<i>O</i> Hyder	$\mathcal{V}$
(	Consultin

# CALCULATIONS

DOCUMENT No

7011-UA001881-UP21B-02

SHEET No

OFFICE	PROJECT TITLE
CARDIFF	NW Bicester Eco Development
SUBJECT	-

Exempla	1 оғ <b>37</b>							
ISSUE	TOTAL SHEETS	AUTHOR	DATE	CHECKED BY	DATE	APPROVED BY	DATE	COMMENTS
1	25	DCB	25/11/10	MP	25/11/10	SAD	25/11/10	
2	25	MP	05/04/11	DCB	05/04/11	SAD	05/04/11	
3								
4								
5								
SUPERSEDES		DATE						

**DESIGN BASIS STATEMENT** (Inc. sources of info/data, assumptions made, standards, etc.)

# Introduction

This calculation has been prepared to assess the sizes of SUDS infiltration features throughout the site. Features have also been assessed with a restricted discharge to simulate worst case scenarion of discharge to watercourse at existing greenfield rates.

Each basin has been assessed using WinDES (an industry standard drainge design package produced by Microdrainage).

# Assumptions

1) Contributing area as per calculation 7015

2) Design to accommodate 100 year rainfall events with a variety of durations in accordance with EA requirements

3) Climate change factor of 30% applied to rainfall

4) Existing greenfield runoff rate calculated as 40 l/s (Ref. Report 3501-UA001881 Flood Risk Assessment - Exemplar Site)

5) In 'no infiltration' worst case scenario SuDS catchments 1,2,3,4 and 5 discharge to catchment 6.

6) In 'no infiltration' worst case scenario SuDS catchment 6 discharges to catchment 7.

7) In 'no infiltration' worst case scenario SuDS catchments 7, 8 and 9 discharge to the watercourse.

# Results

A caclulation titled 'infiltration' is for a SuDS feature tested for discharge by infitIration alone.

A caclulation titled 'no infiltration' is for a SuDS feature tested for discharge to watercourse.

Catchment	Storage volume (m <sup>3</sup> )	Discharge rate in 'no infiltration' scenario
1	250	5
2	245	5
3	120	5
4	190	5
5	165	5
6	55	15
7	135	20
8	175	10
9	405	10

Combined discharge to watercourse = 20 + 10 + 10 = 40 l/s

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5th Floor, The Pithay								<u>الم</u>	
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Date 25/03/2011 15:58		Design	ed By m <u>r</u>	49220		K⊂7 (1 (1  ⊺	ಾಗಗ	ന്തെന്	
File CAT1 SWALE NO INFI	LTRA	Checke	d By				<u>, 1</u>	<u>her her</u>	
Micro Drainage		Source	Control	W.12.4		·			
		_							
Sun	nmary of	Result	s for 10	0 year 1	Return Pe	eriod (+30%	<u>)</u>		
		Polf D	coin Tim	0 . 150	minutoo				
		nali D	rain Tim	e: 438	minutes.				
Storm	Max	Max	Ма	x	Max	Max	Max	Status	
Event	Level	Depth	Infilt	ration	Control	Σ Outflow	Volume	504040	
	(m)	(m)	(1/	s)	(l/s)	(l/s)	(m³)		
15 min Summer	91.238	0.438		0.0	4.9	4.9	114.5	ок	
30 min Summer	91.305	0.505		0.0	4.9	4.9	148.7	OK	
60 min Summer	91,362	0.562		0.0	4.9	4.9	180.8	ОК	
120 min Summer	91.404 91 /19	0.604 0 610		0.0	4.9	4.9	206.4 215 1	UK	
240 min Summer	91.421	0.621		0.0	4.9	4.9 1 0	216 7	0 K 0 V	
360 min Summer	91.413	0.613		0.0	4.9	4,9	212.0	οĸ	
480 min Summer	91.402	0.602		0.0	4.9	4.9	205.1	οĸ	
600 min Summer	91.392	0.592		0.0	4.9	4.9	198.4	ОК	
720 min Summer	91.381	0.581		0.0	4,9	4.9	192.1	ОК	
960 min Summer	91.362	0.562		0.0	4.9	4.9	180.4	ОК	
1440 min Summer	91.323	0.523		0.0	4.9	4.9	158.6	O K	
2160 min Summer	91.265	0.465		0.0	4.9	4.9	128.0	ок	
2880 min Summer	91.206	0.406		0.0	4.9	4.9	99.8	ОК	
4320 min Summer	91.089	0.289		0.0	4.9	4.9	53.6	ОК	
7200 min Summer	91.004 00 059	0.204		0.0	4.9	4.9	27.7 16 A	OK	
8640 min Summer	90.935	0.135		0.0	4.0	4.0	11 6	0 K 0 K	
10080 min Summer	90,919	0.119		0.0	3.7	3.7	8.8	O K	
					•••			• •	
		Stor	m	Rain	Time-P	eak			
		Even	t	(mm/hr)	(mins	3)			
		15 min	Summer	128,28	Ď	25			
		30 min	Summer	84.220	5	40			
	1	60 min	Summer	52.662	2	68 10C			
	1	20 min	Summer	22 35	2	126			
	2	240 min	Summer	18.644	- 1	244			
	3	360 min	Summer	13,543	3	354			
	4	180 min	Summer	10.792	2	408			
	6	500 min	Summer	9.043	3	468 '			
	7	20 min	Summer	7,823	3	530			
	9	960 min	Summer	6.219	9	666			
	14	40 min	Summer	4.493	3	940			
	21	60 min	Summer	3.241	1 1	344			
	28	au min	Summer	2.560	ວ 1 7 າ	128 120			
	43	/60 min	Summer	1.461	, 2 ב	74V 056			
	72	200 min	Summer	1.21	7 3	680			
	86	40 min	Summer	1.048	3 4	408			
	100	80 min	Summer	0.923	3 5	136			
	· · · · · · · · · · · · · · · · · · ·								
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5th Floor, The Pithay							<u> </u>
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Bristol BS1 2NL				*******	<u>ue</u>	SUC	
Date 25/03/2011 15:58	Des	signed By m	p49220		) D ) >>>	ាក្រ	FUE
File CAT1 SWALE NO INFILT	e CAT1 SWALE NO INFILTRA Checked By						
Micro Drainage							
Summa	ary of Res	ults for 10	00 year H	Return Per	iod (+30%)	-	
Shawa	Mara 14			<b>\</b>			<u>a</u>
Event	Max Ma Towal Dou	ax Ma	ux mation	Max Control N	Max	Max	Status
Hvent.	(m) (n		s)	(1/s)	(1/s)	(m <sup>3</sup> )	
	(, (-	-, (-,	-,	(=, =,	(=, 0)	( )	
15 min Winter 9	1.267 0.	467	0.0	4.9	4.9	128.9	ок
30 min Winter 9	91.340 0.	540	0.0	4.9	4.9	167.7	ок
60 min Winter 9	01.402 0.0	602	0.0	4.9	4.9	204.6	ок
120 min Winter 9	91.449 0.0	649	0.0	4.9	4.9	235.4	ОК
180 min Winter 9	1.467 0.0	667	0.0	4.9	4.9	247.2	ОК
240 min Winter 9	91.472 0,0 31.470 0.4	670	0.0	4.9	4.9	250.9	ок
480 min Winter 9	1.459 0.4	659	0.0	4.9 40	4.9	249.1 241 0	OK
600 min Winter 9	1.445 0.0	645	0.0	4.9	4.9	232.6	0 K
720 min Winter 9	1,433 0.0	633	0.0	4.9	4.9	224.7	о к
960 min Winter 9	1.408 0.0	608	0.0	4.9	4.9	208.6	ок
1440 min Winter 9	1.355 0.5	555	0.0	4.9	4.9	176.5	ок
2160 min Winter 9	1.269 0.4	469	0.0	4.9	4,9	129.9	ОК
2880 min Winter 9	1.175 0.3	375	0.0	4.9	4.9	86.2	ОК
4320 min Winter 9	01.001 0.2	201	0.0	4.9	4.9	27.0	OK
5760 min Winter 9	0.938 0.3	138	0.0	4.2	4.2	12.2	O K
7200 min Winter 9 8640 min Winter 9	0.914 0.1	100	0.0	3.6	3.6	8.1	ОК
10080 min Winter 9	0.900 0.0	190	0.0	27	3.1	6.U 1 9	OK
	0.050 0.0		0.0	2	211	4.0	O K
	S	Storm	Rain	Time-Pea	ak		
	E	Svent	(mm/hr)	(mins)			
	15	min Winter	128.285	5 2	25		
	30 :	min Winter	84.226		39		
	120	min Winter	32.662		58 54		
	180 1	min Winter	23 353	<u>بر</u> ۱۶	19		
	240	min Winter	18.644	1 23	38		
	360	min Winter	13.543	35	50		
	480	min Winter	10.792	2 45	i6		
	600 i	min Winter	9.043	3 49	98		
	720	min Winter	7.823	} 5€	58		
	960	min Winter	6.219	9 72	20		
	1440 1	min Winter	4.493	> 102	(Z		
	2100 1	min Winter	2.569	. 144 ) 192	•0 ?A		
	4320 1	min Winter	1.847	238	4		
	5760	min Winter	1.461	. 299	92		
	7200 1	min Winter	1.217	368	10		
	8640 1	min Winter	1.048	440	0		
	10080 1	min Winter	0.923	512	20		

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5th Floor, The Pithay		
All Saints Street		
Bristol BS1 2NL		
Date 25/03/2011 15:58	Designed By mp49220	
File CAT1 SWALE NO INFILTRA	Checked By	
Micro Drainage	Source Control W.12.4	-

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)	20.000	Shortest Storm (mins)	15
Ratio R	0.400	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+30

#### <u>Time / Area Diagram</u>

# Total Area (ha) 0.500

Time	Area	Time	Area	Time	Area
(mins)	(ha)	(mins)	(ha)	(mins)	(ha)
0-4	0.125	4-8	0.250	8-12	0.125

Hyder Consulting Limited		Page 4						
5th Floor, The Pithay								
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Date 25/03/2011 15:58	Designed By mp49220	DDDDDDDDDDD						
File CAT1 SWALE NO INFILTRA	Checked By							
Micro Drainage	Source Control W.12.4							
Model Details								
Stora	Storage is Online Cover Level (m) 91.800							
	Swale Structure							
Infiltration Coefficient	Base (m/hr) 0.00000	Length (m) 150.0						
Infiltration Coefficient	Side (m/hr) 0.00000	Side Slope (1:X) 3.0						
Sa	afety Factor 2.0	Slope (1:X) 1000.0						
Thurs	Porosity 1.00 Cap	Volume Depth (m) 0.000						
Bas	se Width (m) 1.0	tration Depth (m) 0.000						
	Hydro-Brake® Outflow Control							
	Mare Branes Succion Concrot							
Design Hea	d (m) 0.700 Diameter	(mm) 101						
Design Flow	(1/s) 5.0 Invert Level	(m) 90.800						
Hydro-Brake	Type Md6 SW Only							
Depth (m) Flow (1/s) Depth	(m) Flow (1/s) Depth (m) Flow	(1/s) Depth (m) Flow (1/s)						
0.100 3.1 1.	200 6.4 3.000	10.1 7.000 15.4						
0.200 4.9 1.	400 6.9 3.500	10.9 7.500 15.9						
0.300 4.7 1.	600 7.4 4.000	11.6 8.000 16.5						
		12.3 8.500 17.0						
	200 8.2 5.000	13.0 9.000 17.5						
0.800 5.2 2.	400 9.0 6.000	14.3						
1.000 5.8 2.	600 9.4 6.500	14.8						

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5th Floor, The Pithay								
All Saints Street								
Bristol BS1 2NL								
Date 25/03/2011 16:01	Designed By mp49220							
File Cat1 swale infiltratio	Checked By	<u> <u> <u> </u> </u></u>						
Micro Drainage	Source Control W.12.4							
Summary of	Summary of Results for 100 year Return Period (+30%)							
	Half Drain Time : 448 minutes	•						
Storm	Max Max Max	Max Status						
Franc	(m) $(m)$ $(1/e)$	$(m^3)$						
	(m) (m) (1)0)							
15 min Summe	er 91.242 0.442 3.9	9 116.5 ОК						
30 min Summe	er 91.310 0.510 4.4	4 151.3 ОК						
60 min Summe	er 91.369 0.569 4.0	8 184.8 ОК						
120 min Summe	er 91.415 0.615 5.2	2 213.0 ОК						
180 min Summe	er 91.432 0.632 5.3	3 224.1 ОК						
240 min Summe	er 91,438 0,638 5.3	3 227.9 ОК						
360 min Summe	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	3 227.8 OK						
480 min Summe	21 91.435 U.035 5 22 91.431 0.631 5	220,1 UK 32235 OK						
720 min Summe	31,431,0.031,3.0	3 220 3 OK						
960 min Summe	er 91.415 0.615 5.2	2 212.8 OK						
1440 min Summe	er 91.389 0.589 5.0	0 196.6 ОК						
2160 min Summe	er 91.351 0.551 4.	7 174.0 ОК						
2880 min Summe	er 91.317 0.517 4.4	4 154.9 ОК						
4320 min Summe	er 91.259 0.459 4.0	О 124.6 ОК						
5760 min Summe	er 91.211 0.411 3.7	7 102.1 ОК						
7200 min Summe	er 91.171 0.371 3.4	4 84.8 OK						
8640 min Summe	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	I 71.3 OK						
	2.3	9 60.3 OK						
	Storm Bain Time-	Peak						
	Event (mm/hr) (mir	ns)						
	15 min Summer 128,285	26						
	30 min Summer 84.226	40						
	60 min Summer 52.662	68						
	120 min Summer 31.800	126						
	240  min Summer  18 644	242						
	360 min Summer 13.543	324						
	480 min Summer 10.792	384						
	600 min Summer 9.043	446						
	720 min Summer 7.823	512						
	960 min Summer 6.219	650						
	440 min Summer 4.493	926						
2:	LOU MIN SUMMER 3.241	1328						
 л <sup>.</sup>	$320 \text{ min Summer} \qquad 1.847$	2476						
5	760 min Summer 1.461	3232						
7:	200 min Summer 1.217	3960						
8	640 min Summer 1.048	4672						
100	080 min Summer 0.923	5360						
	@1992_2010 Micro Dusinger The							
	STREET MICLO DISTURGE PLC	1						

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5th Floor, The Pithay						_	
All Saints Street					$\square$	പ്രാസ	
Bristol BS1 2NL						יראהר	$\mathbb{P}$
Date 25/03/2011 16:01	Designed H	3y mp49	220			Sende	നെന്ന്
File Catl swale infiltratio	Checked By	,			Ľ		وحرعت
Micro Drainage	Source Cor	ntrol W	.12,4	!			
Summary of	Results fo	r 100 y	year Re	turn Per	iod (+3)	0%)	
Storm	Max	Max	М	ax	Max	Status	
Event	Level	Depth	Infili	tration	Volume		
	(m)	(m)	(1	/s)	(m³)		
15 min Winte	m 01 271	0 471		4 1	100 7	0.77	
30 min Winte	1 91.2/1	0.471		4.1	130.7	OK	
60 min Winte	r 91 407	0.544		5 1	208 0	O K	
120 min Winte	r 91.457	0.657		5.5	240.8	0 K	
180 min Winte	er 91.477	0.677		5.6	254.4	ок	
240 min Winte	er 91.485	0.685		5.7	259.9	οĸ	
360 min Winte	er 91,487	0.687		5.7	261.5	ОК	
480 min Winte	er 91.482	0,682		5.7	257.8	ОК	
600 min Winte	er 91.477	0.677		5.6	254.5	ОК	
720 min Winte	er 91.471	0.671		5.6	250.2	ОК	
960 min Winte	er 91.456	0.656		5.5	239.6	ОК	
1440 min Winte	r 91.420	0.620		5.2	216.4	ОК	
2160 min Winte	er 91.368	0.568		4.8	184.0	ОК	
2880 min Winte	er 91.321	0.521		4.5	157.1	ОК	
4320 min Winte	r 91,242	0.442		3.9	116.7	OK	
5760 min Winte	r 91.180	0.380		3.4	88.5	OK	
8640 min Winte	2 91.130	0.330		3.1	68.Z	U K	
10080 min Winte	r 91.055	0.209		2.7	12 3	O K	
		0.200		2.5	42.5	U K	
	Storm	1	Rain	Time-Pe	ak		
	Event	(H	m/hr)	(mins)	t i		
	15 min Win	ter 12	8.285		26		
	30 min Win	ter 8	4.226		39		
	60 min Win	ter 5	2.662		68		
	120 min Win	ter 3	1.800	1	24		
	180 min Win 240 min Win	ter 2	3.353	1	82		
	sav min win R60 min Win	ter 1	3 5/3	2	30 46		
	180 min Win	ter 1	0.792	د ۵	04		
	500 min Win	ter 1	9.043	4	72		
	/20 min Win	ter	7.823	5	48		
g	60 min Win	ter	6.219	7	02		
14	40 min Win	ter	4.493	10	00		
21	60 min Win	ter	3.241	14	28		
28	880 min Win	ter	2,568	18	24		
43	320 min Win	ter	1.847	26	00		
57	60 min Win	ter	1.461	33	52		
72	OU min Wint	ter	1.217	41	04		
86	940 min Wini	ter	1.048	47	08 08		
100	YOU MIN WIN	ler.	0.923	55	44		
	@1982-2010	Micro	Draina	ae Ita			

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5th Floor, The Pithay		
All Saints Street		
Bristol BS1 2NL		
Date 25/03/2011 16:01	Designed By mp49220	- Destractor
File Cat1 swale infiltratio	Checked By	<u>n ne ne se</u>
Micro Drainage	Source Control W.12.4	ł
	Rainfall Details	

# Rainfall ModelFSRWinter StormsYesReturn Period (years)100Cv (Summer)0.750RegionEngland and WalesCv (Winter)0.840M5-60 (mm)20.000Shortest Storm (mins)15Ratio R0.400Longest Storm (mins)10080Summer StormsYesClimate Change %+30

#### <u>Time / Area Diagram</u>

#### Total Area (ha) 0.500

Time	Area	Time	Area	Time	Area
(mins)	(ha)	(mins)	(ha)	(mins)	(ha)
0-4	0.125	48	0.250	8-12	0.125

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5th Floor, The Pithay		
All Saints Street		DU GREED M
Bristol BS1 2NL		
Date 25/03/2011 16:01	Designed By mp49220	
File Catl swale infiltratio	Checked By	
Micro Drainage	Source Control W.12.4	
	Model Details	
	Model Details	
Storag	ge is Online Cover Level (m)	91.800
	Swale Structure	
Infiltration Coofficient	$P_{2,2,2}$ (m/hm) 0.05(00)	
Infiltration Coefficient	Side $(m/hr) = 0.05600$	Length (M) 150.0 Side Slope (1:X) 3.0
Sa	ifety Factor 2.0	Slope (1:X) 1000.0
	Porosity 1.00 Cap	Volume Depth (m) 0.000
Inver	t Level (m) 90.800 Cap Infil	tration Depth (m) 0.000
Bas	se Width (m) 1.0	
	©1982-2010 Micro Drainage Ltd	

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5th Floor, The Pithay		
All Saints Street		
Bristol BS1 2NL		The share a
 Date 25/03/2011 16:04	Designed By mp49220	DENTRACT
 File Cat2 swale no infiltra	Checked By	<u>L'uctures so</u>
Micro Drainage	Source Control W.12.4	

# Summary of Results for 100 year Return Period (+30%)

Half Drain Time : 468 minutes.

Storm Event	Max Max Max	lax pth	Ma Infilt	x ation	Max Control	Max Σ Outflow	Max Volume	Status
	(m)	m)	(1/	s)	(1/s)	(l/s)	(m³)	
15 min Summer	91.043 0.	443		0.0	4.9	4.9	116.9	ок
30 min Summer	91.111 0.	511		0.0	4.9	4.9	151.8	ОК
60 min Summer	91,169 0.	569		0.0	4.9	4.9	184.7	ОК
120 min Summer	91.212 0.	612		0.0	4.9	4.9	211.0	ОК
180 min Summer	91.226 0.	626		0.0	4.9	4.9	220.2	ок
240 min Summer	91.229 0.	629		0.0	4.9	4.9	222.1	ок
360 min Summer	91.222 0.	622		0.0	4.9	4.9	217.6	ок
480 min Summer	91.211 0.	611		0.0	4.9	4.9	210.6	ок
600 min Summer	91.200 0.	600		0.0	4.9	4.9	203,9	ОК
720 min Summer	91.190 0.	590		0.0	4.9	4.9	197.6	ОК
960 min Summer	91.171 0.	571		0.0	4.9	4.9	185.8	ок
1440 min Summer	91.133 0.	533		0.0	4.9	4.9	163,9	ок
2160 min Summer	91.076 0.	476		0.0	4.9	4.9	133.2	ОК
2880 min Summer	91.017 0.	417		0.0	4.9	4.9	104.9	ок
4320 min Summer	90.900 0.	300		0.0	4.9	4.9	57.5	ок
5760 min Summer	90.812 0.	212		0.0	4.9	4.9	29.8	ок
7200 min Summer	90.762 0.	162		0.0	4.6	4.6	17.3	ок
8640 min Summer	90.738 0.	138		0.0	4.2	4.2	12.1	ок
10080 min Summer	90.722 0.	122		0.0	3.8	3.8	9.2	ок
		Stor	m	Rain	Time-E	?eak		
		Even	t	(mm/hr)	(min	s)		
	15	min	Summer	128 285	5	25		
	30	min	Summar	84 226	5	40		
	50 60	min	Summer	52 662	>	68		
	120	min	Summer	31 800	- 1	126		
	180	min	Summer	23.353	, ,	186		
	240	min	Summer	18.644	1	244		
	360	min	Summer	13.543	3	358		
	480	min	Summer	10.792	2	410		
	600	min	Summer	9,043	3	472		
	720	min	Summer	7,823	3	534		
	960	min	Summer	6.219	)	668		
	1440	min	Summer	4.493	3	942		
	2160	min	Summer	3.241	1	L344		
	2880	min	Summer	2,568	3 1	1732		
	4320	min	Summer	1.847	1 2	2424		
	5760	min	Summer	1.461	1 3	3056		
	7200	min	Summer	1,217	1 3	3688		
	8640	min	Summer	1.048	3 4	1408		
	10080	min	Summer	0.923	3 5	5136		

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5th Floor, The Pithay									
All Saints Street							പ്പാറ	7	
Bristol BS1 2NL							Sho	クト	<u>/ ] </u>
Date 25/03/2011 16:04		Design	ed By m	p49220			ಾಗಗ	ക്രപ	SH.
File Cat2 swale no infi	ltra	Checke	d By				<u>, u u y</u>	<u>ر تحمث ا</u>	Sò
Micro Drainage		Source	Contro	1 W.12.4					
Sum	mary of	Result	s for 10	0 year	Return Pe	riod (+30%)	<u>)</u>		
Storm	Max	Max	Ma	x	Max	Max	Max	Status	
Event	Level	Depth	Infilt	ration	Control	Σ Outflow	Volume		
	(m)	(m)	(1/	's)	(1/s)	(l/s)	(m³)		
15 min Winter	01 073	0 473		0.0	1 0	4 0	121 C	0 V	
30 min Winter	91.146	0.546		0.0	4.5	4.9	171 2		
60 min Winter	91.209	0.609		0.0	4.9	4,9	209.0	O K	
120 min Winter	91.257	0.657		0.0	4.9	4.9	240.6	ок	
180 min Winter	91.275	0.675		0.0	4.9	4.9	252.9	ок	
240 min Winter	91,281	0.681		0.0	4.9	4.9	256.9	ОК	
360 min Winter	91.279	0.679		0.0	4.9	4.9	255.6	ОК	
480 min Winter	91.269	0.669		0.0	4.9	4.9	248.5	ОК	
600 min Winter	91.255	0.655		0.0	4.9	4.9	239.1	ОК	
720 min Winter	91.243	0.643		0.0	4.9	4.9	231.2	ОК	
960 min Winter	91.218	0.618		0.0	4.9	4.9	215.1	ОК	
1440 min Winter	91.166	0.566		0.0	4.9	4.9	183.0	ОК	
2160 min Winter	91.082	0.482		0.0	4.9	4.9	136.4	ОК	
4320 min Winter	90.909	0.309		0.0	4.9 1 Q	4.9	92.4	OK	
5760 min Winter	90.742	0.142		0.0	4.3	4.3	12.9	0 K	
7200 min Winter	90.717	0.117		0.0	3.6	3.6	8.4	O K	
8640 min Winter	90.702	0.102		0.0	3.1	3.1	6.3	оĸ	
10080 min Winter	90,692	0.092		0.0	2.8	2.8	5.0	ОК	
		Stor	m	Rain	Time-Pe	eak			
		Even	.t	(mm/hr)	(mins	•)			
		16 min	Mintor	100 001	=	25			
		30 min	Winter	84 220	5	20			
		60 min	Winter	52.66	>	<i>59</i> 68			
	1	20 min	Winter	31.800	)	124			
	1	80 min	Winter	23.353	3	182			
	2	40 min	Winter	18.644	1 :	240			
	3	60 min	Winter	13.543	3 (	350			
	4	80 min	Winter	10.792	2 4	456			
	6	00 min	Winter	9.043	3 !	504			
	7	20 min	Winter	7.823	3 !	570			
	9 1 4	60 min	Winter	6.219	,	122			
	14 21	40 min 60 min	Winter	4.493	> 1(   12	152 152			
	21	80 min	Winter	2 569	19	432 340			
	43	20 min	Winter	1.84	1 24	124			
	57	60 min	Winter	1.461	. 30	000			
	72	00 min	Winter	1.217	7 36	572			
	86	40 min	Winter	1.048	3 44	108			
	100	80 min	Winter	0.923	3 50	)72			
		©198 <mark>2</mark> 2	2010 Mic	ro Drai	nage Ltd				

