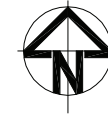




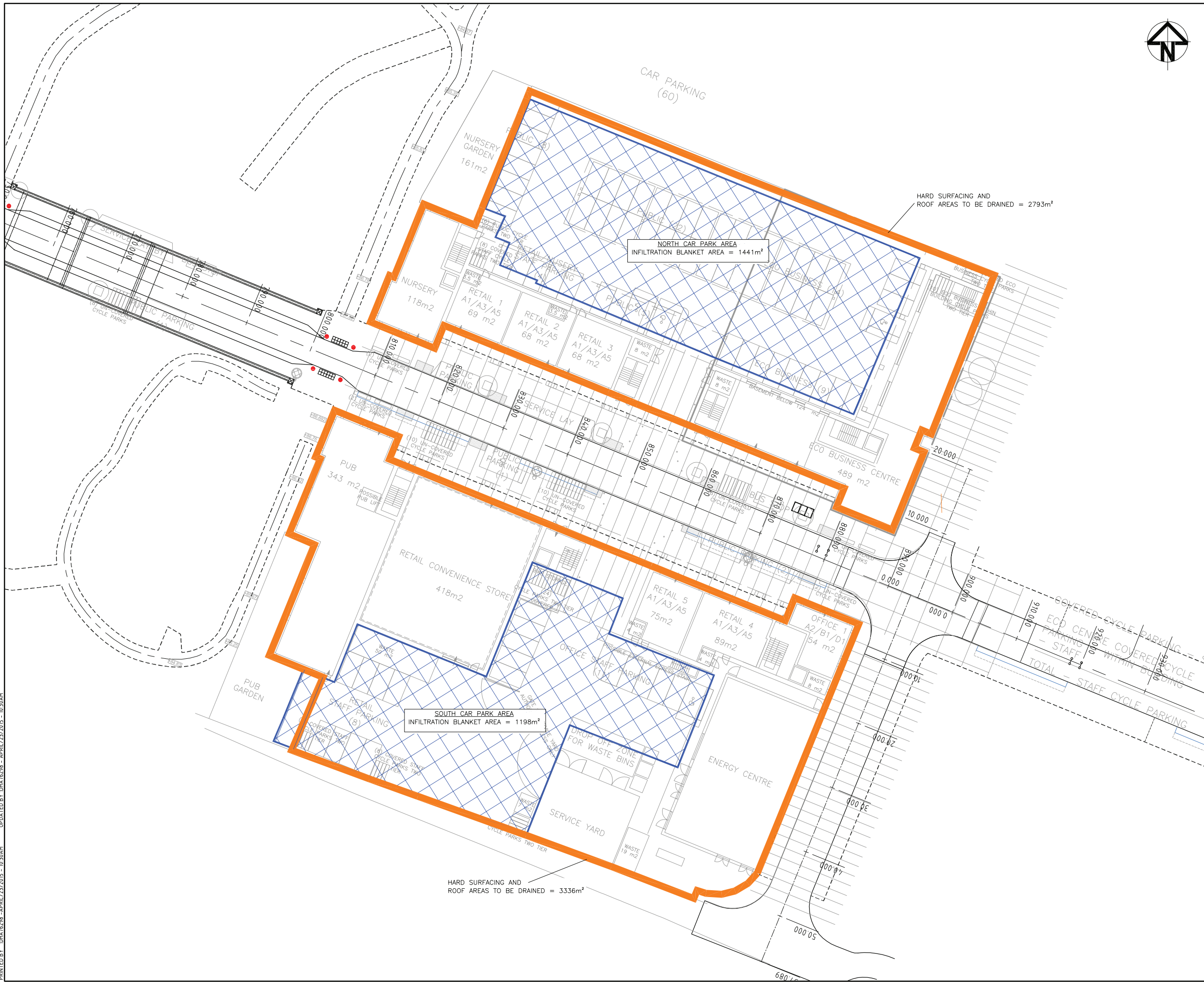
Proposed Updated Drainage Strategy for the Local Centre



LEGEND:

 INFILTRATION BLANKET

 AREAS OF HARD SURFACING AND ROOFS TO BE DRAINED



HARD SURFACING AND ROOF AREAS TO BE DRAINED = 2793m²

NORTH CAR PARK AREA
INFILTRATION BLANKET AREA = 1441m²

SOUTH CAR PARK AREA
INFILTRATION BLANKET AREA = 1198m²

HARD SURFACING AND ROOF AREAS TO BE DRAINED = 3336m²

NOTES:
1. DO NOT SCALE FROM THIS DRAWING. USE FIGURED DIMENSIONS ONLY.

