.392	0.0	1124
2880 min Summer	2.689	0.0	1396
4320 min Summer	1.935	0.0	2204
5760 min Summer	1.531	0.0	2696
7200 min Summer	1.276	0.0	3728
8640 min Summer	1.099	0.0	4168
10080 min Summer	0.968	0.0	5032
15 min Winter	132.861	0.0	9
30 min Winter	87.290	0.0	18
60 min Winter	54.663	0.0	28
120 min Winter	33.095	0.0	66
180 min Winter	24.358	0.0	78
240 min Winter	19.485	0.0	128

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
360 min Winter	170.409	0.009	1.6	0.0	O K
480 min Winter	170.408	0.008	1.4	0.0	O K
600 min Winter	170.407	0.007	1.1	0.0	O K
720 min Winter	170.407	0.007	0.9	0.0	O K
960 min Winter	170.406	0.006	0.8	0.0	O K
1440 min Winter	170.405	0.005	0.6	0.0	O K
2160 min Winter	170.404	0.004	0.4	0.0	O K
2880 min Winter	170.404	0.004	0.3	0.0	O K
4320 min Winter	170.403	0.003	0.2	0.0	O K
5760 min Winter	170.403	0.003	0.2	0.0	O K
7200 min Winter	170.403	0.003	0.2	0.0	O K
8640 min Winter	170.402	0.002	0.1	0.0	O K
10080 min Winter	170.402	0.002	0.1	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
360 min Winter	14.144	0.0	168
480 min Winter	11.275	0.0	266
600 min Winter	9.449	0.0	348
720 min Winter	8.176	0.0	364
960 min Winter	6.502	0.0	496
1440 min Winter	4.700	0.0	732
2160 min Winter	3.392	0.0	900
2880 min Winter	2.689	0.0	1376
4320 min Winter	1.935	0.0	2152
5760 min Winter	1.531	0.0	3232
7200 min Winter	1.276	0.0	3176
8640 min Winter	1.099	0.0	4264
10080 min Winter	0.968	0.0	4000

Rainfall Details

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)	19.300	Shortest Storm (mins)	15
Ratio R	0.400	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.017

Time (mins) From:	To:	Area (ha)
0	4	0.017

Time Area Diagram

Total Area (ha) 0.000

Time (mins) From:	To:	Area (ha)
0	4	0.000

Model Details

Storage is Online Cover Level (m) 171.000

Porous Car Park Structure

Infiltration Coefficient Base (m/hr)	67.30000	Width (m)	5.5
Membrane Percolation (mm/hr)	1000	Length (m)	21.0
Max Percolation (l/s)	32.1	Slope (1:X)	100.0
Safety Factor	10.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	170.400	Membrane Depth (m)	0

Appendix C

Drainage Strategy

Reference	Title	Type	Originator
21390-HYD-XX-XX-DR-D-2001-P01	Foul & Surface Water Drainage Strategy	Drawing	Hydrock
21390-HYD-XX-XX-DR-D-2001-P01	Exceedance Flow Routes	Drawing	Hydrock

OS NORTH

BREAK MANHOLE

EXISTING STW MANHOLE 4202

PROPOSED FOUL PUMPING STATION

PROPOSED INFILTRATION TRENCH
25m x 5m x 2m DEEP

P1 P2 P3 P4 P5 P6 P7 P8 P9 P10

West Town Cottage

West Town House

Bishops Orchard

Richmond House

Faraday House

Ferris House

Larkrise

Maddocks House

Alsworth

Riverdale House

Oakenstone

Coburg House

Applegro

Virginia Cott

Anns Cou

Butwick House

Stewarts Court

Cotswold House

Bramley House

High Rock

Woodways

WOODWAY ROAD

HOOK NORTON ROAD

176.1m

Key

- Existing public foul sewer
- Proposed private surface water drain
- Proposed private foul drain
- Proposed private foul rising main
- Proposed trench soakaway
- Proposed permeable paving with sub-base storage

REVISIONS

Rev	Date	Description	By	Ckd	App
P02	21/12/21	Infiltration trench and pumping station relocated.	RJH		
P01	15/12/21	First issue.	RJH		

Hydrock
OVER COURT BARNS
OVER LANE
ALMONDSBURY
BRISTOL
BS32 4DF
t: +44 (0) 1454 619533
e: bristol@hydrock.com

CLIENT
BLUE CEDAR HOMES

PROJECT
SIBFORD FERRIS, CHERWELL
OXFORDSHIRE

TITLE
FOUL & SURFACE WATER DRAINAGE STRATEGY LAYOUT

HYDROCK PROJECT NO.	SCALE @ A2
21390-IOCB	1:500

STATUS DESCRIPTION	STATUS
INFORMATION	S2

DRAWING NO. (PROJECT CODE-ORIGINATOR-ZONE-LEVEL-TYPE-ROLE-NUMBER)	REVISION
21390-HYD-XX-XX-DR-D-2001	P02

OS NORTH

West Town Cottage

West Town House

GPS

Bishops Orchard

Richmond House

Alsworth

Riverdale House

Oakenstone

Coburg House

Faraday House

Ferris House

Larkrise

Maddocks House

Butwick House

Stewarts Court

Cotswold House

Bramley House

High Rock

Woodways

WOODWAY ROAD

HOOK NORTON ROAD

176.1m

Key

- Proposed private surface water drain
- Proposed trench soakaway
- Surface water exceedance flow route

REVISIONS

Rev	Date	Description	By	Ckd	App
P02	20/12/21	Infiltration relocated.	RJH		
P01	15/12/21	First issue.	RJH		

Hydrock
OVER COURT BARNS
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e: bristol@hydrock.com

CLIENT
BLUE CEDAR HOMES

PROJECT
SIBFORD FERRIS, CHERWELL
OXFORDSHIRE

TITLE
SURFACE WATER EXCEEDANCE
FLOW ROUTES

HYDROCK PROJECT NO.	SCALE @ A2
21390-IOCB	1:500

STATUS DESCRIPTION	STATUS
INFORMATION	S2

DRAWING NO. (PROJECT CODE-ORIGINATOR-ZONE-LEVEL-TYPE-ROLE-NUMBER)	REVISION
21390-HYD-XX-XX-DR-D-2002	P02