Hyder Consulting Limited		Page 3			
5th Floor, The Pithay					
All Saints Street			m		
Bristol BS1 2NL			ye vy		
Date 25/03/2011 16:04	Designed By mp49220		"menare"		
File Cat2 swale no infiltra	Checked By		<u>- 10 y 50</u>		
Micro Drainage	Source Control W.12.	4			
Rainfall Mode Return Period (year:	Rainfall Detai	<u>lls</u> Winter Storms Cv (Summer)	Yes 0.750		
Regio	on England and Wales	Cv (Winter)	0.840		
M5-60 (nu	n) 20.000	Shortest Storm (mins)	15		
Ratio	R 0.400	Longest Storm (mins)	10080		
Summer Storr	ns Yes	Climate Change %	+30		
<u>Time / Area Diagram</u>					

Total Area (ha) 0.510

Time	Area	Time	Area	Time	Area
(mins)	(ha)	(mins)	(ha)	(mins)	(ha)
0-4	0.128	4-8	0.255	8-12	0.127

Hyder Consulting Limited			Page 4	<u></u>			
5th Floor, The Pithay				· · · · · · · · · · · · · · · · · · ·			
All Saints Street			])រ៉ុ 🕅				
Date 25/03/2011 16:04	Designed By mr	49220		A Composition			
File Cat2 swale no infiltra	Checked By	45440	LUC	<u> </u>			
Micro Drainage	Source Control	W.12.4	Contraction of the second se				
	Model Details						
Stora	Storage is Online Cover Level (m) 91.600						
Infiltration Coefficient	Base (m/hr) 0	00000	Topat	-h (m) 150 0			
Infiltration Coefficient S	Side (m/hr) 0. afety Factor Porosity	00000 2.0 1.00 Cap	Side Slope Slope	(1:X) 3.0 (1:X) 1000.0 (1:X) 0.000			
Inve Ba	rt Level (m) 9 se Width (m)	00.600 Cap Infil 1.0	tration Dept	n (m) 0.000			
	Hydro-Brake® (	Outflow Control					
Design Hea Design Flow Hydro-Brake®	ad (m) 0. (1/s) ) Type Md6 SW 0	700 Diameter 5.0 Invert Level nly	(mm) 10 (m) 90.60	1 0			
Depth (m) Flow (l/s) Depth	(m) Flow (l/s)	Depth (m) Flow	(1/s) Dep	th (m) Flow (1/s)			
0.100 3.1 1.	200 6.4	3.000	10.1	7.000 15.4			
0.200 4.9 1.	400 6.9	3.500	10,9	7.500 15.9			
	600 7.4 200 7.0	4,000	11.6	8.000 16.5			
0.400 4.5 1.	000 7.8	4.500	12.3	8.500 17.0			
0,600 4.7 2.	200 8.6	5.500	13.6	9.500 17.9			
0.800 5.2 2.	400 9.0	6.000	14.3	2,13			
1.000 5.8 2.	600 9.4	6.500	14.8				
			·				
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		Provincy of DUC					

Hyder Consulting Limited		Page 1
5th Floor, The Pithay	10 - 10 - 10 - 10 - 10 - 10 - 10 - 10 -	
All Saints Street		
Bristol BS1 2NL		
Date 25/03/2011 16:10	Designed By mp49220	DESERTE
File Cat2 swale infiltratio	Checked By	The start of the second of the
Micro Drainage	Source Control W.12.4	
Summary of	Results for 100 year Return Pe	riod (+30%)
	Half Drain Time : 453 minutes.	
Storm	Max Max Max	Max Status
Event	Level Depth Infiltration	Volume
	(m) (m) (1/s)	(m <sup>3</sup> )
15 min Summe	er 91.047 0.447 3.9	118.8 ОК
30 min Summe	er 91.116 0.516 4.4	154.4 ОК
60 min Summe	er 91.175 0.575 4.9	188.6 O K
120 min Summe	r 91.222 0.622 5.2	217.5 O K
180 min Summe	r 91.240 0.640 5.4	229.0 O K
240 min Summe	r 91.246 0.646 5.4	233.0 OK
360 min Summe	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	203.0 OK
480 min Summe	x 01 030 0 600 5.4	231.3 UK 228.7 AV
720 min Summe	× 91 234 0 634 5,4	220.7 UA 225.5 OX
960 min Summe	r 91 223 0 623 5.2	223.3 OK
1440 min Summe	r 91.197 0.597 5.0	201 6 O K
2160 min Summe	r 91.159 0.559 4.8	178 7 O K
2880 min Summe	r = 91.125 = 0.525 = 4.5	159.2 OK
4320 min Summe	r 91.066 0.466 4.1	128.4 O K
5760 min Summe	r 91.018 0.418 3.7	105.4 ОК
7200 min Summe	r 90.978 0.378 3.4	87.7 ОК
8640 min Summe	r 90.944 0.344 3.2	73.8 ОК
10080 min Summe	r 90.914 0.314 2.9	62.5 ОК
	Storm Rain Time-Pe	eak
	Event (mm/hr) (mins	)
	15 min Summer 128.285	26
	30 min Summer 84,226	40
	60 min Summer 52.662	68
	120  min Summer  31.800	126
-	$240 \text{ min Summer}  18  644 \qquad 7$	201
	360  min Summer  13.543	326
	180 min Summer 10.792	386
	500 min Summer 9.043	148
	20 min Summer 7.823	514
	60 min Summer 6.219	552
14	40 min Summer 4.493	926
21	.60 min Summer 3,241 13	328
28	80 min Summer 2.568 1	732
43	320 min Summer 1.847 25	504
51	60 min Summer 1,461 32	232
72	200 min Summer 1,217 39	968
80	540 min Summer 1.048 46	572
100	180 min Summer 0.923 54	140
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Hyder Consulting Limited					Page 2		
5th Floor, The Pithay							
All Saints Street					III <u>[```</u> , 7	പ്പിന്ന	
Bristol BS1 2NL					<u>  LM</u>	' LAT	
Date 25/03/2011 16:10	Designed	By mp49	220		ר מו∥	Denge	DENCIC
File Cat2 swale infiltratio	Checked B	Checked By				٢٩٩٩	وحريجك
Micro Drainage	Source Co	ntrol W	.12.4		1		
Summary of	Results fo	or 100 y	vear Re	eturn Pei	riod (+3	0%)	
					•		
Storm	Max	Max	Ъ	íax	Max	Status	
Event	Level	Depth	Infil	tration	Volume		
	(m)	(m)	(1	./s)	(m³)		
15 min Winte	er 91.076	0.476		4.1	133.4	ок	
30 min Winte	er 91.150	0.550		4.7	173.5	ОК	
60 min Winte	er 91.214	0.614		5.2	212.3	ок	
120 min Winte	er 91.265	0.665		5.5	245.9	ОК	
180 min Winte	er 91,285	0.685		5.7	259.9	ОК	
240 min Winte	er 91.293	0.693		5.8	265.7	O K	
JOU MIN WINTS	r 91.296	0.696		5.8	267.5	OK	
400 MIN WINC	= 01.00C	0.071 0.071		5./ 5.7	203.8 260 ⊑	U K	
720 min Winte	ar 91.280	0.000		57	200.3	U K O V	
960 min Winte	r 91.260	0.664		55	230.2	OK	
1440 min Winte	er 91.229	0.629		5.3	222.1	0 K	
2160 min Winte	er 91.176	0.576		4.9	189.2	0 K	
2880 min Winte	er 91.129	0.529		4.5	161.8	ОК	
4320 min Winte	er 91.050	0.450		3.9	120.5	ок	
5760 min Winte	er 90,987	0.387		3.5	91.6	ОК	
7200 min Winte	er 90.937	0.337		3.1	70.9	ОК	
8640 min Winte	er 90.895	0.295		2.8	55.6	ок	
10080 min Winte	er 90.861	0.261		2.5	44.2	ОК	
	Storm		Rain	Time-Pe	ak		
	Event	(1	um/hr}	(mins)	)		
	1 F . ( . 11)		0.005		0.0		
	15 Min Wir	nter 12	(8.285		20		
	60 min Wir	ator F	3 662		59 69		
	120 min Wir	nter (	81 800	1	24		
	180 min Wir	iter 2	23.353	1	82		
	240 min Wir	nter 1	8.644	2	38		
	360 min Wir	nter 1	3,543	3	46		
	480 min Wir	nter 1	0.792	4	08		
	600 min Wir	nter	9.043	4	72		
•	720 min Wir	nter	7.823	5	50		
	960 min Wir	iter	6.219	7	02		
14	440 min Wir	iter	4.493	10	00		
23	160 min Wir	nter	3.241	14	28		
20	880 min Wir	nter	2.568	18	28		
41	320 min Wir 760 min Wir	nter	1.847	26	00		
5	200 min Wir	icer	1 017	33	5∠ 04		
14	540 min Wir	iter tor	1 040	41	99 99		
00 1 N T	)80 min Wir	iter	0.923	40 55	44		
101			5.525	55	**		
	@1982_2010	) Micro	Draina	an Itd			
	AT 205-5010	A TATCTO	Prarild	iye ulu			1

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Hyder Consulting Limited		Page 3
5th Floor, The Pithay		
All Saints Street		
Bristol BS1 2NL		
Date 25/03/2011 16:10	Designed By mp49220	Dentrage
File Cat2 swale infiltratio	Checked By	<u>COCHIERS P</u>
Micro Drainage	Source Control W.12.4	

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)	20,000	Shortest Storm (mins)	15
Ratio R	0.400	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+30

# Time / Area Diagram

# Total Area (ha) 0.510

Time	Area	Time	Area	Time	Area	
(mins)	(ha)	(mins)	(ha)	(mins)	(ha)	
0-4	0.128	4-8	0.255	8-12	0.127	

Hyder Consulting Limited			Page 4									
5th Floor, The Pithay				٦ <sub>4</sub>								
All Saints Street			D' HRR	D ~ m								
Date 25/03/2011 16:10	Designed By mp40220			e conce								
File Cat2 swale infiltratio	Checked By mp49220		L'US UN	CCC								
Micro Drainage	Source Control W.12 4											
	bourde concror million											
Model Details												
Storag	ge is Online Cover Le	evel (m)	91.600									
	Swale Structur	ce										
Infiltration Coefficient	Base (m/hr) 0.05600		Length (m)	150.0								
Salar Sa	side (m/nr) 0.05600		Side Slope (1:X)	3.0								
	Porosity 1.00	Cap	Volume Depth (m)	0.000								
Inver	t Level (m) 90.600	Cap Infil	tration Depth (m)	0.000								
Bas	e Width (m) 1.0											
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Hyder Consulting Lim:	ited					Page 1						
5th Floor, The Pithay	/					1						
All Saints Street						L C V						
Bristol BS1 2NL							<u> </u>	$\bigcirc$ $\bigcirc$				
Date 25/03/2011 16:14	/03/2011 16:14 Designed By mp49220						ᡔᡄᠺᢆᡰᡕ	<u> </u>				
File Cat3 roadside no	infil	Check	ed By				<u> </u>	LEREÖ				
Micro Drainage		Source	- Contro	1 10 12	Λ							
miero brainage		DOULC	c concro.									
Summary of Results for 100 year Return Period (+30%)												
-	Juliunity 01	noour		Je Jeaz		101100 (/0						
Half Drain Time : 225 minutes.												
Storm	Max	Max	Max		Max	Max	Max	Status				
Event	Level D	epth	Infiltra	tion (	Control	Σ Outflow	Volume					
	(m)	(m)	(l/s)	)	(l/s)	(l/s)	(m³)					
		5.9.6		~ ~			<i>co</i> 1					
15 min Summer	90.576 0	.5/6		0.0	4.1	4.1	62.4					
30 min Summer	90.703 0	.703		0.0	4.3	4.3	19.1	Flood Risk				
120 min Summer	00 840 V	868		0.0	4.0	4.6 A 7	94.3 102 2	ELOOU KISK				
180 min Summer	90.863 0	.863		0.0	4.7	4,7	102.3	Flood Rick				
240 min Summer	90,845 0	.845		0.0	4.6	4.6	99.1	Flood Risk				
360 min Summer	90.807 0	.807		0.0	4.5	4.5	94.0	Flood Risk				
480 min Summer	90.773 0	773		0.0	4.5	4.5	89.3	Flood Risk				
600 min Summer	90.741 0	.741		0.0	4.4	4.4	84.9	Flood Risk				
720 min Summer	90.709 0	.709		0.0	4.3	4.3	80.6	Flood Risk				
960 min Summer	90.650 0	.650		0.0	4.1	4.1	72.4	ОК				
1440 min Summer	90.538 0	.538		0.0	4.1	4.1	57,2	ок				
2160 min Summer	90.388 0	.388		0.0	4.1	4.1	36.6	ОК				
2880 min Summer	90.266 0	.266		0.0	4.1	4.1	20.0	ОК				
4320 min Summer	90.153 0	.153		0.0	3.9	3.9	6.7	ОК				
5760 min Summer	90.117 0	.117		0.0	3.3	3.3	3.9	ОК				
7200 min Summer	90.098 0	.098		0.0	2.7	2.7	2.7	ОК				
8640 min Summer	90.086 0	.086		0.0	2.4	2.4	2.1	ОК				
10080 min Summer	90.078 0	.078		0.0	2.1	2.1	1./	OK				
		Sto	<b>*</b> -F1	Pair	Timo	-Posk						
		Eve	nt.	(mm/h	r) (m.	ins)						
				(	~, (							
		15 mir	Summer	128.2	85	18						
		30 mir	Summer	84.2	26	33						
		60 mir	Summer	52.6	62	62						
	1	120 mir	Summer	31.8	00	120						
	1	180 mir	Summer	23.3	53	170						
	2	240 mir	1 Summer	18.6	44	198						
		360 mir	n Summer	13.5	43	262						
	1	180 mir	1 Summer	10.7	92	330						
	(	500 mir 720 mi-	Summer	9.0	43 วว	400						
		20 mir	i Summer	1.8. 6 0	23 19	470						
	17	140 mir	Summer	0.Z	93	878						
	21	. 10 mir	Summer	3.2	41	1252						
	21	380 mir	Summer	2.5	 68	1584						
	43	320 mir	Summer	1.8	47	2208						
	51	760 mir	Summer	1.4	61	2936						
	72	200 mir	Summer	1.2	17	3672						
	86	540 mir	Summer	1.0	48	4400						
	100	)80 mir	Summer	0.9	23	5088						
		©1982-	-2010 Mid	cro Dra	inage L	td	*	, , ,				

Hyder Consulting Limi	ted					Page 2	Page 2			
5th Floor, The Pithay										
All Saints Street						$  _{\Gamma}$	Rac			
Bristol BS1 2NL							<u>" rəñ</u>			
Date 25/03/2011 16:14		Desig	Designed By mp49220				DESERTE			
File Cat3 roadside no	infil	Check	ed By			<u>r</u>	<u><u><u> </u></u></u>			
Micro Drainage										
<u>s</u>	ummary of	Resul	ts for 10	)0 year	Return	Period (+3	30%)			
Storm	Max	Max	Max		Max	Max	Max	Status		
Event	Level I	Depth	Infiltra	tion (	Control	Σ Outflow	Volume			
	(m)	(m)	(1/3)	t i i i i i i i i i i i i i i i i i i i	(1/8)	(1/s)	(m³)			
15 min Winter	90.634 (	0.634		0 0	4 1	A 1	70 4	0 8		
30 min Winter	90.779 (	0.779		0.0	4.5	4.5	90.1	Flood Risk		
60 min Winter	90.904 (	0.904		0.0	4.8	4.8	107.2	Flood Risk		
120 min Winter	90.983 (	0.983		0.0	5.0	5.0	118.0	Flood Risk		
180 min Winter	90.989 (	0.989		0.0	5.0	5.0	118.8	Flood Risk		
240 min Winter	90.967 (	0.967		0.0	5.0	5.0	115.9	Flood Risk		
360 min Winter	90.920 (	0.920		0.0	4.8	4.8	109.4	Flood Risk		
480 min Winter	90.873 (	0.873		0.0	4.7	4.7	103.0	Flood Risk		
600 min Winter	90.826 (	0.826		0.0	4.6	4.6	96.6	Flood Risk		
720 min Winter	90,780 (	0.780		0.0	4.5	4.5	90.3	Flood Risk		
960 min Winter	90.692 (	0.692		0.0	4.2	4.2	78.2	ОК		
1440 min Winter	90.526	J.526		0.0	4.1	4.1	55.5	ОК		
2160 min Winter	90.290	J.290		0.0	4.1	4.1	23.2	ОК		
4320 min Winter	90,103 (	1 107		0.0	4.0	4.0	1.0	OK		
5760 min Winter	90.087 (	0.107		0.0	2.4	2.4	2.1	OK		
7200 min Winter	90.075 (	0.075		0.0	2.0	2.0	1.6	0 K		
8640 min Winter	90.067 (	0.067		0.0	1.7	1.7	1.3	0 K		
10080 min Winter	90.062 0	0,062		0.0	1.5	1.5	1.1	о к		
		Sto	orm	Rair	n Time	-Peak				
		Eve	ant	(mm/h	r) (mi	ins)				
					<b>~</b> -					
		15 mi	n Winter	128.2	85	18				
		50 mi	n Winter	84.Z	20 62	32				
		120 mi	n Winter	31.8	02	118				
		180 mi	n Winter	23.3	53	174				
		240 mi	n Winter	18.6	44	224				
		360 mi	n Winter	13.5	43	278				
		480 mi	n Winter	10.7	92	356				
		600 mi	n Winter	9.0	43	434		A		
		720 mi	n Winter	7.8	23	508				
	1	960 mi:	n Winter	6.2	19	656				
	1	440 mi	n Winter	4.4	93	938				
	2	160 mi: 220'	n Winter	3.2	41 C0	1280				
	21	000 M1: 320 mi	n Winter	2.5	00 17	1220				
	4. 5.	220 mi 760 mi	n Winter	1.8 1 /		2204 2936				
	7:	200 mi	n Winter	1.2	17	3584				
	8	640 mi	n Winter	1.0	48	4400				
	10	080 mi	n Winter	0.9	23	5136				
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Hyder Consulting Limited		Page 3
5th Floor, The Pithay		
All Saints Street		TV Parta
Bristol BS1 2NL		LL GLO M
Date 25/03/2011 16.14	Designed By mp49220	1 Drogen of the
Filo Cat2 readaida na infil	Checked By	
File cats roadside no inili	Checked By	
Micro Drainage	Source Control W.12.4	
	Rainfall Details	
Bainfall Mad		liston Charman Mar
Rainiali Mode	$e_1$ $r_{\rm DK}$ $r_{\rm N}$	Cit (Summer) 0 750
Recutil reitou (year	on England and Walog	CV (Summer) 0.750
M5-60 (m	m) 20 000 Shortost	Storm (mince) 15
Batio	R 0.400 Longest	Storm (mins) 10080
Summer Stor	ms Yes Clin	nate Change % +30
		ace change i 150
	Time / Area Diagram	
	Total Area (ha) 0.275	
	Time Area	
	(mins) (ha)	
	0-4 0.275	
	@1982-2010 Micro Drainage Ltd	
1	CERTE RATE DECENTING THE	

Hyder Consulting Limited		Page 4									
5th Floor, The Pithay											
All Saints Street											
Bristol BS1 2NL		LUCICO M									
Date 25/03/2011 16:14	Designed By mp49220	DESERVICE									
File Cat3 roadside no infil	Checked By	C C C C C C C C C C C C C C C C C C C									
Micro Drainage	Source Control W.12.4										
	Model Details										
(the second		01 000									
Courage to Chiline Cover Dever (m/ 51.000											
Infiltration Trench Structure											
Infiltration Coefficient Base (m/hr) 0.00000 Trench Width (m) 1.9											
Infiltration Coefficient Sase (m/hr) 0.000000 Trench Width (m) 1.9 Infiltration Coefficient Side (m/hr) 0.00000 Trench Length (m) 240.0											
Infituration Coefficient Side (M/Nr) 0.00000 Trench Length (M) 240.0 Safety Factor 2.0 Slope (1:X) 1000.0											
-	Porosity 0.30 Cap	Volume Depth $(m)$ 0.000									
Inve	rt Level (m) 90.000 Cap Infil	tration Depth (m) 0.000									
	Hydro-Brake® Outflow Control										
	- <u>-</u>										
Design Hea	ad $(m)$ 1.000 Diameter	(mm) 94									
Hydro-Brake@	(178) 5.0 Invert Level Type Md6 SW Only	(m) 90.000									
Depth (m) Flow (1/s) Depth	(m) Flow (1/s) Depth (m) Flow	(1/s) Depth (m) Flow (1/s)									
	.200 5.5 3.000	8.7 7.000 13.3									
	.400 6.0 3.500	9.4 7.500 13.8									
		10.1 8.000 14.3									
	000 7 1 5 000	11.3 9.000 15.1									
0.600 4.0 2	200 7.5 5.500	11.5 9.000 15.1									
0.800 4.5 2.	400 7.8 6.000	12.3									
1.000 5.0 2.	600 8.1 6.500	12.9									
	@1982-2010 Micro Drainage Itd										
	orne rere micro pratmaye blu										

Hyder Consulting Li	mited					Page	Page 1				
5th Floor, The Pith	ay										
All Saints Street						$  $ $\sum$	ിപ്പാനം				
Bristol BS1 2NL											
Date 25/03/2011 16:	15	Designed By mp49220					Denter	<u>a</u> ran an a			
File Cat3 roadside	infiltra	Checked By						<u>structure</u>			
Micro Drainage		Source	Control	W.12.4							
Summary of Results for 100 year Return Period (+30%)											
Half Drain Time : 161 minutes.											
	Storm	Max	Мах	Мах	:	Max	Status				
	Event	Level	Depth	Infiltra	ation	Volume					
		(m)	(m)	(1/s	)	(m³)					
10		00 575	A 575		<b>F D</b>	<i>co</i> 0	0 W				
15	min Summer	90.575	0.575		5.3	62.2	OK				
30	min Summer	90.697	0.697		5.7	79.0					
120	min Summer	90.797	0.797		0.1	92.0	Flood Risk				
120	min Summer	90.842	0.042		0.3	98./ 00 1	Flood Risk				
180	min Summer	90.039	0.039		0.3	98.3 06 A	Flood RISK				
240	min Summer	30.825	0,020		0.Z	90.4 01 c	Flood Bisk				
300	min Summer	90.79U 90.750	0.750		Р 0 0'Т	91.0 91.0	Flood Bick				
48U 600	min Summer	90.703	0.700		5.9 5.9	00.3 81 ¢	Flood Dieb				
000	min Summor	00 K83	0 600		J.0 5 7	01.0 76 0	LIOOU KISK				
960	min Summer	90.002	0.002		5.4	68 2	OK				
1440	min Summer	90.010	0.010		5.0	537	OK				
2160	min Summer	90.312	0.344		4 6	37 4	O K				
2880	min Summer	90.311	0.311		4.3	26.1	0 K				
4320	min Summer	90.227	0.227		3.8	14.7	0 K				
5760	min Summer	90.191	0.191		3.1	10.4	0 K				
7200	min Summer	90,165	0.165		2.7	7.8	0 K				
8640	min Summer	90.146	0.146		2.3	6.0	ОК				
10080	min Summer	90.130	0.130		2,1	4.8	ОК				
		Stor	n	Rain	Time-	-Peak					
		Even	۲.	(mm/hr)	(mi	ns)					
		15 min	Summer	128.285		18					
		30 min	Summer	84.226		33					
		60 min	Summer	52.662		62					
	:	120 min	Summer	31.800		116					
		180 min	Summer	23.353		144					
	:	240 min	Summer	18.644		176					
	:	360 min	Summer	13,543		244					
		480 min	Summer	10.792		314					
		600 min	Summer	9.043		382					
	•	720 min	Summer	7.823		450					
	!	960 min	Summer	6,219		580					
	14	440 min	Summer	4.493		838					
	2	160 min	Summer	3.241		1208					
	21	380 min	Summer	2.568		1556					
	43	320 min	Summer	1.847		2244					
	5	/60 min	Summer	1,461		2944					
	7:	200 min	Summer	1.217		3672					
	81	040 min	Summer	1.048		4408 E106					
	100	JOU MIN	əunmer	0.923		0130					
		©1982-2	2010 Mic	ro Draina	age Lt	d					