A	FIRST ISSUE	20/04/15
Issue	Description	Date
PRELIMINARY		
Scale	1:250	Author D.HUGHES
Original Size	A1	Checker S.DAVIES
Height Datum	O.S.	Approver S.DAVIES
Grid	O.S.	© Copyright reserved

Client




Hyder Consulting (UK) Limited
HCL House
St. Mellons Business Park
Forlan Road, St Mellons
Cardiff
CF3 0EY
Tel: +44 029 20926700
Fax: +44 029 20925222

Project

BICESTER ECO DEVELOPMENT EXEMPLAR SITE

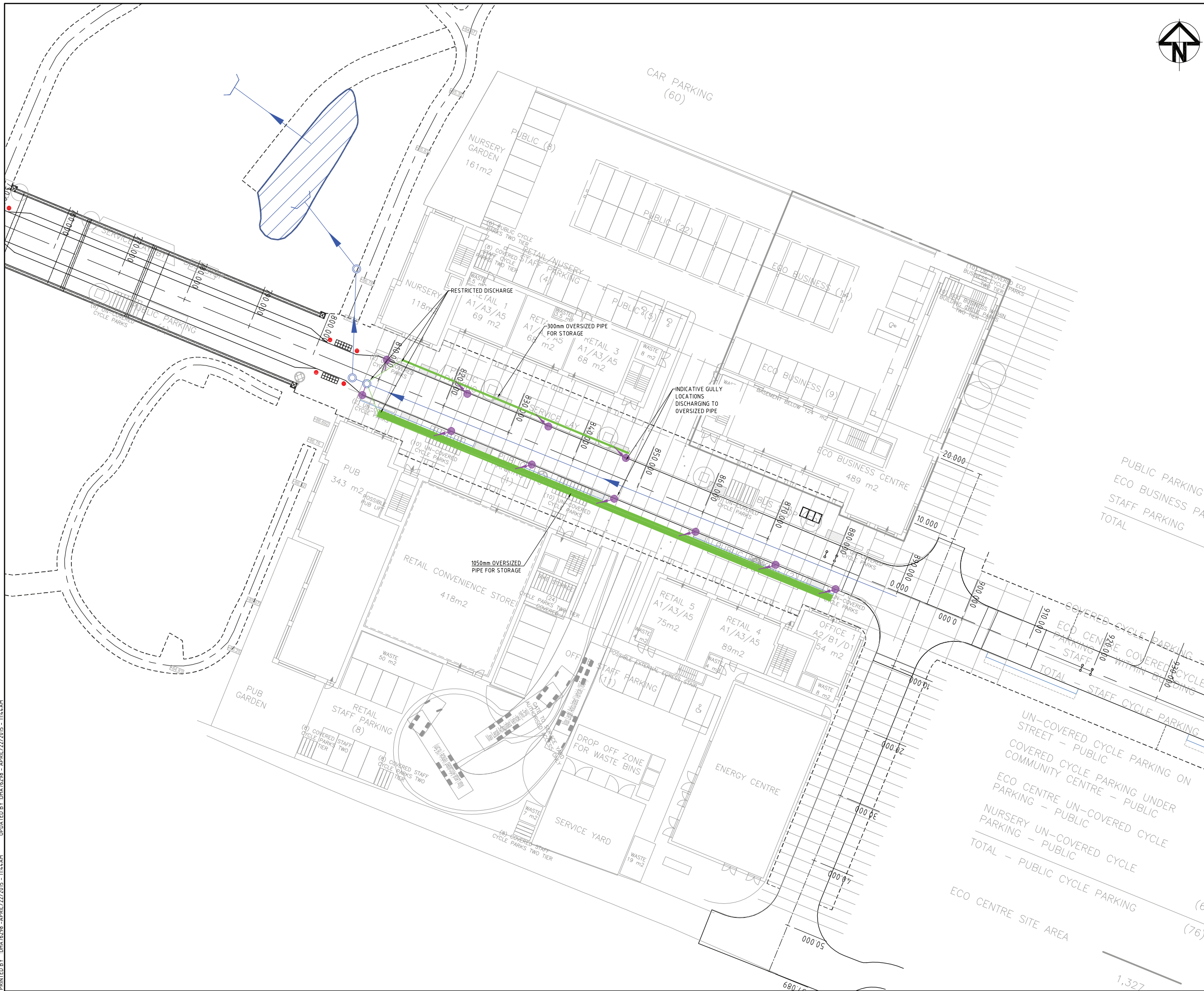
Title

COMMERCIAL CENTRE DRAINAGE STRATEGY PRIVATE AREAS

Drawing No. | Project No. | Issue
5200 — UA001881 — 01

CAD FILE: K:\UA001881_BicesterEco\E-DurDrawings\Current\Civil Engineering\5200-UA001881-UP210-01-DRAINAGE STRATEGY COMMERCIAL CENTRE.dwg
PRINTED BY: DHA16298 - APRIL/23/2015 - 10:30AM

CAD FILE: K:\UA001881_BicesterEco\E-DurDrawings\Current\Civil Engineering\5201-UA001881-UP210-01-DRAINAGE STRATEGY COMMERCIAL STREET.dwg
 PRINTED BY: DHA16298 - APRIL/22/2015 - 11:44 AM



KEY

- SURFACE WATER DRAINAGE
- OVERSIZED STORAGE PIPE
- INDICATIVE GULLY LOCATIONS
- HEADWALL
- SWALE

NOTES:
 1. DO NOT SCALE FROM THIS DRAWING. USE FIGURED DIMENSIONS ONLY.