Hyder Consulting Li	mited					Page	2			
5th Floor, The Pith	nay									
All Saints Street										
Bristol BS1 2NL										
Date 25/03/2011 16:	15	Designe	d By mp	49220		-     b )	Dentract			
File Cat3 roadside	infiltra	Checked	l By							
Micro Drainage	· · ·	Source	Control	W.12.4						
Summary of Results for 100 year Return Period (+30%)										
	Storm	Max	Max	Max	2	Max	Status			
	Event	Level	Depth	Infiltr	ation	Volume				
		(m)	(m)	(1/5	;}	(m³)				
15	min Winter	90 632	0 632		55	70.0	0 K			
30	min Winter	90.772	0.772		6.0	80.0	Flood Risk			
60	min Winter	90.889	0.889		6.4	105.2	Flood Risk			
120	min Winter	90.951	0.951		6.7	113.7	Flood Risk			
180	min Winter	90.944	0.944		6.6	112.7	Flood Risk			
240	min Winter	90.927	0.927		6.6	110.4	Flood Risk			
360	min Winter	90.879	0.879		6.4	103.8	Flood Risk			
480	min Winter	90.825	0.825		6.2	96.5	Flood Risk			
600	min Winter	90.772	0.772		6.0	89.2	Flood Risk			
720	min Winter	90.722	0.722		5.8	82.3	Flood Risk			
960	min Winter	90.630	0.630		5.5	69.8	ОК			
1440	min Winter	90.482	0.482		4.9	49.5	O K			
2100	min Winter	90.325	0.325		4.3	28.1	O K			
4320	min Winter	90.230	0.236		29	10.2	OK			
5760	min Winter	90.147	0.147		2.3	6.2	0 K			
7200	min Winter	90.125	0.125		2.0	4.4	0 K			
8640	min Winter	90.109	0.109		1.7	3.4	O K			
10080	min Winter	90.096	0.096		1.5	2.6	ок			
		Storm	ł	Rain	Time-	Peak				
		Event	:	(mm/hr)	(mi	ns)				
		15	w	100 005						
		15 min 1	Winter	128.285		18				
		60 min I	Winter	52 662		52				
		120 min 1	Winter	31,800		116				
	-			~~~~~		110				
	-	120 min 1 180 min 1	Winter	23.353		162				
		120 min 1 180 min 1 240 min 1	Winter Winter	23.353 18.644		162 186				
		120 min 1 180 min 1 240 min 1 360 min 1	Winter Winter Winter	23.353 18.644 13.543		162 186 264				
		120 min 5 180 min 5 240 min 5 360 min 5 180 min 5	Winter Winter Winter Winter	23.353 18.644 13.543 10.792		116 162 186 264 340				
		120 min 5 180 min 5 240 min 5 360 min 5 180 min 5 500 min 5	Winter Winter Winter Winter Winter	23.353 18.644 13.543 10.792 9.043		116 162 186 264 340 412				
		120 min 5 240 min 5 360 min 5 480 min 5 500 min 5 720 min 5	Winter Winter Winter Winter Ninter Winter	23.353 18.644 13.543 10.792 9.043 7.823		162 186 264 340 412 484				
		120 min 5 120 min 5 1240 min 5 1360 min 5 1480 min 5 1500 min 5 1720 min 5 160 min 5	Winter Winter Winter Winter Winter Winter	23.353 18.644 13.543 10.792 9.043 7.823 6.219		162 186 264 340 412 484 624				
		180 min 5 240 min 5 360 min 5 480 min 5 500 min 5 720 min 5 960 min 5 440 min 5	Winter Winter Winter Winter Winter Winter Winter	23.353 18.644 13.543 10.792 9.043 7.823 6.219 4.493		116 162 186 264 340 412 484 624 882				
		180 min 5 240 min 5 360 min 5 480 min 5 500 min 5 720 min 5 720 min 5 140 min 5 160 min 5	Winter Winter Winter Winter Winter Winter Winter Winter	23.353 18.644 13.543 10.792 9.043 7.823 6.219 4.493 3.241 2.569		116 162 186 264 340 412 484 624 882 1236				
	14 21 26	180 min 5 240 min 5 360 min 5 480 min 5 480 min 5 500 min 5 500 min 5 400 min 5 140 min 5 880 min 5 320 min 5	Winter Winter Winter Winter Winter Winter Winter Winter Winter	23.353 18.644 13.543 10.792 9.043 7.823 6.219 4.493 3.241 2.568 1.847		116 162 186 264 340 412 484 624 882 1236 1528 2248				
	14 21 28 43	180 min 5 240 min 5 240 min 5 360 min 5 480 min 5 720 min 5 720 min 5 720 min 5 720 min 5 880 min 5 880 min 5	Winter Winter Winter Winter Winter Winter Winter Winter Winter Winter Winter	23.353 18.644 13.543 10.792 9.043 7.823 6.219 4.493 3.241 2.568 1.847 1.461		116 162 186 264 340 412 484 624 882 1236 1528 2248 2944				
	14 21 28 43 57	180 min 5 240 min 5 360 min 5 480 min 5 500 min 5 720 min 5 440 min 5 140 min 5 880 min 5 880 min 5 200 min 5	Winter Winter Winter Winter Winter Winter Winter Winter Winter Winter Winter	23.353 18.644 13.543 10.792 9.043 7.823 6.219 4.493 3.241 2.568 1.847 1.461 1.217		116 162 186 264 340 412 484 624 882 1236 1528 2248 2944 3672				
	14 21 28 43 57 72 86	180 min 5 240 min 5 360 min 5 360 min 5 500 min 5 720 min 5 360 min 5 320 min 5 760 min 5 200 min 5 540 min 5	Winter Winter Winter Winter Winter Winter Winter Winter Winter Winter Winter	23.353 18.644 13.543 10.792 9.043 7.823 6.219 4.493 3.241 2.568 1.847 1.461 1.217 1.048		116 162 186 264 340 412 484 624 882 1236 1528 2248 2944 3672 4368				
	14 21 28 43 57 72 86 100	180 min 5 240 min 5 360 min 5 480 min 5 500 min 5 720 min 5 960 min 5 880 min 5 280 min 5 260 min 5 200 min 5 540 min 5	Winter Winter Winter Winter Winter Winter Winter Winter Winter Winter Winter Winter	23.353 18.644 13.543 10.792 9.043 7.823 6.219 4.493 3.241 2.568 1.847 1.461 1.217 1.048 0.923		116 162 186 264 340 412 484 624 882 1236 1528 2248 2944 3672 4368 5136				
	4 21 28 43 57 72 86 100	180 min 5 240 min 5 360 min 5 480 min 5 500 min 5 500 min 5 720 min 5 60 min 5 880 min 5 820 min 5 60 min 5 60 min 5 60 min 5 640 min 5	Winter Winter Winter Winter Winter Winter Winter Winter Winter Winter Winter Winter	23.353 18.644 13.543 10.792 9.043 7.823 6.219 4.493 3.241 2.568 1.847 1.461 1.217 1.048 0.923		116 162 186 264 340 412 484 624 882 1236 1528 2248 2944 3672 4368 5136				
	14 21 28 43 55 72 86 100	180 min 5 240 min 5 240 min 5 360 min 5 500 min 5 500 min 5 720 min 5 60 min 5 880 min 5 760 min 5 760 min 5 540 min 5 540 min 5	Winter Winter Winter Winter Winter Winter Winter Winter Winter Winter Winter Winter Winter	23.353 18.644 13.543 10.792 9.043 7.823 6.219 4.493 3.241 2.568 1.847 1.461 1.217 1.048 0.923		116 162 186 264 340 412 484 624 882 1236 1528 2248 2944 3672 4368 5136				
	14 21 28 45 57 72 86 100	180 min 5 240 min 5 360 min 5 480 min 5 500 min 5 500 min 5 600 min 5 60 min 5 820 min 5 60 min 5 60 min 5 640 min 5 640 min 5	Winter Winter Winter Winter Winter Winter Winter Winter Winter Winter Winter	23.353 18.644 13.543 10.792 9.043 7.823 6.219 4.493 3.241 2.568 1.847 1.461 1.217 1.048 0.923		116 162 186 264 340 412 484 624 882 1236 1528 2248 2944 3672 4368 5136				
	14 21 28 43 57 72 86 100	180 min 5 240 min 5 240 min 5 360 min 5 500 min 5 500 min 5 600 min 5 600 min 5 880 min 5 720 min 5 720 min 5 720 min 5 740 min 5 740 min 5	Winter Winter Winter Winter Winter Winter Winter Winter Winter Winter Winter	23.353 18.644 13.543 10.792 9.043 7.823 6.219 4.493 3.241 2.568 1.847 1.461 1.217 1.048 0.923		116 162 186 264 340 412 484 624 882 1236 1528 2248 2944 3672 4368 5136				
	14 21 28 45 57 72 86 100	180 min 5 240 min 5 360 min 5 480 min 5 500 min 5 500 min 5 600 min 5 600 min 5 760 min 5 760 min 5 760 min 5 760 min 5 760 min 5	Winter Winter Winter Winter Winter Winter Winter Winter Winter Winter Winter	23.353 18.644 13.543 10.792 9.043 7.823 6.219 4.493 3.241 2.568 1.847 1.461 1.217 1.048 0.923		116 162 186 264 340 412 484 624 882 1236 1528 2248 2944 3672 4368 5136				
	14 21 28 43 57 72 86 100	180 min 5 240 min 5 240 min 5 360 min 5 500 min 5 500 min 5 500 min 5 600 min 5 200 min 5 200 min 5 200 min 5 200 min 5 200 min 5	Winter Winter Winter Winter Winter Winter Winter Winter Winter Winter Winter	23.353 18.644 13.543 10.792 9.043 7.823 6.219 4.493 3.241 2.568 1.847 1.461 1.217 1.048 0.923		116 162 186 264 340 412 484 624 882 1236 1528 2248 2944 3672 4368 5136				
	14 21 28 43 57 72 86 100	180 min 5 240 min 5 240 min 5 360 min 5 380 min 5 720 min 5 720 min 5 720 min 5 720 min 5 200 min 5 200 min 5 200 min 5 200 min 5	Winter Winter Winter Winter Winter Winter Winter Winter Winter Winter Winter	23.353 18.644 13.543 10.792 9.043 7.823 6.219 4.493 3.241 2.568 1.847 1.461 1.217 1.048 0.923		116 162 186 264 340 412 484 624 882 1236 1528 2248 2944 3672 4368 5136				
	14 21 28 43 57 72 86 100	180 min 5 240 min 5 240 min 5 360 min 5 380 min 5 720 min 5 720 min 5 720 min 5 380 min 5 380 min 5 200 min 5 200 min 5 200 min 5 200 min 5	Winter Winter Winter Winter Winter Winter Winter Winter Winter Winter	23.353 18.644 13.543 10.792 9.043 7.823 6.219 4.493 3.241 2.568 1.847 1.461 1.217 1.048 0.923		116 162 186 264 340 412 484 624 882 1236 1528 2248 2944 3672 4368 5136				
	14 21 28 43 57 72 86 100	180 min 5 240 min 5 240 min 5 360 min 5 500 min 5 500 min 5 60 min 5 60 min 5 820 min 5 60 min 5 60 min 5 60 min 5 60 min 5 60 min 5 70 min 70 min 5 70 min 70 mi	Winter Winter Winter Winter Winter Winter Winter Winter Winter Winter Winter	23.353 18.644 13.543 10.792 9.043 7.823 6.219 4.493 3.241 2.568 1.847 1.461 1.217 1.048 0.923		116 162 186 264 340 412 484 624 882 1236 1528 2248 2944 3672 4368 5136				

Hyder Consulting Limited			Page 3	
5th Floor, The Pithay				
All Saints Street				min
Bristol BS1 2NL			LULIS	
Date 25/03/2011 16:15	Designed By mp4	9220	1 Drown	9 manarell
File Cat3 roadside infiltra	Checked By		12 - Lie	<u>"lleybeğ</u>
Micro Drainage	Source Control	W.12.4	1	
	<u>Rainfall</u>	Details		
Dainfall Mod	~1	FCD	Winton Storma	No o
Rainidii Moo Return Period (vear	e)	100	Cu (Summer)	1es 0 750
Recutin refrou (year	on England and b	Wales	Cv (Winter)	0.730
M5-60 (m	m) 2	0.000 Shortest	Storm (mins)	15
Ratio	R	0.400 Longest	Storm (mins)	10080
Summer Stor	ms	Yes Cli	mate Change %	+30
	<u>Time / Are</u>	a Diagram		
	Total Area	(ha) 0 275		
	Iotai Mica	(114) 0.275		
	Time	Area		
	(mins)	(ha)		
	0-4	0.275		

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5th Floor, The Pithay		raye 4
All Saints Street		
Bristol BS1 2NL		Li USIO M
Date 25/03/2011 16:15	Designed By mp49220	Dradra-
File Cat3 roadside infiltra	Checked By	L'ACTICE CO
Micro Drainage	Source Control W.12.4	
	Model Details	
Storaç	ge is Online Cover Level (m)	91.000
	Infiltration Trench Structure	
Infiltration Coefficient	Base (m/hr) 0.05600	Trench Width (m) 1.9
Infiltration Coefficient	Side (m/hr) 0.05600	Trench Length (m) 240.0
Sa Sa	Porosity 0.30 Com	Slope (1:X) 1000.0
Inver	t Level (m) 90.000 Can Infil	tration Depth $(m) = 0.000$

Hyder Consulting Limite	đ					Page 1							
5th Floor, The Pithay								<u> </u>					
All Saints Street						I CY CH	ന്ന						
Bristol BS1 2NL	tol BS1 2NL						ڪٽرڪ						
Date 25/03/2011 16:17		Design	ed By mg	\$49220	111) D 7734	ತಾಗಗ್	കുറ്റത്തി						
File Cat4 swale no infi	ltra	Checke	d By				<u>,                                    </u>	<u> </u>					
Micro Drainage		Source	Control	L W.12.4		·····							
Sum	Summary of Results for 100 year Return Period (+30%)												
that 6 Durate Dime + 200 minutes													
		Half D	rain Tim	ie : 328	minutes.								
Chown	Mau	Mary	Ma		Mau	Max	Vou	Chabus					
Event	Tovol	Denth	Tofilt	ration	Control	Max S Outflow	Volume	Scalus					
Avent	(m) Dever	(m)	(1/	al al	(1/s)	(1/s)	(m <sup>3</sup> )						
	(,	(,	(-/	0,	(_/0)	(1)0)	(111 )						
15 min Summer	89.943	0.443		0.0	4.9	4.9	85.9	ок					
30 min Summer	90.014	0.514		0.0	4.9	4.9	111,1	ок					
60 min Summer	90.071	0.571		0.0	4.9	4.9	133,9	ОК					
120 min Summer	90.109	0.609		0.0	4.9	4.9	150.1	ОК					
180 min Summer	90,117	0.617		0.0	4.9	4.9	153.6	ОК					
240 min Summer	90.114	0.614		0.0	4.9	4.9	151.9	ОК					
360 min Summer	90.099	0.599		0.0	4.9	4,9	145.5	O K					
480 min Summer	90.085 90 071	0.585		0.0	4.9	4.9	133.3 133.3	O K					
720 min Summer	90.057	0.557		0.0	4.9 4 9	4.9 4 Q	128 1	O K					
960 min Summer	90.030	0.530		0.0	4.9	4.9	117.3	0 K					
1440 min Summer	89.975	0.475		0.0	4,9	4.9	97.0	ок					
2160 min Summer	89.891	0.391		0.0	4.9	4.9	69.3	ОК					
2880 min Summer	89,808	0,308		0.0	4.9	4.9	46.0	ОК					
4320 min Summer	89.690	0.190		0.0	4.8	4.8	20.1	ОК					
5760 min Summer	89.642	0.142		0.0	4.3	4.3	11.9	ОК					
7200 min Summer	89.619	0.119		0.0	3.7	3.7	8.5	ок					
8640 min Summer	89,604	0,104		0.0	3.2	3.2	6.5	ОК					
10080 min Summer	89.594	0.094		0.0	2.9	2.9	5.2	ΟK					
		Stor	m	Rain	Time-Pa	ak							
		Even	t	(mm/hr)	(mins	)							
				、 <i>i</i>	·								
		15 min	Summer	128.285	ò	25							
		30 min	Summer	84.22€	ô	39							
		60 min	Summer	52.662	2	68							
	1	.20 min	Summer	31.800	) .	126							
	1	.80 min	Summer	23.353	s _	L84							
	2	so min	Summer	13 5/3	نة الا م	200							
	4	80 min	Summer	10.792		362							
	E	500 min	Summer	9.043	}	128							
	7	20 min	Summer	7.823	} 4	196							
	9	960 min	Summer	6.219	) (	532							
	14	40 min	Summer	4.493	3 2	900							
	21	.60 min	Summer	3.241	. 12	280							
	28	80 min	Summer	2.568	3 16	524							
	43	20 min	Summer	1.847	22	256							
	1 C	OU MIN	Summor	1 217	. 29	944 570							
	21 86	540 min	Summer	1.049	، ع ۵۵	100							
	100	80 min	Summer	0.923		136							
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Hyder Consulting Limited					Page 2				
5th Floor, The Pithay									
All Saints Street							പ്പാറ	J.	
Bristol BS1 2NL							حيره	$y \downarrow$	<u></u>
Date 25/03/2011 16:17		Design	ed By m	549220		אבהרמו∥ו	ಎಗಿದ್	SACT	<b>_</b>
File Cat4 swale no infi	ltra	Checke	d By					<u>Let</u>	⊇Ç
Micro Drainage	L	Source	Contro	W.12.4	l	1			
1									
Sum	mary of	Result	s for 10	0 year	Return Per	riod (+30%)	1		
Storm	Max	Max	Ma	x	Max	Max	Max	Status	
Event	Level	Depth	Infilt	ration	Control	Σ Outflow	Volume		
	(m)	(m)	(1/	s)	(1/s)	(l/s)	(m³)		
15 min Winter	90 075	0 475		0.0	4 0	4 0	00 0	0 1	
30 min Winter	09.97J 00 051	0.475		0.0	4.9	4.9	90.0 195.5	OK	
60 min Winter	90.031	0.551		0.0	4,9	4.9	140.0	OK	
120 min Winter	90.158	0.658		0.0	4.9	4.9	172 0	OK	
180 min Winter	90.170	0.670		0.0	4.9	4.9	177.8	ок	
240 min Winter	90.170	0.670		0.0	4.9	4.9	177.6	ок	
360 min Winter	90.156	0.656		0.0	4.9	4.9	170.9	ок	
480 min Winter	90.138	0.638		0.0	4.9	4.9	162.8	ОК	
600 min Winter	90.121	0.621		0.0	4.9	4.9	155.2	ОК	
720 min Winter	90.103	0.603		0.0	4.9	4.9	147.3	ок	
960 min Winter	90.065	0.565		0.0	4.9	4.9	131.5	ок	
1440 min Winter	89.985	0.485		0.0	4.9	4,9	100.7	ок	
2160 min Winter	89.851	0.351		0.0	4.9	4.9	57.6	ок	
2880 min Winter	89.725	0.225		0.0	4.9	4.9	26.9	ок	
4320 min Winter	89.632	0.132		0.0	4.1	4.1	10.4	ок	
5760 min Winter	89.605 90 500	0.105		0.0	3.3	3.3	6.7	OK	
8640 min Winter	09.090 90 590	0.090		0.0	2.7	2.7	4.8	OK	
10080 min Winter	89 573	0.000		0.0	2.3	2.3	3.0	OK	
	001010	0.075		0.0	211	2,1	5.1	0 K	
		Stor	n	Rain	Time-Pe	ak			
		Even	t	(mm/hr)	) (mins	)			
		15 min	Winter	128,28	5	25			
		30 min	Winter	84.22	6	39			
		60 min	Winter	52.66	2	66			
	1	20 min	Winter	31.80	0 1	24			
	1	80 min	Winter	23,35	3 1	180			
	2	40 min	Winter	10.64	4 2 2 2	236			
	5 A	80 min	Winter	10 70	u 3 2 2	840			
	4 6	00 min	Winter	9.04	~ J 3 A	162			
	7	20 min	Winter	7.82	3 5	38			
	9	60 min	Winter	6.21	 9 6	588			
	14	40 min	Winter	4,49	3 9	74			
	21	60 min	Winter	3.24	1 13	348			
	28	80 min	Winter	2.56	8 16	544			
	43.	20 min	Winter	1.84	7 22	248			
	57	60 min	Winter	1.463	1 29	36			
	72	00 min	Winter	1.21	7 36	572			
	86	40 min	Winter	1.04	B 44	08			1
	100	80 min	Winter	0.923	3 50	48			
		01000		<u></u> .					
		©1982-2	2010 Mic	ro Drai	nage Ltd				

Hyder Consulting Limited		Page 3
5th Floor, The Pithay		
All Saints Street		
Bristol BS1 2NL		LATCHE M
Date 25/03/2011 16:17	Designed By mp49220	DENTERATION
File Cat4 swale no infiltra	Checked By	<u>Carrieres</u>
Micro Drainage	Source Control W.12.4	**************************************

	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)	20.000	Shortest Storm (mins)	15
	Ratio R	0.400	Longest Storm (mins)	10080
	Summer Storms	Yes	Climate Change %	+30

#### <u> Time / Area Diagram</u>

# Total Area (ha) 0.380

Time	Time Area		Area	Time	Area	
(mins)	mins) (ha)		(ha)	(mins)	(ha)	
0-4	0.095	4-8	0.190	8-12	0.095	

Hyder Consult	ing Limited				Page 4		
5th Floor, The	e Pithay				-		
All Saints Str	reet				ΓV.	ിറ്റുന	J. S.
Bristol BS1 2	2nl				I LL		$y \cup \nabla \eta$
Date 25/03/201	L1 16:17	Desig	ned By mp4	9220	N b_}	Den lict	) A Caral
File Cat4 swaJ	le no infiltr	a Check	ed By		ľ		<u>122/3220</u>
Micro Drainage	3	Source	e Control	W.12.4	1		
			Model I	Details			
	S	torage is	Online Co	over Level	(m) 90.500		
			<u>Swale</u> St	ructure			
Infiltra	tion Coeffic	ient Base <i>(</i>	m/br) 0 (	20000		Ionath (m)	100.0
Infiltra	tion Coeffic	ient Side (	m/hr) 0.0	00000	Side S	lope (1:X)	3.0
		Safety F	actor	2.0	S	lope (1:X)	1000.0
		Por	osity	1.00	Cap Volume	Depth (m)	0.000
		Invert Leve	l (m) 89	9.500 Cap	Infiltration	Depth (m)	0.000
		Base Widt	h (m)	1.0			
		Hydro	-Brake® O	utflow Cont	rol		;
	Design	Head (m)	0.7	00 Diam	eter (mm)	101	
	Design E	'low (1/s)	5	.0 Invert	Level (m) 8	9.500	
	Hydro-Br	ake® Type	Md6 SW On	ly			
Depth (m) Fl	Low (1/s) De	pth (m) Fl	.ow (1/s)	Depth (m)	Flow (1/s)	Depth (m)	Flow (1/s)
0 100	2.1	1 200		2 000	10.1		1
0.100	3.1	1.200	6.4 6 0	3.000	10.1	7.000	15.4
0.200	4.9	1,400	0.9 7 A	3.500	10.9	7.500	15.9
0,400	4.5	1.800	7.8	4,500	12 3	8 500	10.5
0.500	4.5	2.000	8.2	5.000	13.0	9,000	17.5
0.600	4.7	2.200	8.6	5.500	13.6	9,500	17.9
0.800	5.2	2.400	9.0	6.000	14.3		
1.000	5.8	2.600	9.4	6.500	14.8		
	·		•				
							1

Hyder Consulting Limited		Page 1
5th Floor, The Pithay	······································	
All Saints Street		
Bristol BS1 2NL		Therefore a
Date 25/03/2011 16:18	Designed By mp49220	DESCRETE
File Cat4 swale infiltratio	Checked By	
Micro Drainage	Source Control W.12.4	
Summary of	Results for 100 year Return Pe	riod (+30%)
	Half Drain Time : 486 minutes.	
Storm	Max Max Max	Max Status
Event	Level Depth Infiltration	Volume
		(m-)
15 min Summe	r 89.951 0.451 2.8	88.7 OK
30 min Summe	r 90.024 0.524 3.1	115.2 ОК
60 min Summe	r 90.088 0.588 3.4	141.0 ОК
120 min Summe	r 90.138 0.638 3.7	162.9 ОК
180 min Summe	r 90.158 0.658 3.8	171.9 ОК
240 min Summe	r 90.165 0.665 3.8	175.4 ОК
360 min Summe	r 90.166 0.666 3.8	175.9 ОК
480 min Summe	r 90.164 0.664 3.8	174.8 ОК
600 min Summe	r 90.160 0.660 3.8	173.0 ОК
720 min Summe	r 90.156 0.656 3.8	170.8 ОК
960 min Summe	r 90.144 0.644 3.7	165.6 ОК
1440 min Summe	r 90.118 0.618 3.6	153.9 O K
2160 min Summe	r 90.079 0.579 3.4	137.2 O K
2880 min Summe	r 90.044 0.544 3.2	122.9 O K
5760 min Summe	r 89 934 0.484 2.9	100.2 OK
7200 min Summe	r 89 892 0 392 2.7	69.7 OK
8640 min Summe	r 89.856 0.356 2.3	59.0 OK
10080 min Summe	r 89.825 0.325 2.1	50.6 OK
	Storm Rain Time-Pe	eak
	Event (mm/hr) (mins	•)
	15 min Summer 128.285	26
	30 min Summer 84.226	40
	60 min Summer 52.662	68
]	20 min Summer 31.800	126
	$\frac{19}{240} \text{ min Summer } \frac{19}{23.353}$	104
	13 544	238
	100  min summer  10,702	394
	500 min Summer 9.043	456
	20 min Summer 7.823	520
	960 min Summer 6.219	658
14	40 min Summer 4.493	930
21	.60 min Summer 3.241 1.	344
28	80 min Summer 2.568 1	736
43	20 min Summer 1.847 2!	512
57	60 min Summer 1.461 32	240
72	00 min Summer 1.217 3	968
86	40 min Summer 1.048 40	680
100	080 min Summer 0.923 50	448
1		

Hyder Consulting Limited					Page	2
5th Floor, The Pithay						
All Saints Street					L CY	$76 \approx 10^{-10}$
Bristol BS1 2NL						
Date 25/03/2011 16:18	Designe	d By mp	49220		-     b D	Dentrae
File Cat4 swale infiltratio	Checked	By				
Micro Drainage	Source	Control	W.12.4			
Summary of	Results	for 10	0 year Re	eturn 🗄	Period (	+30%)
Storm	Max	Max	Max	ĸ	Max	Status
Event	Level	Depth	Infiltr	ation	Volume	
	(m)	(m)	(1/:	3)	(m³)	
15 min Minhou	00 000	0 400		2 0	00.5	- <b>H</b>
30 min Winter	09,902	0.402		2.9	99.5 100 F	U K
60 min Winter	90.000	0.000		3.5	129.0	0 K
120 min Winter	90.184	0.684		3.0	184 2	0 K 0 K
180 min Winter	90.206	0.706		4.0	195.1	Flood Risk
240 min Winter	90.216	0.716		4,1	199.8	Flood Risk
360 min Winter	90.220	0.720		4.1	201.9	Flood Risk
480 min Winter	90,216	0.716		4.1	199.8	Flood Risk
600 min Winter	90,211	0.711		4.1	197.2	Flood Risk
720 min Winter	90.205	0.705		4.0	194.4	Flood Risk
960 min Winter	90.190	0.690		4.0	187.1	ОК
1440 min Winter	90.155	0.655		3.8	170.4	ок
2160 min Winter	90.101	0.601		3.5	146.6	ОК
2880 min Winter	90.053	0.553		3.3	126.3	ОК
4320 min Winter	89.971	0.471		2.9	95.5	ОК
5760 min Winter	89,905	0.405		2.5	73.7	OK
7200 min Winter	89,852	0.352		2.3	57.8	O K
10080 min Winter	89.608 80 771	0,308		2.1	45.9	OK
10080 Mill Winter	09.771	0.271		1.9	36.9	OK
	Storm		Bain	Time-	Peak	
	Event		(mm/hr)	(mi	ns)	
				<b>,</b>	,	
	15 min (	Winter	128.285		26	
	30 min N	Winter	84.226		39	
	60 min N	Winter	52.662		68	
	120 min W	Winter	31.800		124	
	180 min 1	Vinter	23.353		182	
	240 min 1	linter	18.644		238	
	360 min 1	vinter	13.543		348	
	480 min \	winter	10,792		446	
	720 min 1	Ninter	9.043 7 012		4/8 55/	
	960 min "	Vinter	6 210		554 708	
1	440 min V	linter	4,493		1010	
	160 min W	Vinter	3,241		1436	
2		linter	2.568		1848	
4	320 min W	Vinter	1.847		2640	
5	760 min V	Vinter	1.461		3400	
	000	linter	1.217		4112	
7	200 min (					
7	200 min V 640 min V	Vinter	1.048		4840	
7 8 10	200 min V 640 min V 080 min V	linter linter	1.048 0.923		4840 5552	
7 8 10	200 min 0 640 min 0 080 min 0	linter linter	1.048 0.923		4840 5552	
7 8 10	200 min # 640 min # 080 min #	linter linter	1.048 0.923		4840 5552	
7 8 10	200 min # 640 min # 080 min #	Vinter Vinter	1.048 0.923		4840 5552	
7 8 10	200 min 0 640 min 0 080 min 0	Vinter Vinter	1.048 0.923		4840 5552	
7 8 10	200 min 0 640 min 0 080 min 0	Winter Winter	1.048 0.923		4840 5552	
7 8 10	200 min 6 640 min 6 080 min 6	Jinter Jinter	1.048 0.923		4840 5552	
7 8 10	200 min 6 640 min 6 080 min 6	Jinter Jinter	1.048 0.923		4840 5552	
7 8 10	200 min 6 640 min 6 080 min 6	Jinter Jinter	1.048 0.923		4840 5552	
7 8 10	200 min 6	<i>linter</i> <i>linter</i>	1.048 0.923		4840 5552	

Hyder Consulting Limited		Page 3
5th Floor, The Pithay		
All Saints Street		
Bristol BS1 2NL		ILLIGLE M
Date 25/03/2011 16:18	Designed By mp49220	DESEMBER
File Cat4 swale infiltratio	Checked By	<u>reactives</u>
Micro Drainage	Source Control W.12.4	

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)	20.000	Shortest Storm (mins)	15
Ratio R	0.400	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+30

# <u> Time / Area Diagram</u>

# Total Area (ha) 0.380

Time	Area	Time	Area	Time	Area
(mins)	(ha)	(mins)	(ha)	(mins)	(ha)
0-4	0.095	48	0.190	8-12	0.095

Hyder Consulting Limited		Page 4
5th Floor, The Pithay		
All Saints Street		
Bristol BS1 2NL		
Date 25/03/2011 16:18	Designed By mp49220	D PRIMARICE
File Cat4 swale infiltratio	Checked By	
Micro Drainage	Source Control W.12.4	
	Model Details	
Storad	e is Online Cover Level (m)	90.500
3		50.000
	Swale Structure	
Infiltration Coefficient	Base (m/hr) 0.05600	Length (m) 100.0
Infiltration Coefficient	Side (m/hr) 0.05600	Side Slope (1:X) 3.0
Sa	Deregity 1.00	Slope (1:X) 1000.0
Inver	Porosicy 1,00 (a)	p volume Depth (m) 0.000
Bas	= Width (m) = 1.0	
Da3		
	@1982-2010 Micro Drainage Itd	
	SIJOZ-ZULU MICTO Drainage Ltd	

Hyder Consulting Limite	ed					Page 1			
5th Floor, The Pithay								<u>ц</u>	
All Saints Street						∭ാപ്റ്	RA		
Bristol BS1 2NL									
Date 25/03/2011 16:20	D	esign	ed By m	p49220		III D J 28	2010	RADE	
File Cat5 swale no infi	lltra C	hecke	d By						
Micro Drainage	S	ource	Contro	1 W.12.4					
C117	mary of P	- eult	e for 1(	N ugar i	Poturn Do	niad (1308)	\		
	unary or n	sure	5 101 10	o year .	Netuin re	1100 (150%)	<u>/</u>		
	Half Drain Time : 293 minutes.								
Storm	Max	Max	Ma	x	Max	Max	Max	Status	
Event	Level D	epth	Infilt	ration	Control	Σ Outflow	Volume		
	(m)	(m)	(1)	'S)	(1/3)	(1/3)	(m³)		
15 min Summer	89,955 (	.455		0.0	4.9	4.9	78.6	ок	
30 min Summer	90.030 0	.530		0.0	4.9	4.9	101.5	ок	
60 min Summer	90.090 0	.590		0.0	4.9	4.9	121.8	ок	
120 min Summer	90.127 0	.627		0.0	4.9	4.9	135.3	ОК	
180 min Summer	90.133 0	.633		0.0	4.9	4.9	137.3	ОК	
240 mín Summer	90.125 0	0.625		0.0	4.9	4.9	134.7	ОК	
360 min Summer	90.108 0	1.608		0.0	4.9	4.9	128.2	OK	
480 min Summer	90.091 (	1.391 575		0.0	4.9	4,9	116 7	0 K	
720 min Summer	90.075 0	550		0.0	4.9	4.9	110./	OK	
960 min Summer	90.039 0	527		0.0	4.9	4.9	100 7	O K O K	
1440 min Summer	89,963 0	.463		0.0	4.9	4.9	80.9	O K	
2160 min Summer	89,865 0	.365		0.0	4.9	4.9	54.2	O K	
2880 min Summer	89.774 0	.274		0.0	4.9	4.9	33.2	ОК	
4320 min Summer	89.668 0	.168		0.0	4.7	4.7	13.6	ОК	
5760 min Summer	89.631 0	.131		0.0	4.1	4.1	8.0	ОК	
7200 min Summer	89.611 C	.111		0.0	3.5	3.5	5.6	ОК	
8640 min Summer	89.597 0	.097		0.0	3.0	3.0	4.3	ОК	
10080 min Summer	89.588 C	.088		0.0	2.6	2.6	3.4	ОК	
		Stor	m	Rain	Time-P	eak			
		Even	it	(mm/hr)	(mins	;)			
	1!	5 min	Summer	128.28	5	25			
	30	) min	Summer	84.22	б	39			
	60	) min	Summer	52,662	2	68			
	120	) min	Summer	31.80	0	126			
	180	) min	Summer	23.35	3	182			
	240	) min	Summer	18.64	4	232			
	360	) min	Summer	13.54	3	288			
	480	) min	Summer	10.792	2	352 420			
	000 701	ງ ແປນ ງ ຫາວກ	Summer	ジ・U4. フロン	2 2	420 488			
	121 961	) min	Summer	6.210	- 9	624			
	144	) min	Summer	4.49	3	890			
	2160	) min	Summer	3.24	1 1	260			
	2880	) min	Summer	2.56	3 1	592			
	4320	) min	Summer	1.84	7 2	252			
	576(	) min	Summer	1,463	1 2	944			
	7200	) min	Summer	1.21	7 3	672			
	864(	) min	Summer	1.048	3 4	400			
	10080	) min	Summer	0.923	3 5	120			
L	©	1982-	2010 Mia	cro Drai	nage Ltd				

Hyder Consulting Limited				Page 2					
5th Floor, The Pithay									
All Saints Street						1 <u>.</u>	പ്പാ	SLA.	
Bristol BS1 2NL				LUISU M					
Date 25/03/2011 16:20	Designed By mp49220			DESARGERE					
File Cat5 swale no infi	ltra	Checke	d By						
Micro Drainage	Source	Contro	L W.12.4						
Sum	mary of	Results	s for 10	0 year	Return Pe	eriod (+30%	)		
				-					
Storm	Max	Max	Ma	x	Max	Max	Max	Status	
Event	Level	Depth	Infilt	ration	Control	$\Sigma$ Outflow	Volume		
	(m)	(m)	(1/	's)	(1/s)	(1/s)	(m³)		
							~ ~ ~		
15 min Winter	89.989	0.489		0.0	4.9	4.9	88.7	ОК	
30 min Winter	90.070	0.570		0.0	4.9	4.9	114.8	O K	
120 min Winter	90.130	0.630		0.0	4.9	4.9	138.5	OK	
180 min Winter	90.101	0.001		0.0	4.9	4.9	159.0	OK	
240 min Winter	90.187	0.687		0.0	49	4.9	158 2	O K O K	
360 min Winter	90.167	0.667		0.0	4.9	4.9	150.2	0 K	
480 min Winter	90.147	0.647		0.0	4.9	4.9	142.6	0 K	
600 min Winter	90.126	0.626		0.0	4.9	4.9	134.9	0 K	
720 min Winter	90.104	0.604		0.0	4.9	4,9	127.0	ок	:
960 min Winter	90.060	0.560		0.0	4.9	4,9	111.4	ОК	
1440 min Winter	89.964	0.464		0.0	4.9	4.9	81.1	ОК	
2160 min Winter	89.805	0.305		0.0	4.9	4.9	39.9	ОК	
2880 min Winter	89.688	0.188		0.0	4.8	4.8	16.8	ОК	
4320 min Winter	89.621	0.121		0.0	3.8	3.8	6.8	ОК	
5760 min Winter	89.598	0.098		0.0	3.0	3.0	4.3	ок	
7200 min Winter	89.585	0.085		0.0	2.5	2.5	3.2	ОК	
8640 min Winter	89.576	0.076		0.0	2.2	2.2	2.5	ОК	
10080 min Winter	89.569	0.069		0.0	1.9	1.9	2.1	ок	
		Otom	-	Dain		1-			
		Fuer	<u>na</u> ►	Kain (mm/hm	Time-P	ear			
		Bven		(000) 111	) (101118	• /			
		15 min	Winter	128.28	5	25			
		30 min	Winter	84.22	6	39			
		60 min	Winter	52,66	2	66			
	1	20 min	Winter	31.80	0	124			
	1	.80 min	Winter	23.35	3	180			
	2	240 min	Winter	18.64	4	234			
	3	360 min	Winter	13,54	3	330			
	4	180 min	Winter	10.79	2 .	376			
	6	500 min	Winter	9.04	3	454			
	7	20 min	Winter	7.82	3	530			
	9	00 min	Winter	6.21	9	678			
	14	40 min	Winter	4.49	5 1 1	200			
	21	80 min	Winter	2.24. 2.56	L 1. R 1.	500 588			
	20 47	20 min	Winter	2.00	ים קיבור די	212			ĺ
	57	'60 min	Winter	1.46	. 2. 1 2'	920			
	72	00 min	Winter	1.21	7 3	632			
	86	40 min	Winter	1.04	3 4:	352			
	100	80 min	Winter	0.92	3 5:	112			
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5th Floor, The Pithay		
All Saints Street		
Bristol BS1 2NL		
Date 25/03/2011 16:20	Designed By mp49220	
File Cat5 swale no infiltra	Checked By	<u>L'herriers</u>
Micro Drainage	Source Control W.12.4	

	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)	20.000	Shortest Storm (mins)	15
	Ratio R	0.400	Longest Storm (mins)	10080
	Summer Storms	Yes	Climate Change %	+30

#### <u>Time / Area Diagram</u>

# Total Area (ha) 0.350

Time	Area	Time	Area	Time	Area
(mins)	(ha)	(mins)	(ha)	(mins)	(ha)
0-4	0.088	4-8	0.175	8-12	0.087
Hyder Consulting Limited		Page 1			
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5th Floor, The Pithay					
All Saints Street					
Bristol BS1 2NL					
Date 25/03/2011 16:22	Designed By mp49220				
File Cat5 swale no infiltra	Checked By				
Micro Drainage	Source Control W.12.4				
Summary of	Results for 100 year Retur	n Period (+30%)			
	Half Drain Time : 480 minu	ites.			
Storm	Max Max Max	Max Status			
Event	(m) (m) (1/a)	tion volume			
		(iii )			
15 min Summe	r 89.966 0.466	2.6 81.6 ОК			
30 min Summe	r 90.044 0.544	2.9 106.1 ОК			
60 min Summe	r 90.112 0.612	3.2 129,7 ОК			
120 min Summe	r 90.166 0.666	3.4 149.8 OK			
180 min Summe	r 90.187 0.687	3.5 158.0 ОК			
240 min Summe	r 90.194 0.694	3.6 161.0 ОК			
360 min Summe	r 90.195 0.695	3.6 161.3 O K			
480 min Summe	r 90.192 0.692	3.5 160.1 OK			
600 min Summe	r 90.188 0.688	3.5 158.4 UK			
	r 90,162 0.662	3.5 150.2  OK			
1440 min Summe	r = 90.140 = 0.640	3.3 140.2 OK			
2160 min Summe	r 90.098 0.598	3.1 124.7 OK			
2880 min Summe	r 90.060 0.560	3.0 111.5 ОК			
4320 min Summe	r 89.994 0.494	2.7 90.3 ОК			
5760 min Summe	r 89.940 0.440	2.5 74.3 ОК			
7200 min Summe	r 89.895 0.395	2.3 61.8 ОК			
8640 min Summe	r 89,856 0.356	2.1 51.9 ОК			
10080 min Summe	r 89.822 0.322	2.0 43.9 OK			
	Storm Rain Ti	me-Peak (mino)			
	Evenc (mm/nr)	(mins)			
	15 min Summer 128.285	26			
	30 min Summer 84,226	40			
	60 min Summer 52,662	68			
:	20 min Summer 31.800	126			
:	.80 min Summer 23.353	184			
:	240 min Summer 18.644	244			
	360 min Summer 13.543	338			
	10.792	392 454			
	$720 \text{ min Summer} \qquad 7.043$	404 520			
	360  min Summer  6.219	658			
1	140 min Summer 4.493	930			
22	160 min Summer 3.241	1344			
28	880 min Summer 2.568	1736			
4:	320 min Summer 1.847	2512			
51	60 min Summer 1.461	3240			
72	200 min Summer 1.217	3968			
80	540 min Summer 1.048	4680			
100	380 min Summer 0.923	5448			
		* + J			
	©1982-2010 Micro Drainage	ьса			

Hyder Consulting Limited					Page	2
5th Floor, The Pithay						
All Saints Street						
Bristol BS1 2NL					<u>   Ľ</u> ₩	
Date 25/03/2011 16:22	Designe	d By mp	49220		- D )	Pallagor
File Cat5 swale no infiltra	Checked	Ву			Non-second second	
Nicro Drainage	Source	Control	W.12.4			
Summary of	Results	for 10	0 year Re	eturn	Period (	+30%)
Storm	Marr	Man	Max	_	24	Cha hu a
Event	Max Lovol	max Depth	Max Infiltr	e etion	Max	Status
	(m)	(m)	(1/s	3)	(m <sup>3</sup> )	
				·		
15 min Winter	89,999	0.499		2.7	91.6	ОК
30 min Winter	90.082	0.582		3.1	119.2	ОК
60 min Winter	90.156	0.656		3.4	146,0	
120 min Winter	90.215	0.715		3.0	109.4	Flood Risk
240 min Winter	90.249	0.749		3.8	183.5	Flood Risk
360 min Winter	90.253	0.753		3.8	185.3	Flood Risk
480 min Winter	90.248	0.748		3.8	183.1	Flood Risk
600 min Winter	90.242	0.742		3.8	180.7	Flood Risk
720 min Winter	90.236	0.736		3.7	177.9	Flood Risk
960 min Winter	90.219	0.719		3.7	170.9	Flood Risk
1440 min Winter 2160 min Winter	90.180	0.680		3.5	155.2	ОК
2100 Min Winter 2880 min Winter	90.121	0.621		3.2	133.1 114 A	OK
4320 min Winter	89.979	0.479		2.6	85.7	0 K
5760 min Winter	89,908	0.408		2.3	65.3	ОК
7200 min Winter	89.850	0.350		2.1	50.4	ок
8640 min Winter	89.802	0.302		1.9	39.3	ОК
10080 min Winter	89.762	0.262		1.7	30.8	ОК
	Storm		Rain	Time-	Poak	
	Event		(mm/hr)	(mi	ns)	
	15	0 ÷ +	100 005			
	15 Min W	Vinter	128.285		26	
	60 min W	Vinter	52.662		59 68	
1	20 min W	Vinter	31,800		124	
1	.80 min ¥	Vinter	23.353		182	
2	240 min W	linter	18.644		238	
3	860 min M	linter	13.543		348	
4	180 min W	linter	10.792		444	
(	000 min V 20 min V	vinter Jintor	9.043		4/8 554	
	20 min V 960 min V	linter	6.219		708	
14	40 min W	linter	4.493		1008	
21	.60 min 🕅	linter	3.241		1432	
28	80 min V	linter	2.568		1848	
43	20 min 🕅	linter	1.847		2640	
57	60 min W	linter	1.461		3400	
12	00 min 6 40 min 5	unter linter	1.217		4112	
100	80 min ¤	linter	0.923		4040 5552	
					~~~~	
						· · · · · · · · · · · · · · · · · · ·

Hyder Consulting Limited		Page 3
5th Floor, The Pithay		
All Saints Street		Man S
Bristol BS1 2NL		LUBLE M
Date 25/03/2011 16:22	Designed By mp49220	Destractor
File Cat5 swale no infiltra	Checked By	<u>rucence</u>
Micro Drainage	Source Control W.12.4	
	· · · · · · · · · · · · · · · · · · ·	·····
	Rainfall Details	

#### 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)	20.000	Shortest Storm (mins)	15
	Ratio R	0.400	Longest Storm (mins)	10080
	Summer Storms	Yes	Climate Change %	+30

### <u>Time / Area Diagram</u>

### Total Area (ha) 0.350

Time	Area	Time	Area	Time	Area
(mins)	(ha)	(mins)	(ha)	(mins)	(ha)
0-4	0.088	4-8	0.175	8-12	0.087

Hyder Consulting Limited			Page 4	· ··- ·
5th Floor, The Pithay				2270
All Saints Street			$\nabla$	$\sum$
Bristol BS1 2NL			<u>In Repo</u>	
Date 25/03/2011 16:22	Designed By mp4	9220	Deeder	NEV TO
File Cat5 swale no infiltra	Checked By			<u> </u>
Micro Drainage	Source Control N	W.12.4		
	<u>Model D</u>	<u>etails</u>		
Stora	ge is Online Co	ver Level (m)	90.500	
	Swale St	ructure		
	ondre oe	Idocare		
Infiltration Coefficient	Base (m/hr) 0.0	5600	Length (m)	150.0
Infiltration Coefficient	Side (m/hr) 0.0	5600	Side Slope (1:X)	1.5
Sá	afety Factor	2.0	Slope (1:X)	1000.0
	Porosity	1.00 Car	> Volume Depth (m)	0.000
Inve	rt Level (m) 89	.500 Cap Infil	ltration Depth (m)	0.000
Bas	se Width (m)	0.8		
	©1982-2010 Micro	Drainage Ltd		

Hyder Consulting Limited			Page 1		
5th Floor, The Pithay					
All Saints Street				hamaly	~~~
Bristol BS1 2NL			III LLL'	neña (	<u></u>
Date 25/03/2011 16:26	Designed By mp	49220	11) D )r	PENDER	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
File Cat6 basin infiltratio	Checked By			<u>er ner</u>	Sö
Micro Drainage	Source Control	W.12.4			
		_			
Summary of	Results for 10	<u>0 year Return Pe</u>	riod (+3	0%)	
	Half Drain Tim	ne : 72 minutes.			
Storm	Max Max	k Max	Max	Status	
Event	Level Dept	h Infiltration	Volume		
	(m) (m)	(1/s)	(m³)		
15 min Cumma	- 90 33E 0.01	)E 2 E	00 1	0 W	
15 min Summe	r 89.325 0.02	25 3.5 20 4.3	22.1	OK	
60 min Summe	r 89.330 0.03	30 4.5 ≷∆ 4.8	27.3	0 K	
120 min Summe	r 89.335 0.01	35 5.0	31.8	O K	
180 min Summe	r 89.335 0.03	35 4.9	31.5	0 K	
240 min Summe	r 89.334 0.03	34 4.8	30.5	ОК	
360 min Summe	r 89.332 0.03	4.5	28.4	ОК	
480 min Summe	r 89.329 0.02	.1	26.4	ОК	
600 min Summe	r 89.327 0.02	.7 3.8	24.7	ОК	
720 min Summe	r 89.326 0.02	3.6	23.1	ОК	
960 min Summe	r 89.323 0.02	3.2	20.6	ОК	
1440 min Summe	r 89.319 0.01	.9 2.6	17.0	ОК	
2160 min Summe	r 89.315 0.01	.5 Z.L	13.6	O K	
4320 min Summe	r 89.313 0.01		LL.4 Q 7	OK	
5760 min Summe	r 89.308 0.00	1.4	7.2	0 K 0 K	
7200 min Summe	r 89.307 0.00	07 1.0	6.0	о к	
8640 min Summe	r 89.306 0.00	0.8	5.3	ОК	
10080 min Summe	r 89.305 0.00	0.7	4.6	ОК	
	Storm	Rain Time-P	eak		
	Event	(mm/hr) (mins	;)		
	15 min Summer	128.285	17		
	30 min Summer	84.226	31		
	60 min Summer	52.662	52		
	20 min Summer	31.000	04 110		
1	240 min Summer	18.644	152		
	160 min Summer	13,543	218		
4	80 min Summer	10.792	284		
6	00 min Summer	9.043	348		
	20 min Summer	7.823	412		
Ş	60 min Summer	6.219	538		
14	40 min Summer	4.493	780		
21	60 min Summer	3.241 1	144		
28	20 min Summer	2,000 L	244		
43	60 min Summer	1.461 2	952		
72	00 min Summer	1,217 3	680		
86	40 min Summer	1.048 4	416		
100	80 min Summer	0.923 5	144		
	<u>01000 0010 ++:</u>				
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Hyder Consulting Limited					Page 2		
5th Floor, The Pithay							
All Saints Street					$\{\gamma\}$	2	
Bristol BS1 2NL						بالحلالا	
Date 25/03/2011 16:26	Designed H	3y mp493	220			ාකරිය	Ner and
File Cat6 basin infiltratio	Checked By	,				<u>Conn</u>	Ch Co
Micro Drainage	Source Cor	י htrol ש	12 4				
Summary of	Results fo	r 100 s	war Re	turn Par	10d (+3)	181	
	Reduited 10	<u>1 100 j</u>	cur ne	curn rer		557	
Storm	Max	Max	м	ax	Max	Status	
Event	Level	Depth	Infilt	ration	Volume		
	(m)	(m)	(1	/s)	(m <sup>3</sup> )		
		•••		• • •			
15 min Winte	er 89.328	0.028		3.9	24.9	ОК	
30 min Winte	r 89.334	0.034		4.8	30.7	οк	
60 min Winte	r 89.338	0.038		5.3	34.2	ОК	
120 min Winte	r 89.339	0.039		5.5	35.2	ОК	
180 min Winte	r 89,338	0.038		5.3	34.1	ок	
240 min Winte	er 89,336	0.036		5.1	32.5	ок	
360 min Winte	r 89.333	0.033		4.6	29.3	ОК	
480 min Winte	r 89.329	0.029		4.1	26.5	ок	
600 min Winte	r 89.327	0,027		3.8	24,1	ОК	
720 min Winte	r 89.325	0.025		3.5	22.1	ОК	
960 min Winte	r 89.321	0.021		3.0	19.1	ОК	
1440 min Winte	r 89.317	0.017		2.4	14.9	ок	
2160 min Winte	r 89.313	0.013		1.8	11.3	ок	
2880 min Winte	r 89.310	0.010		1.4	9.2	ок	
4320 min Winte	r 89.308	0.008		1.1	6.8	ОК	
5760 min Winte	r 89.306	0.006		0.9	5.4	ОК	
7200 min Winte	r 89.305	0.005		0.7	4.5	OK	
10090 min Winte	r 89.304	0.004		0.6	3,9	OK	
10080 min wince	1 09.504	0.004		0.5	3.5	0 K	
	Storm	,	Pain	Timo-Do	- <b>b</b>		
	Event	1.77	m/br)	(mine)	an		
	arcito	14	,,	(104113)			
	15 min Win	ter 12	8.285		17		
	30 min Win	ter 8	4.226		31		
	60 min Win	ter 5	2.662		56		
1	20 min Win	ter 3	1.800		90		
1	.80 min Win	ter 2	3.353	1	26		
2	40 min Win	ter 1	8.644	1	62		
3	360 min Win	ter 1	3,543	2	32		
4	180 min Win	ter 1	0.792	3	00		
6	500 min Win	ter	9.043	3	64		
7	20 min Win	ter	7.823	4	28		
S	60 min Win	ter	6.219	5	56		
14	40 min Win	ter	4.493	7	96		
21	.60 min Win	ter	3.241	11	64 00		
28	ou min Win	ter	2.568	15	28		
43	SCU RIN WIN	ter	1.04/	22	10 10		
נכ רידי	oo min win	tor	1 017	29	16		
12	340 min Win	ter	1 049	20.	10 04		
100	180 min Win	ter	0.923	52	56		
100				52.	~ ~		
· · · · · · · · · · · · · · · · · · ·	01000 0010						
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Hyder Consulting Limited		Page 3
5th Floor, The Pithay	,	
All Saints Street		1 Promotion
Bristol BS1 2NL		LLLELC M
Date 25/03/2011 16:26	Designed By mp49220	
File Cat6 basin infiltratio	Checked By	LUCULCUG
Micro Drainage	Source Control W.12	4
		<b>A</b>
	Rainfall Detai	ls
Rainfall Mode	el FSR	Winter Storms Yes
Return Period (years	3) 100	Cv (Summer) 0.750
Regio	on England and Wales	Cv (Winter) 0.840
M5-60 (mr	a) 20.000	Shortest Storm (mins) 15
Ratio	R 0.400	Longest Storm (mins) 10080
Summer Storn	ns Yes	Climate Change % +30
	Time / Dunn Die	
	Time / Area Diad	<u>gram</u>
	Total Area (ha) (	0.100
	<b>Ψίπο λ</b>	
	(mins) (ha)	
	<u> </u>	
	0-4 0.100	0
	©1982-2010 Micro Drai	nage Ltd

Byder Consulting Limited		Page 4
5th Floor, The Pithav		
All Saints Street		IV BARA
Bristol BS1 2NL		Therefore a
Date 25/03/2011 16:26	Designed By mp49220	DRAMAROS
File Cat6 basin infiltratio	Checked By	
Micro Drainage	Source Control W.12.4	· · · · · · · · · · · · · · · · · · ·
	Model Details	
Stora	je is Online Cover Level (m)	90.300
	Infiltration Basin Structure	
Infiltration Coef Infiltration Coef	Invert Level (m) 89.300 Sa ficient Base (m/hr) 0.05600 ficient Side (m/hr) 0.05600	afety Factor 2.0 Porosity 1.00
Depth	(m) Area (m <sup>2</sup> ) Depth (m) Area	a (m²)
0	.000 900.0 1.000	900.0
	01000 0010 001	
	©1982-2010 Micro Drainage Ltd	

Hyder Consulting Limited				Page	1	
5th Floor, The Pithay						
All Saints Street				IΓ	ിപ്പാനം	
Bristol BS1 2NL						y - Uni
Date 25/03/2011 16:29	Designed By	mp49220				SACTO
File Cat6 basin no infiltra	Checked By					<u>وحر کیا</u>
Micro Drainage	Source Conti	col W.12	.4			
Summary of	Results for	100 yea:	Return	Period	(+30%)	
					-	
Storm	Max	Мах	Max	Max	Status	
Event	Level	Depth	Control	Volume		
	(m)	(m)	(l/s)	(m³)		
15 min Cu	mmon 00 207	0 027	0.4	22.0	0 1/	
30 min Su	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	0.027	0.4	23.9	OK	
60 min Su	mmer $89.342$	0.042	1 0	38.0	0 K	
120 min Su	mmer 89.349	0.049	1.3	43.7	о к о к	
180 min Su	mmer 89,351	0.051	1.4	45.8	ОК	
240 min Su	mmer 89.352	0.052	1.4	46.4	ОК	
360 min Su	mmer 89.353	0.053	1.5	47.3	ок	
480 min Su	mmer 89,353	0.053	1.5	47.8	ОК	
600 min Su	mmer 89.353	0.053	1,5	48.1	ОК	
720 min Su	mmer 89,353	0.053	1.5	48.1	ок	
960 min Su	mmer 89.353	0.053	1.5	47.8	ОК	
1440 min Su	mmer 89.352	0.052	1.4	46.4	ОК	
2160 min Su	mmer 89.349	0.049	1.3	44.1	ОК	
2880 min Su 4320 min Su	mmer 89.347	0.047	1.2	41.9	O K	
4320 MIII SU 5760 min Su	mmer 89,343	0.045	1.0	38.4 35 6	0 K	
7200 min Su	mmer 89.337	0.037	0.8	33.4	0 K 0 K	
8640 min Su	mmer 89.335	0.035	0.7	31.7	ок	
10080 min Su	mmer 89.334	0.034	0.6	30.2	ОК	
15 min Wi	nter 89.330	0.030	0.5	26,7	ОК	
	Storm	Rai	n Time	-Peak		
	Event	(mm/)	ır) (mi	ins)		
	15	. 100 (		10		
	15 min Summe	r 128.2	285	19		
	50 min Summo	E 84.2 v 52.6	20 62	34 60		
	20 min Summe	r 31.9	102	122		
1	180 min Summe	r 23.3	53	180		
	240 min Summe	r 18.6	44	218		
3	360 min Summe	r 13.5	43	272		
4	180 min Summe	r 10.7	92	336		
	500 min Summe	r 9.0	43	404		
2	120 min Summe	r 7.8	23	470		
<u> </u>	960 min Summe	r 6.2	19	606		
14	40 min Summe	r 4.4	93	868		a babaran a series a
21	100 min Summe	r 3.2 r 3.5	.41 .41	1644		
20	320 min Summe	r 2.3 r 19	47	2380		
3- 57	60 min Summe	r 1.0	61	3120		
72	200 min Summe	r 1.2	17	3888		
86	540 min Summe	r 1.0	48	4584		
100	80 min Summe	r 0.9	23	5344		
	15 min Winte	r 128.2	85	19		
······						
	©1982-2010 M	licro Dra	ainage Lt	d		

Hyder Consulting Limited				Page	2	
5th Floor, The Pithay						
All Saints Street				ςγ	$\Box$ that	
Bristol BS1 2NL					LICE	$\mathbb{P}$
Date 25/03/2011 16:29	Designed By	mp49220		N	) Then the	han and
File Cat6 basin no infiltra	Checked By					Let 130
Micro Draipage	Source Contr	ol W 12	4			
Micro Draimage	Dource contr	.01 11.12	• 7			
Summary of	Results for	100 yea	r Beturn	Period	(+30%)	
<u>Junanal y or</u>	Reduited idi	100 100	<u>i neculn</u>		(,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	
Storm	Max	Мах	Max	Max	Status	
Event	Level	Depth	Control	Volume		
	(m)	(m)	(l/s)	(m³)		
30 min Wi	nter 89.339	0,039	0.8	34.7	ОК	
60 min Wi	nter 89.347	0.047	1.2	42.4	ОК	
120 min Wi	nter 89.354	0.054	1.6	48.7	ОК	
180 min Wi	nter 89.357	0.057	1.7	51.0	ОК	
240 min Wi	nter 89.357	0.057	1.7	51.7	ок	
360 min Wi	nter 89.358	0.058	1.8	52.3	ОК	
480 min Wi	nter 89.358	0.058	1.8	52.5	ОК	
600 min Wi	nter 89,358	0.058	1.8	52.3	ОК	
720 min Wi	nter 89.358	0.058	1.8	51.8	OK	
960 min Wi	nter 89.356	0.056	1.7	50.6	ОК	
1440 min Wi	nter 89.353	0.053	1.5	47.9	OK	
2160 min Wi	nter 89.349	0.049	1.3	44.2	OK	
2880 min Wi 4220 min Wi	nter 89.346	0.046	1.1	41.3	OK	
4320  min Wi	nter 89.341	0.041	0.9	30.7	OK	
7200 min Wi	ntor 89.337	0.035	0.0	33.0	OK	
8640 min Wi	nter 89.332	0.032	0.7 0.6	20.2	0 K	
10080 min Wi	nter 89.331	0.031	0.5	27.6	0 K	
10000 /////		0.001	0.0	27,0	0 K	
	Storm	Rai	n Time	-Peak		
	Event	(mm/)	nr) (m:	ins)		
	30 min Winte	r 84.	226	33		
	60 min Winte	r 52.	662	62		
	120 min Winte	r 31.	800	118		
	180 min Winte	r 23.	353	174		
	240 min Winte	r 18.	644	226		
	360 min Winte	r 13.	543	278		
	480 min Winte	r 10.	792	354		
	600 min Winte	r 9.	043	428		:
	720 min Winte	r 7.	523	500		
-	960 min Winte	r 6.	403 41A	644		
	440 min Winte 160 min Winte	т 4. т э	493 241	922		
2	200 min Winte 880 min Winte	ar 3.	494 568	1704		
Z	320 min Winte	τ 2. γ 1	847	2468		
5	760 min Winte	r 1	461	3224		
7	200 min Winte	r 1.	217	3960		
8	640 min Winte	r 1.	048	4752		
10	080 min Winte	r 0.1	923	5448		
		-				
L		-1	, .	- 4		

Hyder Consulting Limited		Page 3
5th Floor, The Pithay	····	
All Saints Street		
Bristol BS1 2NL		
Date 25/03/2011 16:29	Designed By mp49220	DESTREAM
File Cat6 basin no infiltra	Checked By	<u>L'ACTIONES</u>
Micro Drainage	Source Control W.12.4	J
	Rainfall Details	
Rainfall Mode	el FSR	Winter Storms Yes
Return Period (year	s) 100	Cv (Summer) 0.750
Regio	on England and Wales	Cv (Winter) 0.840
HO-60 (m	n) 20.000 Shortest	Storm (mins) 15
Summer Store	ns Vac Cli	3001m (mins) 10080
Sandler Storr		have change s +50
	<u>Time / Area Diagram</u>	
	Total Area (ha) 0.100	
	Time Area	
	(mins) (ha)	
	0-4 0.100	
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Hyder Consulting Limited		Page 4
5th Floor, The Pithay		
All Saints Street		L'URRO M
Bristol BS1 2NL		
Date 25/03/2011 16:29	Designed By mp49220	
File Cate basin no infiltra	Checked By	
Micro Drainage	Source Control W.12.4	
	Model Details	
Storag	ge is Online Cover Level (m)	90.300
	Tank or Pond Structure	
	Invert Level (m) 89.300	
Depth	n (m) Area (m²) Depth (m) Area	(m <sup>2</sup> )
0	0.000 900.0 1.000	900.0
	Hydro-Brake® Outflow Control	
Design Head (m) 0. Design Flow (l/s) 1	500 Hydro-Brake® Type Md2 Inv 0.0 Diameter (mm) 117	ert level (m) 89.300
Depth (m) Flow (1/s) Depth	(m) Flow (1/s) Depth (m) Flow	(1/s) Depth (m) Flow (1/s)
0.100 4.6 1.	200 15.7 3.000	24.7 7.000 37.8
0.200 8.8 1.	400 16.9 3.500	26.7 7.500 39.1
0.300 8.4 1.	600 18.1 4.000	28.6 8.000 40.4
0.400 9.1 1.	800 19.2 4.500	30.3 8.500 41.7
0.500 10.1 2.	000 20.2 5.000	31.9 9.000 42.9
	200 21.2 5.500	33.5 9.500 44.0
	400 22.1 6.000 600 23.0 6.500	35.0
1,000 14.5 2.	23.0 0.500	50.4
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Hyder Consulting Limited Page 1							
5th Floor, The Pithay						-0	<u> </u>
All Saints Street						പ്പുപ	
Bristol BS1 2NL							
Date 05/04/2011 14:37	Designe	d By mp	49220		D (	pent	RUDI
File Cat7 swale infiltratio	Checked	Ву					<u> </u>
Micro Drainage	Source	Control	W.12.4		•••••		
Summary of	Results	for 100	) year Re	eturn 1	Period (·	+30%)	
	Half Dra	ain Time	e : 715 m	ninutes	3.		
Storm	Max	Max	Мах	•	Max	Status	
Event	Level	Depth	Infiltr	ation	Volume		
	(m)	(m)	(1/s	3)	(m³)		
15 min Summer	84.326	0.526		2.1	94.I	OK	
30 min Summer	84.430 04 523	0.630		2,4	122.0	U K	
120 min Summer	04,343 84 602	0,723		2.0 2 Q	176 5	Flood Risk	
120 min Summer	84.636	0.836		2.9	188.6	Flood Risk	
240 min Summer	84.654	0.854		2.9	194.7	Flood Risk	
360 min Summer	84.668	0.868		3.0	199.8	Flood Risk	
480 min Summer	84.669	0.869		3.0	200.2	Flood Risk	
600 min Summer	84.666	0.866		3.0	199.1	Flood Risk	
720 min Summer	84.662	0.862		3.0	197.7	Flood Risk	
960 min Summer	84.652	0.852		2.9	194.0	Flood Risk	
1440 min Summer	84.626	0.826		2.9	185.1	Flood Risk	
2160 min Summer	84,583	0.783		2.8	170.4	Flood Risk	
2880 min Summer	84.542	0.742		2.7	156.7	Flood Risk	
4320 min Summer	84.469	0.669		2.5	134.1	OK	
5760 min Summer	84.400	0.606		2.3	110.6		
8640 min Summer	84,301	0.502		2.2	88 0	O K	
10080 min Summer	84.258	0.458		1.9	77.3	ОК	
	••••						
	Storm	ł	Rain	Time-	Peak		
	Event	:	(mm/hr)	(mi)	ns)		
	15 min (	Pummor	120 205		26		
	30 min 9	Summer	84.226		20 40		
	60 min 9	Summer	52,662		70		
	120 min \$	Summer	31.800		128		
	180 min S	Summer	23.353		186		
	240 min \$	Summer	18,644		246		
:	360 min \$	Summer	13.543		364		
	480 min \$	Summer	10.792		476		
	600 min \$	Summer	9.043		522		
	/20 min \$	Summer	7.823		582		
	960 Min S	Summer	0.219		708 000		
	440 MIN 3	Summer	4.493		902 1392		
2.	380 min 4	Summer	2.568		1796		
4-	320 min 8	Summer	1.847		2600		
5	760 min S	Summer	1,461		3360		
7:	200 min \$	Summer	1.217		4112		
8	540 min \$	Summer	1.048		4848		
100	)80 min \$	Summer	0,923		5560		
	©1982-2	010 Mic:	ro Draina	age Lto	d		
<b>_</b>							

Hyder Consulting Limited		•			Page	2	
5th Floor, The Pithay							
All Saints Street					ΓV.	പ്പുപ്പും	
Bristol BS1 2NL							
Date 05/04/2011 14:37	Designe	d By mp	49220		[]] D)	೧೯೯೪೯	EVEN
File Cat7 swale infiltratio	. Checked	l By					65130
Micro Drainage	Source	Control	W.12.4				
Summary o	f Results	for 10	0 year Re	eturn 1	Period (·	+30%)	
Storm	Max	Max	Max	¢	Max	Status	
Event	Level	Depth	Infiltr	ation	Volume		
	(m)	(m)	(1/6	3)	(m³)		
15 min Minto	~ 01 260	0 5 6 0		2 2	105 5	0 V	
30 min Winte	C 04.309 ⊬ 9/ //01	0.509		2.2	137 7		
60 min Winte	r 84 581	0.001		2.5	169 6	Flood Risk	
120 min Winte	r 84.666	0.866		3.0	199.1	Flood Risk	
180 min Winte	r 84,705	0.905		3.1	213.2	Flood Risk	
240 min Winte	84.725	0.925		3.1	220.8	Flood Risk	
360 min Winte:	c 84.744	0.944		3.2	227.9	Flood Risk	
480 min Winte	c 84,749	0.949		3.2	229.8	Flood Risk	
600 min Winte:	r 84,746	0.946		3.2	228.8	Flood Risk	
720 min Winte:	r 84.739	0.939		3.2	226.2	Flood Risk	
960 min Winte:	r 84,727	0.927		3.1	221.6	Flood Risk	
1440 min Winter	84,695	0.895		3.0	209.7	Flood Risk	
2160 min Winter	c 84.638	0.838		2.9	189.3	Flood Risk	
2880 min Winter	c 84.582	0.782		2.8	169.8	Flood Risk	
4320 min Winter	04.480	0.504		2.5	13/.4	O K	
7200 min Winter	- 84 321	0.594		2,3	112.D 02.8	OK	
8640 min Winter	- 84.257	0.457		1.9	76.9	O K	
10080 min Winter	84.201	0.401		1.8	64.2	O K	
	Stor	<b>1</b>	Rain	Time-	Peak		
	Event		(mm/hr)	(mi	ns)		
	15 min	Winter	128.285		26		
	30 min	Winter	84.226		40		
	60 min	Winter	52.662		68 10C		
	120 min	Winter	22.200		194		1
	240 min	Winter	18 644		240		
	360 min	Winter	13.543		354		
	480 min	Winter	10.792		464		
	600 min '	Winter	9.043		570		
	720 min '	Winter	7,823		662		
	960 min '	Winter	6.219		750		
	1440 min	Winter	4.493		1058		
	2160 min '	Winter	3.241		1504		
	2880 min '	Winter	2.568		1936		
	4320 min	Winter	1.847		2768		
	5/60 min 1 7200 min 1	Winter	1.461		3568 1320		
	7200 MIN 9 8640 min 9	Minter Ninter	1 049		4320 5096		
ī	0080 min 1	Winter	0.923		5768		
¥.	COC WITH		0.040				
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Hyder Consulting Limited     Page 3       Sth Floor, The Pithay     Isintal Street       Bristol BSI 2NL     Designed By mp49220       Date 05/04/2011 14:137     Checked By       File Cat7 swale infiltratio     Checked By       Micro Drainage     Source Control W.12.4       Image 3       Image 3       Image 100       Region England and Wales       CV (Winter) 0.840       M5-60 (mm)     20.000 Shortest Storm (mins) 15       Ratio R     0.400 Longest Storm (mins) 1080       Summer Storms     Yes       Time / Area Diagram       Total Area (mins) (ha)       0-4 0.100     4-8 0.200       8-12 0.100			
Sth Floor, The Pithay All Saints Street Bistol BS1 2NL Date 05/04/2011 14:37 File Cat7 swale infiltratio Checked By Source Control W.12.4 Rainfall Model FSR Minter Storms Yes Return Period (years) 100 Cv (Summer) 0.750 Region England and Wales Cv (Winter) 0.840 MS-60 (mm) 20.000 Shortest Storm (mins) 15 Ratio R 0.400 Longest Storm (mins) 10080 Summer Storms Yes Climate Change % +30 Time / Area Diagram Total Area (ha) 0.400 Time Area Time Area Time Area (mins) (ha) (mins) (ha) 0-4 0.100 4-8 0.200 8-12 0.100	Hyder Consulting Limited	· · · · · · · · · · · · · · · · · · ·	Page 3
All Saints Street       Designed By mp49220         Checked By       Checked By         Source Control W.12.4       Designed By mp49220         Checked By       Source Control W.12.4         Rainfall Model       FSR       Winter Storms       Yes         Return Period (years)       100       Cv (Summer)       0.750         Return Period (years)       100       Cv (Summer)       0.750         Ratio R       0.400       Longest Storm (mins)       15         Ratio R       0.400       Longest Storm (mins)       100         Summer Storms       Yes       Climate Change %       +30         Time / Area Diagram       Total Area (ha)       0.400       8-12       0.100         0-4       0.100       4-8       0.200       8-12       0.100	5th Floor, The Pithay		
Bristol BSI 2ML       Designed By mp49220         Pile Cat7 swale infiltratio       Checked By         Micro Drainage       Source Control W.12.4         Designed By mp49220         Micro Drainage       Source Control W.12.4         Designed By mp49220         Micro Drainage         Source Control W.12.4         Designed By mp49220         Micro Drainage         Source Control W.12.4         Micro Drainage         Rainfall Model       FSR       Winter Storms Yes         Return Period (years)       100       Cv (Summer)       0.750         Region England and Wales       Cv (Winter)       0.780         M5-60 (ma)       20.000       Shortest Storm (mins)       10080         Summer Storms       Yes       Climate Change %       +30         Time Area Diagram         Time Area       Time Area         (mins)       (ha)       (mins)       (ha)         0-4       0.100       4-8       0.200       8-12       0.100	All Saints Street		D' MERO ~
Deter 69704/2011 14.37 (File Cat7 swale infiltratio) Checked By Source Control W.12.4          Beinfall Details       Description (Control W.12.4)         Beinfall Nodel       Source Control W.12.4         Micro Drainage       Source Control W.12.4         Micro Drainage       Source Control W.12.4         Mainfall Model       FSR       Winter Storm       Yes         Region       England and Wales       CV (Summer) 0.750       Region         Micro Bio       Control W.12.4       Control W.12.4         Micro Bio       CV (Summer) 0.750       Region       England and Wales       CV (Summer) 0.750         Macro Bio       England and Wales       CV (Summer) 0.750       Region       England and Wales       CV (Summer) 0.750         Summer Storms       Yes       Clinate Change 3       430         Summer Storms       Yes       Clinate Change 3       430         Mines       Area       Time       Area       Time       Area         (mins)       (ha)       (ha)       (ha)       8-12       0.100         0-4       0.100       4-8       0.200       8-12       0.100	Bristol BS1 2NL		
Pile Cat/ swale infiltratio Checked By       Image: Control W.12.4         Source Control W.12.4         Bainfall Details         Rainfall Model       FSR       Winter Storms       Yes         Refurn Period (years)       100       Cv (Summer)       0.750         Refurn Period (years)       100       Cv (Winter)       0.840         M5-60 (mm)       20.000       Shortest Storm (mins)       15         Ratio R       0.400       Longest Storm (mins)       100         Summer Storms       Yes       Climate Change %       +30         Jime / Area Diagram         Total Area (ha)       0.400         Time Area (mins) (ha)         0-4       0.100       4-8       0.200       8-12       0.100	Date 05/04/2011 14:37	Designed By mp4922	
Source Control W.12.4         Rainfall Details         Aging Source Control W.12.4         Rainfall Model       FSR       Winter Storms Yes         Return Period (years)       100       Cv (Summer)       0.750         Region England and Wales       Cv (Summer)       0.840         M5-60 (mm)       20.000       Shortest Storm (mins)       15         Ratio R       0.400       Longest Storm (mins)       10000         Summer Storms       Yes       Climate Change %       +30         Time / Area Diagram         Total Area (ha) 0.400         Time Area       Time Area       Time Area       Time Area         (mins)       (ha)       (mins)       (ha)       (mins)       (ha)         0-4       0.100       4-8       0.200       8-12       0.100	File Cat7 swale infiltratio	Checked By	
Paintal DetailsMainfall ModelFSRWinter StormsNesRegionEngland and WalesCv (Winter)0.800M5 60 (mm)20.000Shortest Storm (mins)1000Summer StormsYesClimate Change %+30Dial Area DiagramTotal Area (ha) 0.400One Area (mins)finsMinsMasMinsMins0-40.1004-80.2008-120.100	Micro Drainage	Source Control W.1	2.4 
Rainfall ModelFSRWinter StormsYesReturn Period (years)100CV (Summer)0.750RegionEngland and WalesCV (Winter)0.840M5-60 (mm)20.000Shortest Storm (mins)15Ratio R0.400Longest Storm (mins)10080Summer StormsYesClimate Change %+30Time / Area DiagramTotal Area (ha) 0.400TimeAreaTimeArea(mins)(ha)(mins)(ha)(mins)0-40.1004-80.2008-120.100		Rainfall De	ails
Return Period (years)100Cv (Summer) 0.750RegionEngland and WalesCv (Winter) 0.840M5-60 (mm)20.000Shortest Storm (mins)15Ratio R0.400Longest Storm (mins)10080Summer StormsYesClimate Change %+30Time / Area DiagramTotal Area (ha) 0.400TimeAreaTimeArea(mins)(ha)(mins)(ha)(mins)0-40.1004-80.2008-120.100	Rainfall Mode	el F	R Winter Storms Yes
RegionEngland and WalesCv (Winter)0.840M5-60 (mm)20.000Shortest Storm (mins)15Ratio R0.400Longest Storm (mins)10080Summer StormsYesClimate Change %+30Time / Area DiagramTotal Area (ha) 0.400Time / AreaTime / AreaTime / Area(mins)(ha)(mins)(ha)0-40.1004-80.2008-120-40.1004-80.2008-120.100	Return Period (years	s) 1	00 Cv (Summer) 0.750
M5-60 (mm) Ratio R Outputs Outputs Summer Storms 20.000 Shortest Storm (mins) 15 Ratio R O.400 Longest Storm (mins) 10080 Summer Storms Yes Climate Change % +30 Time / Area Diagram Total Area (ha) 0.400 Time Area (mins) (ha) (mins) (ha) (mins) (ha) O-4 0.100 4-8 0.200 8-12 0.100	Regio	on England and Wal	s Cv (Winter) 0.840
Ratio R Summer Storms0.400 YesLongest Storm (mins) Climate Change % +30Time / Area DiagramTotal Area (ha) 0.400Time Area (mins) (mins) 0-40.1004-80.2008-120.1000-40.1004-80.2008-120.100	M5-60 (mr	m) 20.0	0 Shortest Storm (mins) 15
Summer Storms Yes Climate Change % +30 <u>Time / Area Diagram</u> Total Area (ha) 0.400 <u>Time Area (ha) (ha) (mins) (ha)</u> 0-4 0.100 4-8 0.200 8-12 0.100	Ratio	R 0.4	0 Longest Storm (mins) 10080
Time / Area DiagramTotal Area (ha) 0.400Time Area (mins) (ha)Time Area (mins) (ha)0-40.1004-80.2008-120.1000-40.1004-80.2008-120.100	Summer Storn	ns Y	s Climate Change % +30
Total AreaTime (mins)Area (mins)Time (mins)Area (mins)0-40.1004-80.2008-120.100		Time / Area D	iagram
Time (mins)Area (mins)Time (mins)Area (mins)Time (mins)Area (mins)0-40.1004-80.2008-120.100		Total Area (ha	0.400
	Time	Area Time An (ha) (mins) ()	ea Time Area
	0-4	0.100 4-8 0.	200 8-12 0.100
		·	I
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Hyder Consulting Limited		Page 4
5th Floor, The Pithay		
All Saints Street		
Bristol BS1 2NL		
Date 05/04/2011 14:37	Designed By mp49220	
File Cat7 swale infiltratio	Checked By	
Micro Drainage	Source Control W.12.4	
	M. J. J. D. 4 21 -	
	Model Details	
Storad	re is Online Cover Level	(m) 84.800
	<b>,</b>	
	Swale Structure	
Infiltration Coefficient	Base $(m/hr) = 0.05600$	Length $(m)$ 50.0
Infiltration Coefficient	afety Factor 2.0	Slope $(1;X) = 0.0$
	Porosity 1.00	Cap Volume Depth (m) 0.000
Inve	rt Level (m) 83.800 Car	> Infiltration Depth (m) 0.000
Ba	se Width (m) 2.0	
L	©1982-2010 Micro Drainage	e Ltd
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Hyder Consulting Limited			1	Page 1		
5th Floor, The Pithay						
All Saints Street				$\Gamma$	m	
Bristol BS1 2NL				LLLC	KO VM	
Date 05/04/2011 14:27	Designed By mr	49220			Acore (	
Filo Cot7 suplo no infiltra	Checked By			LULG	LICCED	
Minu Ducing and	Checked by	10 10 A				
Micro Drainage	Source Control	L W.12.4				
0	Desults for 10	A many Dat		ad (120%)		
Summary of	Results for 10	U year keu	urn Peri	oa (+30%)		
(h	Man					
Storm	max Tours D	max ma	LX MƏ			
Event	Tévei D	eptri cont	-roi voi /a) /m	37		
	(111)	(10) (1/	8) (a	.)		
15 min Su	mmer 84 216 0	416 1	6.9 8	3.2 OK		
30 min Su	mmer 84 322 0	1522 1	7 2 10	44 OK		
60 min Su	mmer 84 384 0	584 1	8 2 11	67 OK		
120 min Su	mmer 84 394 0	1 594 1	8 4 11	89 OK		
120 min 50	mmer 84.371 0	.571 1	8.0 11	4.2 OK		
240 min Su	mmer 84.338 0	.538 1	7.5 10	7.6 OK		
360 min Su	mmer 84.270 0	.470 1	L6.9 9.	4.0 OK		
480 min Su	mmer 84.205 0	.405 1	L6.9 8	1.0 OK		
600 min Su	mmer 84,142 0	.342 1	L6.9 6	8.4 OK		
720 min Su	mmer 84.092 0	.292 1	6.9 5	8.3 OK		
960 min Su	mmer 84.035 0	.235 1	5.9 4	7.0 OK		
1440 min Su	mmer 83,979 O	.179 1	3.1 3	5.9 ОК		
2160 min Su	mmer 83.944 0	.144 1	0.1 2	8.7 ОК		
2880 min Su	mmer 83.924 0	.124	8.1 2	4.9 ОК		
4320 min Su	mmer 83,903 0	.103	6.0 2	0.5 ОК		
5760 min Su	mmer 83.890 0	.090	4.8 1	8.0 OK		
7200 min Su	mmer 83.882 0	.082	4.0 1	6.3 ОК		
8640 min Su	mmer 83.875 0	.075	3.4 1	5.0 ок		
10080 min Su	mmer 83.870 0	.070	3.0 1	4.1 ОК		
15 min Wi	nter 84.270 0	.470 1	6.9 9	4.0 OK		
30 min Wi	nter 84.391 0	.591 1	8.3 11	8.1 OK		
	Storm	Rain	Time-Peal	k		
	Event	(mm/hr)	(mins)			
	15 min Summer	128.285	2	2		
	30 min Summer	84.226	3	5		
	60 min Summer	52.662	5	6		
	120 min Summer	31.800	9	0		
	180 min Summer	23.353	12	4		
	240 min Summer	18.644	15	8		
	360 min Summer	13.543	22	6		
	480 min Summer	10.792	29	0		
	600 min Summer	9.043	34	8		
	720 min Summer	7.823	40:	2		
	960 min Summer	6.219	51	6		
1	440 min Summer	4.493	75:	2		
2	160 min Summer	3.241	110	8		
2	380 min Summer	2.568	147:	2		
4	320 min Summer	1.847	220	4		
5	760 min Summer	1.461	293	6		
7	200 min Summer	1.217	366	4		
8	640 min Summer	1.048	440	0		
10	080 min Summer	0.923	513	6		
	15 min Winter	128.285	23	3		
	30 min Winter	84.226	3.	5		
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Hyder Consulting Limited				Page	2		
5th Floor, The Pithay						a	
All Saints Street					ഹാടവി		
Bristol BS1 2NL							
Date 05/04/2011 14:27	Designed By	mp49220	)	D 🛛	)rx=nHra	ണെന്ന്	
File Cat7 swale no infiltra	Checked By					وحريجك	
Micro Drainage	Source Cont:	rol W.12	.4				
Summary of	Results for	100 yea	r Return	Period	<u>(+30%)</u>		
Storm	Max	Max	Max	Max	Status		
Event	Level	Depth	Control	Volume			
	(m)	(m)	(l/s)	(m³)			
60 min Ni	nton 04 162	0 663	10 /	122 5	0 K		
00 min Wi 120 min Wi	$n + \alpha r = 84.465$	0.005	19.4	132.0	O K O K		
180 min Wi	nter 84.426	0.626	18.8	125.2	O K		
240 min Wi	nter 84.376	0.576	18.1	115.1	0 K		
360 min Wi	nter 84.274	0.474	16.9	94.8	ок		
480 min Wi	nter 84.173	0.373	16.9	74.6	ОК		
600 min Wi	nter 84.085	0.285	16.9	57.0	ОК		
720 min Wi	nter 84.039	0.239	16.1	47.9	ок		
960 min Wi	nter 83.989	0.189	13.8	37.8	ОК		
1440 min Wir	nter 83.947	0.147	10.4	29.4	ок		
2160 min Wi	nter 83.919	0.119	7.6	23.7	ок		
2880 min Win	nter 83.903	0.103	6.0	20.7	ОК		
4320 min Wi	nter 83.886	0.086	4.5	1/.1	O K		
5760 min Wi 7200 min Wi	nter 83.876	0.076	3.5	13.1	OK		
8640 min Wil	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	0.069	2.9	12.7	0 K		
10080 min Wi	nter 83,860	0.060	2.2	11.9	OK		
		0.000	2.2	11.9	0 1		
	Storm	Rai	n Time	-Peak			
	Event	(mm/1	hr) (mi	ins)			
	60 min Winte	er 52.	662	60			
1	L20 min Winte	er 31.	800	96			
1	180 min Winte	r 23.	353	134			
	240 min Winte	r 18.	644	170			
-	360 min Winte 190 min Winte	r 13.	543 702	242			
-	sou min winte	r 9.	192	354			
	720 min Winte	r 7.	823	408			
ç	960 min Winte	r 6.	219	520			
14	40 min Winte	r 4.	493	756			
21	60 min Winte	r 3.:	241	1108			
28	380 min Winte	r 2.	568	1476			
43	320 min Winte	r 1.	847	2204			
57	60 min Winte	r 1.	461	2936			
72	200 min Winte	r 1.3	217	3656			
86	940 min Winte	r 1.	J48	4376			
100	J80 min Winte	r 0.1	923	5048			
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Hyder Consulting Limited	Page 3					
5th Floor, The Pithay						
All Saints Street				male m		
Bristol BS1 2NL						
Date 05/04/2011 14:27	Designed By mp4922	0	n acre	I DE CAR		
File Cat7 swale no infiltra	Checked By		L'UC°	<u>nerizon</u>		
Micro Drainage	Source Control W.1	2.4	I			
	Rainfall De	tails				
Rainfall Mode	el F	SR	Winter Storms	Yes		
Return Period (years	3) 1	00	Cv (Summer)	0,750		
Regio	on England and Wal	es	Cv (Winter)	0.840		
M5-60 (mm	n) 20.0	00 Shortest	Storm (mins)	15		
Ratio	R 0.4	00 Longest	Storm (mins)	10080		
Summer Storn	ns Y	es Cli	mate Change %	+30		
<u>Time / Area Diagram</u>						
Total Area (ha) 0.400						

Time	Area	Time	Area	Time	Area
(mins)	(ha)	(mins)	(ha)	(mins)	(ha)
0-4	0.100	4-8	0.200	8~12	0.100

Hyder Consulting Limited			Page 4					
5th Floor, The Pithay		· · · ·						
All Saints Street			L'HERO ~ ~					
Bristol BS1 2NL								
Date 05/04/2011 14:27	Designed By mp	49220	DRATARCAL					
File Cat7 swale no infiltra	. Checked By							
Micro Drainage	Source Control	W.12.4	MILLE					
	Model	Details						
Stor	age is Online C	over Level (m)	84.800					
	Tank or Por	nd Structure						
	Invert Level	L (m) 83.800						
Dept	th (m) Area (m²)	Depth (m) Area	a (m <sup>2</sup> )					
	0.000 200.0	1.000	200.0					
	<u>Hydro-Brake® (</u>	Outflow Control						
Design Head (m) ( Design Flow (l/s)	0.700 Hydro-Brake 20.0 Diamete	e® Type Md2 Inv er (mm) 151	vert Level (m) 83.800					
Depth (m) Flow (1/s) Depth	n (m) Flow (1/s)	Depth (m) Flow	7 (1/s) Depth (m) Flow (1/s)					
0.100 5.7 1	1,200 26,1	3.000	41.2 7.000 63.0					
0.200 14.5 1	L.400 28.2	3.500	44.5 7.500 65.2					
0.300 16.8 1	L.600 30.1	4.000	47.6 8.000 67.3					
0.400 15.8 1	L.800 31.9	4.500	50,5 8,500 69.4					
0.500 16.9 2	2.000 33.7	5.000	53.2 9.000 71.4					
0.600 18.4 2	2.200 35.3	5.500	55.8 9.500 73.3					
	2,400 36,9	6.000	58.3					
1.000 23.8 2	2.600 38.4	6.500	60.7					
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Hyder Consulting Limited					Page	18		
5th Floor, The Pithay 7011-UA001881-UP21B-01								
All Saints Street	reet Exemplar Site							
Bristol BS1 2NL	SUDS Storage Structure 5							
Date 05/04/2011 14:44	Designed By mp49220					Dentrae		
File Cat8 swale infiltratio	Checked	l By				<u>ue lesso</u>		
Micro Drainage	Source	Control	W,12,4					
Summary of	Results	for 10	) year Re	turn	Period (-	+30%)		
	Half Dr	ain Time	e : 733 m	inute	s.			
Storm	Max	Max	Max		Max	Status		
Event	Level	Depth	Infiltra	ation	Volume			
	(m)	(m)	(l/s	)	(m³)			
15 min Summer	99.492	0.492		2.2	99.0	O K		
30 min Summer	99.598	0.598		2.4	129.0	OK		
60 min Summer	99.694 00 775	0.694		2.6	195 6	UK Flood Rick		
120 min Summer	99.//5 99 211	0.775		∠.ŏ 2 0	100.0 100.7	FLOOD RISK		
240 min Summer	00.830 20.011	0.829		2.9	204 8	Flood Risk		
360 min Summer	99.845	0.845		3.0	210.4	Flood Risk		
480 min Summer	99.846	0,846		3.0	211.0	Flood Risk		
600 min Summer	99.842	0.842		3.0	209.5	Flood Risk		
720 min Summer	99.838	0.838		3.0	207.8	Flood Risk		
960 min Summer	99.826	0.826		2.9	203.6	Flood Risk		
1440 min Summer	99.798	0.798		2.9	193.6	Flood Risk		
2160 min Summer	99.752	0.752		2.8	177.7	Flood Risk		
2880 min Summer	99.709	0.709		2.7	163.6	Flood Risk		
4320 min Summer	99.634	0.634		2.5	139.7	ОК		
5760 min Summer	99.567	0.567		2.3	120.1	ок		
7200 min Summer	99.509	0.509		2.2	103.6	OK		
8640 min Summer	99.456	0.456		2.1	89.7	OK		
10080 min Summer	99.410	0,410		2.0	78.0	ОК		
	Store		Pain	Timo-	Posk			
	Event		(mm/hr)	/mi	reax			
	Byent	•	(2007) 112 7	(IIII)				
	15 min	Summer	128.285		23			
	30 min :	Summer	84.226		37			
	60 min :	Summer	52.662		66			
t	.20 min :	Summer	31.800		126			
1	80 min 8	Summer	23.353		184			
2	40 min	Summer	18.644		244			
3	360 min 4	Summer	13.543		362			
4	180 min :	Summer	10.792		480			
	000 min 3	Summer	9.043		536			
	20 min : 160 min :	Summer	1.023		294 710			
5 1 A	40 min 9	Summer	4.493		986			
21	.60 min 4	Summer	3.241		1404			
28	80 min 8	Summer	2.568		1816			
43	20 min :	Summer	1.847		2600			
57	60 min 3	Summer	1,461		3400			
72	00 min 8	Summer	1.217		4176			
86	40 min 3	Summer	1.048		4848			
100	80 min 3	Summer	0.923		5640			
	©1982-2	010 Mic	ro Draina	ge Lte	đ			

Hyder Consulting Limited					Page	19		
5th Floor, The Pithay 7011-UA001881-UP21B-01							]	
All Saints Street	Exempla	r Site			ΓV			
Bristol BS1 2NL	SUDS St	orage S	tructure	5				
Date 05/04/2011 14:44	Designe	d By mp	49220					
File Cat8 swale infiltratio	Checked	Ву			Real and a second second		$V \ge 0$	
Micro Drainage	Source	Control	W.12.4		1			
Summary of	Results	for 10	0 year Re	turn I	Period (·	+30%)		
Storm	Max	Max	Max		Max	Status		
Event	Level	Depth	Infiltra	ation	Volume			
	(m)	(m)	(1/8	•)	(m°)			
15 min Winter	99 536	0 536		23	111 1	O K		
30 min Winter	99.650	0.650		2.5	144.8	0 K		
60 min Winter	99.754	0.754		2.8	178.4	Flood Risk		
120 min Winter	99.842	0.842		3.0	209.3	Flood Risk		
180 min Winter	99.883	0.883		3.1	224.3	Flood Risk		
240 min Winter	99.904	0.904		3.1	232.3	Flood Risk		
360 min Winter	99.924	0.924		3.2	240.1	Flood Risk		
480 min Winter	99.930	0.930		3.2	242.4	Flood Risk		
600 min Winter	99.928	0.928		3.2	241.5	Flood Risk		
720 min Winter	99.921	0.921		3.2	238.9	Flood Risk		
960 min Winter	99,907	0.907		3.1	233.5	Flood Risk		
1440 min Winter	99.873	0.873		3.1	100 0	Flood Risk		
2160 Min Winter	99.013	0.013		2.9	178 2	Flood Risk		
4320 min Winter	99.755	0.755		2.0	144 2	O K		
5760 min Winter	99.557	0.557		2.3	117.2	O K		
7200 min Winter	99.478	0.478		2.1	95.4	O K		
8640 min Winter	99.409	0,409		2.0	77.9	ОК		
10080 min Winter	99.349	0.349		1.8	63.5	ОК		
	Storm	1	Rain	Time-	Peak			
	Event	:	(mm/hr)	(mi	ns)			
	15 min 1	Wintor	100 205		22			
	30 min t	Winter	84 226		22			
	60 min 1	Winter	52.662		66			
	120 min M	Winter	31.800		124			
	180 min 1	Winter	23.353		182			
	240 min 1	Winter	18.644		238			
:	360 min 1	Winter	13.543		354			
· · · ·	480 min 1	Winter	10.792		464			
	600 min N	Winter	9.043		572			
	720 min 1	Winter	7.823		670 75.6			
7	960 min 1 440 min 1	Winter	6.219		156			
	440 min \ 160 mi∽ "	winter Winter	4.495		1516 1516			
2	100 min 1 880 min 1	Winter	2.568		1960			
4	320 min 1	Winter	1.847		2772			
5	760 min N	Winter	1.461		3576			
7:	200 min W	Winter	1.217		4328			
8	640 min 1	Winter	1.048		5104			
10	080 min V	Winter	0.923		5848			
							1	
							-	

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The second state of the se	7011 115001001	10010 01									
Sth Floor, The Pitnay	7011-0A001881	-05518-01									
All Saints Street	Exemplar Site	0 <b>- -</b>									
Bristol BSI 2NL	SUDS Storage	structure									
Date 05/04/2011 14:44	Designed By m	p49220									
File Cat8 swale infiltratio	Checked By										
Micro Drainage	Source Contro	1 W.12.4									
	Rainfall Details										
Deinfall Med	-1	FOD	Winter Storma Veg								
Rainiali Mode	51 51	100	$\frac{1}{2} \frac{1}{2} \frac{1}$								
Recuin Ferrou (year	>) ⊃n England ang	i Wales	CV (Winter) 0.840								
M5-60 (m	n)	20.000	Shortest Storm (mins) 15								
Ratio	, R	0.400	Longest Storm (mins) 10080								
Summer Storn	ns	Yes	Climate Change % +30								
	<u>Time / A</u>	rea Diagi	ram								
	Total Are	a (ha) 0.	. 420								
	Time Area	Time	Area								
	(mins) (ha)	(mins)	(ha)								
	0-4 0.210	4-8	0.210								

Hyder Consulting Limited				Page 21	
5th Floor, The Pithay	7011-UA00188	31-UP21B-0	)1	<b>1</b>	
All Saints Street	Exemplar Sit	:e		L. Bana	
Bristol BS1 2NL	SUDS Storage	e Structur	e 5	M R R R R	$\mathcal{I}$
Date 05/04/2011 14:44	Designed By	mp49220		DESER	E
File Cat8 swale infiltratio	Checked By				<u>ler 150</u>
Micro Drainage	Source Contr	ol W.12.4	1		
	Mode	el Details	3		
Storag	e ic Online	Cover Io	vol (m)		
50149	e 15 Oniffie	cover he	ver (m) .	200.000	
	Swale	e Structui	re		
Infiltration Coefficient	Base (m/nr)	0.05600		Length (m)	45.0
a initication coefficient	afotu Factor	2.0		Side Slope (1:X)	3.0
	Porosity	1.00	Car	v Volume Depth (m)	0.000
Inve	rt Level (m)	99.000	Cap Infi	tration Depth (m)	0.000
Ba	se Width (m)	3.0	···F -···-		
					**************************************
	01000 0C1 -				
	©1982-2010 M	icro Drai	nage Ltd		

Hyder Consulting Limited		Page 18							
5th Floor, The Pithay	7011-UA001881-UP21B-01								
All Saints Street	Exemplar Site								
Bristol BS1 2NL	SUDS Storage Structure 5								
Date 05/04/2011 14:39	Designed By mp49220	D. PETTERO							
File Cat8 swale no infiltra	Checked By								
Micro Drainage	Source Control W.12.4								
Summary of	Results for 100 year Return	n Period (+30%)							
Storm	Max Max Max	Max Status							
Event	Level Depth Control	Volume							
	(m) (m) (1/s)	(m <sup>3</sup> )							
15 min Summ	er 99.534 0.534 9.5	93.4 O K							
30 min Summ	er 99.683 0.683 9.5	119.6 OK							
120 min Summ	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	140.6 Flood Risk							
180 min Summ	er 99.852 0.852 9.5	149.1 Flood Risk							
240 min Summ	er 99.832 0.832 9.5	145.5 Flood Risk							
360 min Summ	er 99.782 0.782 9.5	136.8 Flood Risk							
480 min Summ	er 99.729 0.729 9.5	127.5 Flood Risk							
600 min Summ	er 99.676 0.676 9.5	118.2 O K							
720 min Summ	er 99.623 0.623 9.5	109.0 O K							
960 min Summ	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	91.4 O K							
2160 min Summ	99.224 0.224 9.2	39.2 OK							
2880 min Summ	er 99.175 0.175 8.1	30.6 OK							
4320 min Summ	er 99.133 0.133 6.1	23.3 ОК							
5760 min Summ	er 99.111 0.111 4.9	19.5 ОК							
7200 min Summ	er 99.097 0.097 4.1	17.0 ОК							
8640 min Summ	er 99.088 0.088 3.6	15.3 ОК							
10080 min Summ	er 99.080 0.080 3.2	14.0 O K							
15 min Winte	er 99.602 0.602 9.5	105.4 O K							
	Storm Rain Tim	ne-Peak							
	Event (mm/hr) (i	mins)							
	15 min Summer 128.285	21							
	30 min Summer 84.226	35							
-	60 min Summer 52,662	64 120							
	120  min summer  31.800	148							
	240 min Summer 18.644	180							
	360 min Summer 13.543	248							
	180 min Summer 10.792	316							
(                                 • •	500 min Summer 9.043	384							
	720 min Summer 7.823	452							
	40 min Summer 6.219	วชบ 810							
21	.60 min Summer 3.241	1144							
28	880 min Summer 2.568	1480							
43	20 min Summer 1.847	2208							
57	60 min Summer 1.461	2936							
72	200 min Summer 1.217	3672							
86	40 min Summer 1.048	4400							
100	15 min Winter 128 285	21 21							
	15 min winter 120,205	42							
	©1982-2010 Micro Drainage 1	Ltd							

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5th Floor, The Pithay	7011-UA00	1881-UP2	1B-01					
All Saints Street			الم					
Bristol BS1 2NL		MERIC						
Date 05/04/2011 14:39	te 05/04/2011 14:39 Designed By mp49220							
File Cat8 swale no infiltra	Checked B	v			LEC-LICE L	ZÖ		
Micro Drainage Source Control W.12.4								
Summary of	Results fo	or 100 ye	ear Retur	n Period	1 (+30%)			
· · · · · · · · · · · · · · · · · · ·					<u>`</u>			
Storm	Max	Max	Max	Max	Status			
Event	Level	Depth	Control	Volume				
	(m)	(m)	(l/s)	(m³)				
30 min Wint	er 99.772	0.772	9.5	135.1	Flood Risk			
60 min Wint	er 99.913	0.913	9.7	159.7	Flood Risk			
120 min Wint	er 99.986	0,986	10.0	170 5	Flood Risk			
240 min Wint	$e_1  99.974$	0.974	9.9 9.8	165.8	Flood Risk			
360 min Wint	er 99.878	0.878	9.5	153.7	Flood Risk			
480 min Wint	er 99.801	0.801	9.5	140.2	Flood Risk	ſ		
600 min Wint	er 99.722	0.722	9.5	126.4	Flood Risk			
720 min Wint	er 99.642	0.642	9.5	112.4	O K			
960 min Wint	er 99.485	0.485	9.5	84.8	ОК			
1440 min Wint	er 99.261	0.261	9.5	45.7	0 К			
2160 min Wint	er 99.167	0.167	7.8	29.3	ОК			
2880 min Wint	er 99,135	0.135	6.3	23.7	ОК			
4320 min Wint	er 99.104	0.104	4.5	18.3	ОК			
5760 min Wint	er 99.088	0.088	3.6	15.4	ОК			
7200 min Wint	er 99.078	0.078	3.0	13.6	ОК			
8640 min Wint	er 99.070	0.070	2.6	12.3	O K			
10080 min Wint	er 99.065	0.065	2.3	11.3	O K			
	<b>Ch</b>		aia mi	ma Daah				
	Storm	K. (mn	ain ii n/hr)	me-reak				
	Avent	(100	al / 11 L <b>/</b>	(mrne)				
	30 min Wir	ter 84	4.226	35				
	60 min Wir	nter 52	2.662	62				
	120 min Wir	nter 31	1,800	118				
	180 min Wir	iter 23	3,353	166				
	240 min Wir	iter 18	3.644	190				
	360 min Wir	iter 13	3.543					
				268				
	480 min Wir	ter 10	0.792	268 342				
	480 min Wir 600 min Wir	iter 10 iter 9	0.792 9.043	268 342 416				
	480 min Win 600 min Win 720 min Win	iter 10 iter 9 iter 7	0.792 9.043 7.823	268 342 416 488				
1	480 min Wir 600 min Wir 720 min Wir 960 min Wir 440 min Wir	iter 10 iter 9 iter 7 iter 6	0.792 9.043 7.823 5.219	268 342 416 488 616 820				
1	480 min Win 600 min Win 720 min Win 960 min Win 440 min Win 160 min Win	iter 10 iter 9 iter 7 iter 6 iter 4	0.792 9.043 7.823 5.219 4.493	268 342 416 488 616 820 1144				
1 2 2	480 min Win 600 min Win 720 min Win 960 min Win 440 min Win 160 min Win 880 min Win	iter 10 iter 9 iter 7 iter 6 iter 6 iter 3 iter 3	0.792 9.043 7.823 6.219 4.493 8.241 2.568	268 342 416 488 616 820 1144 1496				
1 2 2 4	480 min Wir 600 min Wir 720 min Wir 960 min Wir 440 min Wir 160 min Wir 880 min Wir 320 min Wir	iter 10 iter 2 iter 7 iter 6 iter 6 iter 2 iter 2 iter 1	0.792 9.043 7.823 5.219 4.493 3.241 2.568 L.847	268 342 416 488 616 820 1144 1496 2208				
1 2 2 4 5	480 min Wir 600 min Wir 720 min Wir 960 min Wir 440 min Wir 160 min Wir 880 min Wir 320 min Wir 760 min Wir	ater 10 ater 9 ater 7 ater 6 ater 4 ater 3 ater 2 ater 1 ater 1	0.792 9.043 7.823 5.219 4.493 3.241 2.568 L.847 L.461	268 342 416 488 616 820 1144 1496 2208 2936				
1- 2- 4- 5- 7- 7-	480 min Wir 600 min Wir 720 min Wir 960 min Wir 440 min Wir 160 min Wir 880 min Wir 320 min Wir 760 min Wir 200 min Wir	Atter 10 Atter 9 Atter 7 Atter 6 Atter 6 Atter 2 Atter 1 Atter 1 Atter 1 Atter 1	0.792 9.043 7.823 5.219 4.493 3.241 2.568 1.847 1.461 1.217	268 342 416 488 616 820 1144 1496 2208 2936 3672				
1 2 2 4 5 7 8	480 min Wir           600 min Wir           720 min Wir           960 min Wir           440 min Wir           160 min Wir           880 min Wir           320 min Wir           760 min Wir           840 min Wir	Atter 10 Atter 9 Atter 7 Atter 6 Atter 6 Atter 2 Atter 1 Atter 1 Atter 1 Atter 1 Atter 1 Atter 1	0.792 9.043 7.823 5.219 4.493 3.241 2.568 L.847 L.461 L.217 L.048	268 342 416 488 616 820 1144 1496 2208 2936 3672 4400				
1. 22 4. 55 77 8 100	480 min Wir           600 min Wir           720 min Wir           960 min Wir           440 min Wir           160 min Wir           880 min Wir           320 min Wir           760 min Wir           760 min Wir           760 min Wir           200 min Wir           200 min Wir           200 min Wir           640 min Wir           640 min Wir	atter 10 atter 2 atter 7 atter 6 atter 4 atter 2 atter 1 atter 1 atter 1 atter 1 atter 1 atter 1 atter 2 atter 1 atter 2 atter 1 atter 2 atter 1 atter 2 atter	0.792 9.043 7.823 5.219 4.493 3.241 2.568 1.847 1.461 1.217 1.048 0.923	268 342 416 488 616 820 1144 1496 2208 2936 3672 4400 5120				
1. 2. 4. 5 7. 8 10	480         min         Win           600         min         Win           720         min         Win           960         min         Win           960         min         Win           960         min         Win           960         min         Win           980         min         Win           320         min         Win           760         min         Win           200         min         Win           640         min         Win           080         min         Win	ater 10 ater 2 ater 7 ater 6 ater 4 ater 2 ater 1 ater 1 ater 1 ater 1 ater 2 ater 1 ater 2 ater 1 ater 2 ater 1 ater 2 ater 1 ater 2 ater 1 ater 2 ater 3 ater 3 a	0.792 9.043 7.823 5.219 4.493 3.241 2.568 1.847 1.461 1.217 1.048 0.923	268 342 416 488 616 820 1144 1496 2208 2936 3672 4400 5120				
1 2 2 4 5 7 8 10	480 min Wir 600 min Wir 720 min Wir 960 min Wir 440 min Wir 160 min Wir 320 min Wir 320 min Wir 760 min Wir 200 min Wir 640 min Wir	ater 10 ater 2 ater 7 ater 6 ater 2 ater 1 ater 1 ater 1 ater 1 ater 1 ater 2 ater 3 ater 3 a	0.792 9.043 7.823 6.219 4.493 8.241 2.568 L.847 L.461 L.217 L.048 D.923	268 342 416 488 616 820 1144 1496 2208 2936 3672 4400 5120				
1 2: 4: 5 7: 8: 10:	480 min Wir 600 min Wir 720 min Wir 960 min Wir 440 min Wir 160 min Wir 320 min Wir 320 min Wir 200 min Wir 640 min Win 080 min Win	ater 10 ater 2 ater 7 ater 6 ater 2 ater 2 ater 1 ater 1 ater 1 ater 1 ater 2 ater 3 ater 3 a	0.792 9.043 7.823 6.219 4.493 8.241 2.568 L.847 L.461 L.217 L.048 D.923	268 342 416 488 616 820 1144 1496 2208 2936 3672 4400 5120				
1 2 4 4 5 7 7 8 10	480 min Wir 600 min Wir 720 min Wir 960 min Wir 440 min Wir 160 min Wir 320 min Wir 760 min Wir 640 min Wir 080 min Win	ater 10 ater 2 ater 7 ater 6 ater 4 ater 3 ater 1 ater 1 ater 1 ater 1 ater 1 ater 2 ater 2 ater 2 ater 2 ater 2 ater 2 ater 4 ater 4 a	0.792 9.043 7.823 6.219 4.493 3.241 2.568 L.847 L.461 L.217 L.048 D.923	268 342 416 488 616 820 1144 1496 2208 2936 3672 4400 5120				
1 2 4 5 7 8 10	480 min Win 600 min Win 720 min Win 960 min Win 440 min Win 160 min Win 320 min Win 760 min Win 200 min Win 080 min Win	ater 10 ater 2 ater 7 ater 6 ater 4 ater 3 ater 1 ater 1 ater 1 ater 1 ater 1 ater 6 ater 2 ater 1 ater 6 ater 6 ater 6 ater 6 ater 6 ater 7 ater 6 ater 7 ater 6 ater 7 ater 7 a	0.792 9.043 7.823 6.219 4.493 3.241 2.568 L.847 L.461 L.217 L.048 D.923	268 342 416 488 616 820 1144 1496 2208 2936 3672 4400 5120				
1 2 4 5 7 8 10	480 min Win 600 min Win 720 min Win 960 min Win 440 min Win 160 min Win 320 min Win 320 min Win 640 min Win 580 min Win	ater 10 ater 2 ater 7 ater 6 ater 2 ater 1 ater 1 ater 1 ater 1 ater 1 ater 2 ater 3 ater 4 ater 4 a	0.792 9.043 7.823 6.219 4.493 3.241 2.568 L.847 L.461 L.217 L.048 D.923	268 342 416 488 616 820 1144 1496 2208 2936 3672 4400 5120				
1 22 4 5 7 8 10	480 min Wir 600 min Wir 720 min Wir 960 min Wir 440 min Wir 160 min Wir 320 min Wir 320 min Wir 640 min Win 080 min Win	ater 10 ater 2 ater 7 ater 6 ater 2 ater 1 ater 1 ater 1 ater 1 ater 1 ater 2 ater 1 ater 2 ater 2 ater 2 ater 2 ater 2 ater 2 ater 2 ater 2 ater 2 ater 4 ater 2 ater 4 ater 4 a	0.792 9.043 7.823 6.219 4.493 3.241 2.568 L.847 L.461 L.217 L.048 D.923	268 342 416 488 616 820 1144 1496 2208 2936 3672 4400 5120				
1 2 2 4 5 7 7 8 10	480 min Wir 600 min Wir 720 min Wir 960 min Wir 440 min Wir 160 min Wir 320 min Wir 760 min Wir 200 min Win 640 min Win	ater 10 ater 2 ater 7 ater 6 ater 4 ater 1 ater 1 ater 1 ater 1 ater 1 ater 2 ater 1 ater 2 ater 2 ater 2 ater 2 ater 2 ater 4 ater 4 a	0.792 9.043 7.823 6.219 4.493 3.241 2.568 L.847 L.461 L.217 L.048 D.923	268 342 416 488 616 820 1144 1496 2208 2936 3672 4400 5120				
1 2 2 4 5 7 7 8 10	480 min Wir 600 min Wir 720 min Wir 960 min Wir 440 min Wir 160 min Wir 320 min Wir 760 min Wir 200 min Win 640 min Win	ater 10 ater 2 ater 7 ater 6 ater 2 ater 1 ater 1 ater 1 ater 1 ater 2 ater 1 ater 2 ater 3 ater 4 ater 3 ater 4 ater 3 ater 4 ater 4 a	0.792 0.792 0.743 7.823 6.219 4.493 3.241 2.568 1.847 1.461 1.217 1.048 0.923	268 342 416 488 616 820 1144 1496 2208 2936 3672 4400 5120				
1 2 2 4 5 7 8 10	480 min Wir 600 min Wir 720 min Wir 960 min Wir 440 min Wir 160 min Wir 320 min Wir 760 min Wir 200 min Win 640 min Win	ater 10 ater 2 ater 7 ater 6 ater 4 ater 1 ater 1 ater 1 ater 1 ater 1 ater 2 ater 1 ater 2 ater 1 ater 2 ater 2 ater 2 ater 2 ater 4 ater 2 ater 4 ater 4 a	0.792 0.792 0.743 7.823 6.219 4.493 3.241 2.568 1.847 1.461 1.217 1.048 0.923	268 342 416 488 616 820 1144 1496 2208 2936 3672 4400 5120				
1 2 2 4 5 7 7 8 10	480 min Wir 600 min Wir 720 min Wir 960 min Wir 440 min Wir 160 min Wir 320 min Wir 760 min Wir 200 min Win 640 min Win	ater 10 ater 2 ater 7 ater 6 ater 4 ater 1 ater 1 ater 1 ater 1 ater 1 ater 2 ater 1 ater 2 ater 1	0.792 9.043 7.823 6.219 4.493 3.241 2.568 1.847 1.461 1.217 1.048 0.923	268 342 416 488 616 820 1144 1496 2208 2936 3672 4400 5120				

Hyder Consulting Limited		Page 20
5th Floor, The Pithay	7011-UA001881-UP21B-01	
All Saints Street	Exemplar Site	
Bristol BS1 2NL	SUDS Storage Structure 5	march a
Date 05/04/2011 14:39	Designed By mp49220	DESTRETE
File Cat8 swale no infiltra	Checked By	
Micro Drainage	Source Control W.12.4	

## Rainfall Details

Rain	fall Model	FSR	Winter Storms	Yes
Return Peri	od (years)	100	Cv (Summer)	0.750
	Region	England and Wales	Cv (Winter)	0.840
	45-60 (mm)	20.000	Shortest Storm (mins)	15
	Ratio R	0.400	Longest Storm (mins)	10080
Sum	ner Storms	Yes	Climate Change %	+30

# <u>Time / Area Diagram</u>

Total Area (ha) 0.420

Time	Area	Time	Area
(mins)	(ha)	(mins)	(ha)
0-4	0.210	4-8	0.210

Hyder Consulting Limited			Page 2	1	
5th Floor, The Pithay	7011-UA001881-	-UP21B-01	[minimum		
All Saints Street	Exemplar Site		ΓV		
Bristol BS1 2NL	SUDS Storage	Structure 5		<u>u le la c</u>	$\mathcal{V}$
Date 05/04/2011 14:39	Designed By m	549220		තතරය	S C C C
File Cat8 swale no infiltra	Checked By			<u>sen n</u> h	CH HO
Micro Drainage	Source Control	W 12 4			
	200200 000000				
	Model	Details			
Stora	ge is Online C	over Level (m	n) 100.000		
	Tank or Po	nd Structure			
	Invert Leve	el (m) 99.000	)		
	_				
Dept	h (m) Area (m²)	Depth (m)	Area (m²)		
	0 000 175 (	1 000	175 0		
	0.000 1/5.0	1 1.000	1/5.0		
	Hydro-Brake®	Outflow Contr	-0]		
	11010 DIUNCO	- action conci	<b>-</b>		
Design He	ad (m) 1.	000 Diame	eter (mm)	132	
Design Flow	(1/s) 1	0.0 Invert L	level (m) 9	9.000	
Hydro-Brake	® Type Md6 SW C	only			
Depth (m) Flow (1/s) Depth	(m) Flow $(1/s)$	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100 4.3 1	.200 10.9	3.000	17.2	7.000	26.3
0.200 8.8 1	.400 11.8	3,500	18.6	7.500	27.2
	.600 12.6	4.000	19.9	8.000	28.1
0.400 9.2 1	.800 13.3	4,500	21,1	8,500	29.0
0.500 8.9 2		5,000	22.2	9.000	29.8
	.200 14.7	5,500	23.3	9.500	30.6
1 000 10 0 2	.400 15.4 .600 16.0	6.000	24.4		
1.000 10.0 2	.000 IO.(	0.500	29.3		
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Hyder Consulting Limited					Page	1
5th Floor, The Pithay						L
All Saints Street					Π <u>Γ</u> Υ	
Bristol BS1 2NL						
Date 05/04/2011 15:00	Designe	d By mp	49220		_ ∥ D)	Dentrace
File Cat9 swale infiltratio	Checked	lВy				<u>ne neris</u>
Micro Drainage	Source	Control	W.12.4			
Summary of	Results	for 10	) year Re	eturn 1	Period (	+30%)
	Half Dr	ain Time	е: 316 п	ninute	5.	
Storm	Max	Max	Мах	c	Max	Status
Event	Level	Depth	Infiltr	ation	Volume	
	(m)	(m)	(1/s	3)	(m³)	
15 min Summer	86.557	0.557		9.6	192.2	OK
30 min Summer	86.6/3	0.6/3		10.2	248.9	U K Flood Bigk
120 min Summer	00./00 86 861	0.780		11 1	301.2	Flood Risk
120 min Summer	86.884	0.884		11.3	351 7	Flood Risk
240 min Summer	86.883	0.883		11.3	351.1	Flood Risk
360 min Summer	86.869	0.869		11.2	344.3	Flood Risk
480 min Summer	86,852	0.852		11.1	335.9	Flood Risk
600 min Summer	86.832	0.832		11.0	326.5	Flood Risk
720 min Summer	86.812	0.812		10.9	316.4	Flood Risk
960 min Summer	86,770	0.770		10.7	296.1	Flood Risk
1440 min Summer	86,692	0.692		10.3	258.1	ок
2160 min Summer	86.592	0.592		9.8	209.6	0 K
2880 min Summer	86.511	0.511		9.4	169.8	ОК
4320 min Summer	86.392	0.392		8.8	112.1	ОК
5760 min Summer	86.323	0.323		8.3	78.1	O K
7200 min Summer	86.287	0,287		7.3	61.6	O K
10090 min Summer	80.25/	0.257		6.5 5 0	49.7	OK
10080 min Schaler	00.234	0.234		5.9	41.2	0 K
	Storm	1	Rain	Time-	Peak	
	Event	:	(mm/hr)	(mi	ns)	
				-		
	15 min 3	Summer	128,285		25	
	30 min 9	Summer	84.226		39	
	60 min 3	Summer	52.662		68	
]	120 min 5	Summer	31,800		126	
	180 min 3	Summer	23,353		182	
	240 min 3	Summer	12 642		234	
	500 min : 180 min :	Summer	10 702		290	
	100 MLD 3	Summer	0 043 10.792		332 420	
	720 min 1	Summer	7,823		490	
	960 min :	Summer	6.219		626	
14	140 min 1	Summer	4.493		898	
21	L60 min s	Summer	3.241		1284	
28	380 min \$	Summer	2.568		1656	
43	320 min \$	Summer	1.847		2380	
57	/60 min \$	Summer	1.461		3048	
72	200 min \$	Summer	1.217		3752	
86	540 min \$	Summer	1.048		4488	
100	180 min 9	Summer	0.923		5152	
	· · · ·					
	©1982-2	010 Mic	ro Draina	age Lt	d	

Hyder Consulting Limited					Page	2	
5th Floor, The Pithay							L 7
All Saints Street					ΓY.	പ്പുപ്പുപ	
Bristol BS1 2NL						<u>- Buc</u>	
Date 05/04/2011 15:00	Designe	d By mp	49220		b )	Dente	er al
File Cat9 swale infiltratio	. Checked	l By					وحرعك
Micro Drainage	Source	Control	W.12.4				
Summary o	f Results	for 10	0 year Re	eturn 1	Period (·	+30%)	
Storm	Max	Max	Max	۲.	Max	Status	
Event	Level	Depth	Infiltr	ation	Volume		
	(m)	(m)	(1/8	3)	(m³)		
15 min Hintor		0 606		0.0	216 1	0 1	
30 min Winter	- 96,000	0.000		9.0 10 5	210.1	Flood Rick	
60 min Winter	- 86 861	0.757		11 1	200.J 340.4	Flood Risk	
120 min Winter	r 86.958	0.958		11.6	387.6	Flood Risk	
180 min Winter	86.989	0.989		11.8	402.9	Flood Risk	
240 min Winter	86,993	0,993		11.8	405.0	Flood Risk	
360 min Winter	86,973	0,973		11.7	395.2	Flood Risk	
480 min Winter	86.952	0.952		11.6	384.8	Flood Risk	
600 min Winter	86,926	0,926		11.5	372.2	Flood Risk	
720 min Winter	86,897	0.897		11.3	358.2	Flood Risk	
960 min Winter	86.837	0.837		11.0	329.0	Flood Risk	
1440 min Winter	: 86.723	0.723		10.4	273.5	Flood Risk	
2160 min Winter	86.579	0.579		9.7	203.2	ОК	
2880 min Winter	1 86.466 . 0C 204	0.466		9.1	147.9	OK	
4320 min Winter	- 06.024	0.324		0.4 6 0	5/ 0		
7200 min Winter	· 86 233	0.271		59	40.6	0 K	
8640 min Winter	86.204	0.204		5.1	31.3	O K	
10080 min Winter	86.182	0.182		4.5	24.9	0 K	
	Storm	n	Rain	Time-	Peak		
	Event	:	(mm/hr)	(mi	ns)		
	15 min	Winter	128.285		25		
	30 min	Winter	84.226		39		
	60 min	Winter	52.662		66 124		
	120 min	Winter	23 353		124		
	240 min	Winter	18.644		234		
	360 min '	Winter	13.543		328		
	480 min	Winter	10.792		376		
	600 min '	Winter	9.043		454		
	720 min 1	Winter	7.823		530		
	960 min	Winter	6.219		680		
:	1440 min	Winter	4.493		968		
:	2160 min 1	Winter	3.241		1368		and the second se
:	2880 min 1	Winter	2.568		1736		<b>Weight According</b>
	4320 min '	Winter	1.847		2316		
	ンパロレー min 1 7200 min 1	winter Winter	1,401 1,217		3752		
s	7200 min 1 8640 min 1	Winter	1.048		4496		
11	0080 min 1	Winter	0.923		5160		
					2		
	@1002.2	010 Mic	ro Drain	ago It	<u></u>		

Hyder Consulting Limited		Page 3
5th Floor, The Pithay		Letter Letter
All Saints Street		
Bristol BS1 2NL		THE PLE V
Date 05/04/2011 15:00	Designed By mp49220	1) DESTRET
File Cat9 swale infiltratio	Checked By	
Micro Drainage	Source Control W.12.4	
	Rainfall Details	
Rainfall Mod	el FSR	Winter Storms Yes

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)	20.000	Shortest Storm (mins)	15
Ratio R	0.400	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+30

# Time / Area Diagram

## Total Area (ha) 0.840

Time	Area	Time	e Area Time .		e Area Time A		ne Area Time Are		Area
(mins)	(ha)	(mins)	s) (ha) (mins)		s) (ha) (mins)		ns) (ha) (mins) (ha		(ha)
0-4	0.210	4-8	0.420	8-12	0.210				

Hyder Consulting Limited		Page 4
 5th Floor, The Pithay		
All Saints Street		
Bristol BS1 2NL		
Date 05/04/2011 15:00	Designed By mp49220	DETENSION
File Cat9 swale infiltratio	Checked By	
Micro Drainage	Source Control W.12.4	4

# Model Details

## Storage is Online Cover Level (m) 87.000

### Infiltration Trench Structure

Infiltration Coefficient Base (m/hr)	0.05600	Trench Width (m)	3.0
Infiltration Coefficient Side (m/hr)	0.05600	Trench Length (m)	325.0
Safety Factor	2.0	Slope (1:X)	1000.0
Porosity	0.50	Cap Volume Depth (m)	0.000
Invert Level (m)	86.000	Cap Infiltration Depth (m)	0.000

	BS1 2NL	~~							$\mathbf{\nabla}$
Date 05/0	04/2011 15:	03	Desi	gned By my	549220		_ ∥] D ∫	ᢓᠵᠫ᠋᠋	186
File Cats	swale no	infiltra.	Chec	ked By	1 10 10	A			
MICLO DIS	iinage		Sour	ce Contro.	1 0.12.4				
		Summary	of Resul	ts for 10	00 year	Return	Period (+3	0%)	
			Half	Drain Tim	ne : 365	o minute	es.		
	Storm	Max	Max	Max	trian ()	Max	Max	Max	Stat
	Event	(m)	Depth (m)	(1/s)	tion Co	(1/s)	(1/s)	(m <sup>3</sup> )	
15	min Summe	r 86.555	0.555		0.0	9.5	9.5	191.1	
30	min Summe	86.671	0.671		0.0	9.5	9.5	247.8	
60	min Summe:	86.778	0.778		0.0	9.5	9,5	299.9	Flood
120	) min Summe:	6 86.857	0.857		0.0	9.5	9.5	338.8	Flood
180	min Summe:	86.879	0,879		0.0	9.5	9.5	349.5	Flood
240	min Summe:	6.878	0.878		0.0	9,5	9.5	348.6	Flood
360	min Summe:	86.853	0.853		0.0	9.5	9.5	336.6	Flood
480	min Summer	86.828	0.828		0.0	9.5	9.5	324.5	Flood
600	min Summer	86.804	0.804		0.0	9.5	9.5	312.8	Flood
720	min Summer	: 86.781	0.781		0.0	9.5	9.5	301.6	Flood 1
960	min Summer	: 86,737 . 06,655	0.737		0.0	9.5	9.5	280.0	FTOOD ]
1440	min Summer	. 86.653 - 0∠ cor	0,653 0 ⊑⊐⊏		0.0	9.5 0.5	9.5	239.Z	
2000 2000	min Summer	- 86 133 - 86 130	0.030		0.0	9,0 0 5	9.5 0 E	130 E	
2000	min Summer	- 86 288	0.430		0.0	9.5	9.5 Q K	420.0 42 A	
5760	min Summer	· 86 212	0.200		0.0	9.J Q 1	9.9 Q 1	22.4	
7200	min Summer	86.175	0.175		0.0	8.1	8_1	22.9	
8640	min Summer	86.152	0.152		0.0	7.1	7.1	17.3	
10080	min Summe	86,136	0.136		0.0	6.3	6.3	13.9	
			St	orm	Rain	Time	-Peak		
			Eve	ent	(mm/hr	) (mi	ins)		
			15 mi	n Summer	128.28	5	25		
			15 mi 30 mi	n Summer n Summer	128.28	5	25 39		
			15 mi 30 mi 60 mi	n Summer n Summer n Summer	128.28 84.22 52.66	5 6 2	25 39 68		
			15 mi 30 mi 60 mi 120 mi	n Summer n Summer n Summer n Summer	128.28 84.22 52.66 31.80	5 6 2 0	25 39 68 126		
			15 mi 30 mi 60 mi 120 mi 180 mi 240 m <sup>2</sup>	n Summer n Summer n Summer n Summer n Summer	128.28 84.22 52.66 31.80 23.35	5 6 2 0 3 ∡	25 39 68 126 184 242		
			15 mi 30 mi 60 mi 120 mi 180 mi 240 mi 360 mi	n Summer n Summer n Summer n Summer n Summer n Summer	128.28 84.22 52.66 31.80 23.35 18.64	5 6 2 0 3 4 3	25 39 68 126 184 242 314		
			15 mi 30 mi 60 mi 120 mi 180 mi 240 mi 360 mi 480 mi	n Summer n Summer n Summer n Summer n Summer n Summer n Summer	128.28 84.22 52.66 31.80 23.35 18.64 13.54 10.79	5 6 2 0 3 4 3 2	25 39 68 126 184 242 314 378		
			15 mi 30 mi 60 mi 120 mi 180 mi 240 mi 360 mi 480 mi	n Summer n Summer n Summer n Summer n Summer n Summer n Summer n Summer	128.28 84.22 52.66 31.80 23.35 18.64 13.54 10.79 9.04	5 6 2 0 3 4 3 2 3	25 39 68 126 184 242 314 378 440		
			15 mi 30 mi 60 mi 120 mi 180 mi 360 mi 480 mi 600 mi 720 mi	n Summer n Summer n Summer n Summer n Summer n Summer n Summer n Summer n Summer	128.28 84.22 52.66 31.80 23.35 18.64 13.54 10.79 9.04 7.82	5 6 2 0 3 4 3 2 3 3 3	25 39 68 126 184 242 314 378 440 508		
			15 mi 30 mi 60 mi 120 mi 180 mi 360 mi 480 mi 600 mi 720 mi 960 mi	n Summer n Summer n Summer n Summer n Summer n Summer n Summer n Summer n Summer	128.28 84.22 52.66 31.80 23.35 18.64 13.54 10.79 9.04 7.82 6.21	5 6 2 0 3 4 3 2 3 9	25 39 68 126 184 242 314 378 440 508 646		
			15 mi 30 mi 60 mi 120 mi 180 mi 240 mi 360 mi 480 mi 600 mi 720 mi 960 mi	n Summer n Summer	128.28 84.22 52.66 31.80 23.35 18.64 13.54 10.79 9.04 7.82 6.21 4.49	5 6 2 0 3 4 3 2 3 9 3 9 3	25 39 68 126 184 242 314 378 440 508 646 916		
			15 mi 30 mi 60 mi 120 mi 180 mi 360 mi 480 mi 600 mi 720 mi 960 mi 1440 mi	n Summer n Summer	128.28 84.22 52.66 31.80 23.35 18.64 13.54 10.79 9.04 7.82 6.21 4.49 3.24	5 6 2 0 3 4 3 2 3 9 3 1	25 39 68 126 184 242 314 378 440 508 646 916 1304		
			15 mi 30 mi 60 mi 120 mi 240 mi 360 mi 480 mi 600 mi 720 mi 960 mi 1440 mi 2160 mi	n Summer n Summer	128.28 84.22 52.66 31.80 23.35 18.64 13.54 10.79 9.04 7.82 6.21 4.49 3.24 2.56	5 6 2 0 3 4 3 2 3 9 3 1 8	25 39 68 126 184 242 314 378 440 508 646 916 1304 1676		
			15 mi 30 mi 60 mi 120 mi 240 mi 360 mi 480 mi 600 mi 720 mi 960 mi 1440 mi 2160 mi 2880 mi	n Summer n Summer	$128.28 \\ 84.22 \\ 52.66 \\ 31.80 \\ 23.35 \\ 18.64 \\ 13.54 \\ 10.79 \\ 9.04 \\ 7.82 \\ 6.21 \\ 4.49 \\ 3.24 \\ 2.56 \\ 1.84 \\ \end{array}$	5 6 2 0 3 4 3 2 3 9 3 1 8 7	25 39 68 126 184 242 314 378 440 508 646 916 1304 1676 2336		
			15 mi 30 mi 60 mi 120 mi 240 mi 360 mi 480 mi 600 mi 720 mi 960 mi 1440 mi 2160 mi 2880 mi 4320 mi	n Summer n Summer	$128.28 \\ 84.22 \\ 52.66 \\ 31.80 \\ 23.35 \\ 18.64 \\ 13.54 \\ 10.79 \\ 9.04 \\ 7.82 \\ 6.21 \\ 4.49 \\ 3.24 \\ 2.56 \\ 1.84 \\ 1.46 \\ \end{array}$	5 6 2 0 3 4 3 2 3 9 3 1 8 7 1	25 39 68 126 184 242 314 378 440 508 646 916 1304 1676 2336 2992		
			15 mi 30 mi 60 mi 120 mi 240 mi 360 mi 480 mi 600 mi 720 mi 960 mi 1440 mi 2160 mi 2880 mi 4320 mi 5760 mi	n Summer n Summer	$128.28 \\ 84.22 \\ 52.66 \\ 31.80 \\ 23.35 \\ 18.64 \\ 13.54 \\ 10.79 \\ 9.04 \\ 7.82 \\ 6.21 \\ 4.49 \\ 3.24 \\ 2.56 \\ 1.84 \\ 1.46 \\ 1.21 \\ \end{array}$	5 6 2 0 3 4 3 2 3 9 3 1 8 7 1 7	25 39 68 126 184 242 314 378 440 508 646 916 1304 1676 2336 2992 3680		
			15 mi 30 mi 60 mi 120 mi 240 mi 360 mi 480 mi 600 mi 720 mi 960 mi 1440 mi 2160 mi 2880 mi 4320 mi 5760 mi 7200 mi 8640 mi	n Summer n Summer	$128.28 \\ 84.22 \\ 52.66 \\ 31.80 \\ 23.35 \\ 18.64 \\ 13.54 \\ 10.79 \\ 9.04 \\ 7.82 \\ 6.21 \\ 4.49 \\ 3.24 \\ 2.56 \\ 1.84 \\ 1.46 \\ 1.21 \\ 1.04 \\ 1.04$	5 6 2 0 3 4 3 2 3 9 3 1 8 7 1 7 8	25 39 68 126 184 242 314 378 440 508 646 916 1304 1676 2336 2992 3680 4408		

Hyder Consulting Limited						Page 2	Page 2			
5th Floor, The Pithay	,	I								
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Bristol BS1 2NL							بكحك			
Date 05/04/2011 15:03	1	Desig	ned By m	p49220		N D \	Dentr	าคาสเป		
File Cat9 swale no in	filtra	Check	ed By					<u>11:5550</u>		
Micro Drainage Source Control W.12.4										
S	Summary of	Resul	ts for 10	)0 year	Return	Period (+3	0%)			
Storm	Max	Max	Max		Max	Max	Max	Status		
Event	Level I	Depth	Infiltra	tion (	Control	Σ Outflow	Volume			
	(m)	(m)	(1/5)	)	(1/8)	(1/8)	(m-)			
15 min Winter	86 604 0	0 604		0.0	9.5	9.5	215.3	ОК		
30 min Winter	86,736	0.736		0.0	9.5	9.5	279.6	Flood Risk		
60 min Winter	86.859 (	0.859		0.0	9.5	9.5	339.6	Flood Risk		
120 min Winter	86.956	0,956		0.0	9.9	9.9	387.0	Flood Risk		
180 min Winter	86.988	0.988		0.0	10.0	10.0	402.5	Flood Risk		
240 min Winter	86.993 (	0.993		0.0	10.0	10.0	404.7	Flood Risk		
360 min Winter	86.972 (	0.972		0.0	9.9	9.9	394.7	Flood Risk		
480 min Winter	86.939 (	0.939		0.0	9.8	9,8	378.5	Flood Risk		
600 min Winter	86.909 (	0.909		0.0	9.7	9.7	364.0	Flood Risk		
720 min Winter	86.878 (	J.878		0.0	9.5	9.5	348.9	riood Risk		
960 min Winter	86.815 (	J.815		0.0	9.5 0.5	9.0	318.Z	FIOOD RISK		
2160 min Winter	86 508 (	1 508		0.0	9.5	9,5	168 6	O K		
2880 min Winter	86.353 (	1.353		0.0	9.5	9.5	92.9	O K		
4320 min Winter	86.200 (	0.200		0.0	8.8	8.8	29.9	ок		
5760 min Winter	86.154 (	0.154		0.0	7.2	7.2	17.8	ОК		
7200 min Winter	86.131 (	0.131		0.0	6.0	6.0	12.8	ОК		
8640 min Winter	86,116 (	0.116		0.0	5.2	5,2	10.0	ОК		
10080 min Winter	86.105 (	0.105		0.0	4.6	4,6	8.3	ОК		
		Sto	orm	Rair	ı Time	-Peak				
		EV6	inc.	(RRU/ II	r) (au	ins)				
		15 mi	n Winter	128.2	85	25				
		30 mi	n Winter	84,2	26	39				
		60 mi:	n Winter	52.6	62	68				
		120 mi	n Winter	31.8	00	124				
		180 mi	n Winter	23.3	53	180				
		240 mi	n Winter	18.6	44	236				
		360 mi:	n Winter	13.5	43	344				
		480 ml: 600 mi	n Winter	10.7	92 13	390				
		720 mi	n Winter	9.0 7 8	23	546				
		960 mi	n Winter	6.2	19	700				
	1	440 mi	n Winter	4.4	93	998				
	2	160 mi	n Winter	3.2	41	1396				
	2	880 mi	n Winter	2.5	68	1728				
	4	320 mi	n Winter	1.8	47	2292				
	5	760 min	n Winter	1.4	61	2944				
	7:	200 min 640	n Winter	1.2	17	3672				
	10	040 min 080	n winter	1.0	40 23	4400 5136				
	10	000 RT	a winter	0.9	2.0	2120				
		©1982	-2010 Mic	cro Dra	inage Lt	d				

Hyder Consulting Limited					Page 3					
Stn Floor, The Pithay										
All Saints Street					10 V KR2	MO MA				
Bristol BS1 2NL										
Date 05/04/2011 15:03	Designe	d By mp49	220			വാടനവ്				
File Cat9 swale no infiltra	Checked	І Ву								
Micro Drainage	Source	Control W	.12.4							
		Rainfall	Detail	5						
Rainfall Mode	el		FSR	P	Vinter Storms	Yes				
Return Period (year	s)		100		Cv (Summer)	0.750				
Regi	on Engl	and and W	ales		Cv (Winter)	0.840				
M5-60 (m	m) _	20	.000	Shortest	Storm (mins)	15				
Ratio	R	0	.400	Longest	Storm (mins)	10080				
Summer Stori	as		ies	Clin	ate Change %	+30				
	<u>Ti</u>	me / Area	Diagr	am						
	Tot	al Area (	ha} 0.	840						
Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)					
0-4	0.210	4-8	0.420	8-12	0.210					
	01220		0.1201	0 12	0.210					
Hyder Consulting Limited		Page 4								
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5th Floor, The Pithay										
All Saints Street										
Bristol BS1 2NL		Receie ~								
Date 05/04/2011 15:03	Designed By mp49220	DELLER								
File Cat9 swale no infiltra	Checked By									
Micro Drainage	Source Control W.12.4									
	N. 1.1. D. 6. (1.									
	MODEL DECAILS									
Stora	me is Online Cover Level (m)	87.000								
Storage is online cover hever (m) of our										
	Infiltration Trench Structure									
Infiltration Coefficient	Base (m/hr) 0.00000	Trench Width (m) 3.0								
Infiltration Coefficient	Side $(m/nr) = 0.00000$	$\frac{11}{2} \frac{11}{2} \frac$								
	Porosity 0.50 Cap	Volume Depth (m) 0.000								
Inve	rt Level (m) 86.000 Cap Infil	tration Depth (m) 0.000								
	_									
	Hydro-Brake® Outflow Control									
Deader Har	d (m) 1 000 Diamotor	(mm) 132								
Design Hea Design Flow	(1/s) 10.0 Invert Level	(mu) 86.000								
Hydro-Brake®	Type Md6 SW Only									
-										
Depth (m) Flow (1/s) Depth	(m) Flow (1/s) Depth (m) Flow	(1/s) Depth (m) Flow (1/s)								
0.100 4.3 1	200 10 8 3 000	17 2 7 000 26 2								
0.100 $4.3$ $1.$	400 11.7 3.500	18.6 7.500 27.2								
0.300 9.5 1.	600 12.6 4.000	19.8 8.000 28.1								
0.400 9.2 1.	800 13.3 4.500	21.0 8.500 28.9								
0.500 8.8 2.	000 14.0 5.000	22.2 9.000 29.8								
0.600 8.8 2.	200 14.7 5.500	23.3 9.500 30.6								
0.800 9.2 2.	400 15.4 6.000	24.3								
1.000 10.0 2.	600 16.0 6.500	25.3								
	©1982-2010 Micro Drainage Ltd									
	- A - 2000									

### CALCULATIONS

DOCUMENT No

#### 7015-UA001881-UP21B-01

FFICE				PROJECT TITLE								
CARDIF	-			NW Bicester E								
SUBJECT								SHEET No				
Surface Water Catchment Areas									1			
ISSUE	TOTAL SHEETS	AUTHOR	DATE	CHECKED BY	DATE	APPROVED BY	DATE	COMMENTS				
1	1	MP	25/03/11	DCB	25/03/11	SAD	25/03/11					
2												
3												
4												
5												
SUPERSEDES DOC No												

DESIGN BASIS STATEMENT (Inc. sources of info/data, assumptions made, standards, etc.)

#### Introduction

This calculation has been prepared to establish the contributing impermeable area for each group of SuDS features based on topographically derived catchment areas.

#### Assumptions

1) Catchment areas are as shown on drawings 7160 & 7161 UA001881-UP21D-02, and have been measured for this calculation using AutoCAD.

1) Contributing areas are derived from the area of impermeable paving adjacent to the SuDS features within the catchment, plus 20% of the remaining impermeable area for the catchment.

3) Main commercial areas are assumed to provide surface water storage within the plot boundary, and have been omitted from these calculations.

Calculation

Catchment	Total Catchment Area (ha)	Impermeable Paving (ha)	20% of Remaining Catchment (ha)	Contributing Area (ha)
1	2.00	0.13	0.38	0.50
2	2.15	0.10	0.41	0.51
3		0.28		0.28
4	1.55	0.09	0.29	0.38
5	1.45	0.08	0.28	0.35
6		0.10		0.10
7	1.45	0.15	0.26	0.41
8	1.20	0.22	0.20	0.42
9	2.85	0.34	0.50	0.84

uder

Hyder		CALC	CULAT	DOCUMENT № 7016-UA001881-UP21B-01							
OFFICE											
	Cardiff NW Bicester Eco-Town										
SUBJECT	SUBJECT SHEET No										
Greenfield Runoff - Volumetric Calculation 1 OF 1											
ISSUE	TOTAL SHEETS	AUTHOR	DATE	CHECKED BY	DATE	APPROVED BY	DATE	COMMENTS			
1	1	DCB	25/03/11	MP	25/03/11	SAD	25/03/11				
2											
3											
4											
5											
SUPERSEDES	DOC No							DATE			

DESIGN BASIS STATEMENT (Inc. sources of info/data, assumptions made, standards, etc.)

#### Introduction

This calculation has been prepared to assess the greenfield runoff volume in accordance with The SUDS Manual (CIRIA) - Section 4.2.2: Estimating greenfield runoff volumes.

For the purpose of this calculation we have used the FSSR 16 runoff model - fixed percentage runoff, assuming larger rainfall depths.

#### Assumptions

1) Catchment Area = 17.5 Ha

2) SPR = 13.1 (obtained from FEH descriptors)

3) CWI = 103 (obtained from The SUDS Manual - Fig 4.4 for an annual average rainfall of 647mm)

4) Rainfall Depth (P) = 62.5mm (obtained through Windes modelling for the 100 year 360 minute storm)

### Results

The SUDS Manual - Box 4.3:

Percentage Runoff (PR<sub>RURAL</sub>) = SPR + DPR<sub>CWI</sub> + DPR<sub>RAIN</sub>

Where:

- DPR<sub>CWI</sub> = 0.25 x (CWI 125) = -5.5
- $DPR_{BAIN} = 0.45 (P 40)^{0.7} = 4.0$

Therefore:

 $PR_{RURAL} = 13.1 + (-5.5) + 4.0 = 11.6 \%$ 

The SUDS Manual - Section 4.2.2:

Runoff Volume = Percentage Runoff (PR) x Catchment Area x Rainfall Depth

 $= 0.116 \times 175,000 \times 0.0625$  $= 1,270 \text{ m}^3$ 

The above runoff volume represents the approximate existing greenfield runoff for the undeveloped Exemplar Site.

Assuming the proposed development is to be limited to the same runoff volume of 1,270m<sup>3</sup>, this would equate to the discharge volume from a developed area of approximately 25,400m<sup>2</sup> (2.5 Ha), assuming a PR of 80%.

### Appendix E

# FOUL WATER LOADINGS

7006-UA001881- Site Sewage Generation

Hyder		CALC	ULAT	IONS	DOCUMENT № 7006-UA001881-UP21B-03				
OFFICE				PROJECT TITLE	<u>.</u>				
CARDIFF	NW Bicester Eco Development								
SUBJECT				1				SHEET No	
Exemplar	Site Sewa	age Gener	ation Cale	culation				1 OF 2	2
ISSUE	TOTAL SHEETS	AUTHOR	DATE	CHECKED BY	DATE	COMMENTS			
1	2	DB	02/09/10	SD	02/09/10	SD	02/09/10		
2	2	DB	12/11/10	MP	12/11/10	SD	12/11/10		
3	2	DB	25/11/10	MP	25/11/10	SD	25/11/10		
4									
5									
SUPERSEDES	DOC No							DATE	
								J	
DESIGN B	ASIS STAT	EMENT (Inc	. sources of	info/data, ass	sumptions m	ade, standarc	ls, etc.)		

Water Demand:

Conventional Development Rates: Thames Water Guidelines for Undertaking Sewerage Modelling (November 2005)

residential buildings brief (4/11/2010) and Accommodation Schedule (29/10/1010).

Sustainable Development Rates:

Code For Sustainable Homes Technical Guide (May 2009 - Version 2) BREEAM Offices - Assessment Prediction Checklist

#### NW Bicester Eco Development 7006-UA001881-UP21B-03 Exemplar Site Sewage Generation Calculation

-

	Land Use	Area (m2)	Number of Properties	Total Population	Water Consumption (l/person[m2]/day)	Rainwater Harvesting Contribution (I/person[m2]/day)	Average Discharge (I/day)	Average Discharge (Vs)	Peak Discharge (l/s)	
	Residential		400	1151	80	12.00	105,928.80	3.68	22.07	]
	Social / Community	540	N/A	123	6.5	0.98	920.45	0.03	0.19	
	Commercial	3,610	N/A	820	6.5	0.98	6,153.41	0.21	1.28	
	Restaurant	300	N/A	68	162	24.30	12,702.27	0.44	2.65	
	Retail / Leisure	660	N/A	N/A	2.4	0.36	1,821.60	0.06	0.38	
	Education	1,110	N/A	139	48	7.20	7,659.00	0.27	1.60	
							135,185.54	4.69	28.16	
	Developm	ent Total	l				135,186	5	28	]
Assumptio	ns.									
Fastara	///3.									
Factors										
	Peaking Factor		6		[Conversion from	1 average discharge	rate to peak dischar	ge ratej		
	Infiltration		0%							
	Rainwater Harvest	ting	15%		[Additional contri	bution to foul discha	irge rates]			
Residential										
	Baseline for Conve	entional Developm	nent	150	l/person/day	IThames Water Gu	idelines for Underta	king Sewerage Mode	alling (November 20	05): General Housing - 600 l/property/dav]
	Sustainable Double	opmont		80	l/percon/day	[Code for Sustainal	ole Homes (Level 6)	ang concruge mou	aning (Horonibol 20	50). Contrar ricebing = 000 inproperty days
	Sustainable Devel	opment		80	(person/uay	CODE IOI SUSIAIIIAL	bie Hornes (Lever 6)]			
	Residential split									
		Affordable Private		123 270						
	Residents per pro	perty								
		Affordable Private		4.40						
	Water consumptio	n assumed to be	over an	8	hour day					
Commoroic	d (Officee / Heirdree	acom) and Casial	(Communitu							
Commercia	Deselies for Orea	and obciai	, community.		1 (n m m m / el m	There were the	islalis en fan Lindastal	in One Mad	line (Managhan 00	
	Baseline for Conve	entional Developm	ient	33	/person/day	[I names water Gu	idelines for Undertai	king Sewerage wool	alling (November 20	us): Onices = 750 #100m2/day (population density as below)]
	Sustainable Devel	opment		6.5	l/person/day	[BREEAM Offices :	2005 (16-24 points):	1.5m3 per person p	er year (assume 23	0 working days per year)]
	Staff density			4.4	m2/person	[The Workplace (H	ealth, Safety & Welf	are) Regulations 199	92: Minimum workin	g space = 11m3 (assume 2.5m high)]
	Water consumptio	n assumed to be	over an	8	hour day					
Restaurant	(Take-away / Pub)	):								
	Baseline for Conve	entional Developm	nent	270	l/person/day	[Thames Water Gu	idelines for Undertal	king Sewerage Mode	elling (November 20	05): Restaurant = 270 l/seat/day (population density as below)]
	Sustainable Devel	opment		162	l/person/day	[Assume 40% redu	ction from baseline]			
	Staff / customer de	ensity		4.4	m2/person	[Assumption - The	Workplace (Health,	Safety & Welfare) R	egulations 1992: Mi	nimum working space = 11m3 (assume 2.5m high)]
	Water consumptio	in assumed to be	over an	8	hour day					
Retail / Leis	sure:									
	Baseline for Conve	entional Developm	nent	4	l/m2/day	Thames Water Gu	idelines for Undertal	king Sewerage Mode	elling (November 20	05): Shopping Centre = 400 l/100m2/day]
	Sustainable Devel	opment		2.4	l/m2/dav	[Assume 40% redu	ction from baseline)			
	Water consumptio	n assumed to be	over an	8	hour day					
Educat										
Education:										
	Baseline for Conve	entional Developm	nent	80	l/person/day	[Thames Water Guidelines for Undertaking Sewerage Modelling (November 2005): School]				
	Sustainable Devel	opment		48	l/person/day	[Assume 40% redu	ction from baseline]			
	Pupil density			8	m2/pupil	[Assumption]				
	Water consumption	n assumed to be	over an	R	hour day					
				0						

Appendix F

# CORRESPONDENCE

TW email 23 Nov 2010

Subject: FW: NW Bicester eco-town - Kick-off meeting with Thames Water

-----Original Message-----From: Andrew.Forestiero@thameswater.co.uk [mailto:Andrew.Forestiero@thameswater.co.uk] Sent: 22 November 2010 23:13 To: Michael Pearson Cc: Angela.Barugh@thameswater.co.uk; Geoff.Nokes@thameswater.co.uk; Karl.Tuchscherer@thameswater.co.uk; Nick.Ayling@thameswater.co.uk; Pete.Pearce@thameswater.co.uk Subject: RE: NW Bicester eco-town - Kick-off meeting with Thames Water

Dear Mike,

Apologies for the delay in responding. Geoff Nokes made the following point in relation to the Exemplar site:

A Grampian condition will be imposed on this planned development to ensure that any identified reinforcement works will be carried out prior to occupation and thus avoid detrimental impact on our wastewater network. It should be possible to accommodate much of the Exemplar site without reinforcement but the trigger point will need to be identified prior to occupation and this will be the condition, especially as the Mid Level Sustainability Peak Discharge may have not yet been agreed on this first phase.

I understand that you are progressing matters with Karl regarding water network reinforcement.

Hope this helps.

Kind regards,

Andy

Andy Forestiero Customer Led Manager Developer Services 07747 642805 Int. 42805