Issue	Description	Date
A	FIRST ISSUE	20/04/15
PRELIMINARY		
Scale	1:250	Author D.HUGHES
Original Size	A1	Checker S.DAVIES
Height Datum	O.S.	Approver S.DAVIES
Grid	O.S.	© Copyright reserved

Client

Hyder Consulting (UK) Limited
 HCL House
 St. Mellons Business Park
 Forlan Road, St Mellons
 Cardiff, CF3 0EY
 Tel: +44 029 20926700
 Fax: +44 029 20925222

Project

BICESTER ECO DEVELOPMENT EXEMPLAR SITE

Title

COMMERCIAL STREET DRAINAGE STRATEGY

Drawing No.	Project No.	Issue
5201	UA001881	01

100mm on Original



CALCULATIONS

DOCUMENT No

7022-UA001881-UP21B-02

OFFICE

CARDIFF

PROJECT TITLE

NW Bicester Eco Development

SUBJECT

Commercial centre south - Soakaway Sizing Calculation

SHEET No

1 OF 5

ISSUE	TOTAL SHEETS	AUTHOR	DATE	CHECKED BY	DATE	APPROVED BY	DATE	COMMENTS
1	5	SJ	22/07/13	PJ	22/07/13	SAD	22/07/13	
2	5	DH	20/04/15	PJ	20/04/15	SAD	20/04/15	
3								
4								
5								

SUPERSEDES DOC No

DATE

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

Introduction

This calculation is intended to establish the size of the soakaway to drain the commercial centre south of the spine road.

The soakaway has been assessed as an infiltration blanket (1198m² in plan) using WinDES (an industry standard drainage design package produced by Microdrainage).


Assumptions

- 1) Contributing area from commercial buildings, energy centre and car park (Catchment area of 3336m²)
- 2) Car Park to have impermeable surface with permeable construction underneath
- 3) Ground infiltration rates are assumed to be 38mm/hr
- 4) Design to accommodate events up to and including 100 yr rainfall events with a 30% allowance for climate change
- 5) Infiltration blanket used, as defined by WinDES (void formed by a blanket filled with gravel or similar porous material - for the purpose of this model porosity assumed as 30%)
- 6) Infiltration through all sides and base of blanket
- 7) Factor of Safety of 10 applied to soakage rate
- 8) Inflow to soakaway is via car park gullies and rain water downpipes from buildings

Results

- Maximum water depth - 603 mm (960 minute winter storm)
- Half drain time - 1428 minutes

The results indicate that the soakaway can accommodate events up to and including 100yr + 30%CC without any flooding, and the half drain time of the system is less than the maximum recommended 1440 minutes (24 hours). Please refer to drawing 7711-UA001881-UP21D-01


Hyder Consulting UK Ltd		Page 1
HCL House Forttran Road St Mellons Business Park Cardiff CF3 0EY	Bicester Infiltration Blanket Calcs Car Park South	
Date April 2015 File CAR PARK SOUTH 100YR + ...	Designed by PJ Checked by	
XP Solutions	Source Control 2014.1	

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

Half Drain Time : 1428 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m ³)	Status
15 min Summer	86.721	0.221	1.3	79.3	O K
30 min Summer	86.788	0.288	1.3	103.5	O K
60 min Summer	86.856	0.356	1.3	128.0	O K
120 min Summer	86.922	0.422	1.3	151.5	O K
180 min Summer	86.956	0.456	1.3	163.7	O K
240 min Summer	86.976	0.476	1.3	171.1	O K
360 min Summer	87.001	0.501	1.3	179.8	O K
480 min Summer	87.014	0.514	1.3	184.6	O K
600 min Summer	87.020	0.520	1.3	186.9	O K
720 min Summer	87.023	0.523	1.3	187.7	O K
960 min Summer	87.018	0.518	1.3	186.1	O K
1440 min Summer	86.997	0.497	1.3	178.4	O K
2160 min Summer	86.966	0.466	1.3	167.3	O K
2880 min Summer	86.937	0.437	1.3	156.9	O K
4320 min Summer	86.883	0.383	1.3	137.7	O K
5760 min Summer	86.834	0.334	1.3	120.0	O K
7200 min Summer	86.789	0.289	1.3	103.7	O K
8640 min Summer	86.747	0.247	1.3	88.8	O K
10080 min Summer	86.710	0.210	1.3	75.4	O K
15 min Winter	86.748	0.248	1.3	88.9	O K


Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Time-Peak (mins)
15 min Summer	128.285	0.0	19
30 min Summer	84.226	0.0	34
60 min Summer	52.662	0.0	64
120 min Summer	31.800	0.0	124
180 min Summer	23.353	0.0	184
240 min Summer	18.644	0.0	242
360 min Summer	13.543	0.0	362
480 min Summer	10.792	0.0	482
600 min Summer	9.043	0.0	602
720 min Summer	7.823	0.0	722
960 min Summer	6.219	0.0	960
1440 min Summer	4.493	0.0	1226
2160 min Summer	3.241	0.0	1584
2880 min Summer	2.568	0.0	1988
4320 min Summer	1.847	0.0	2808
5760 min Summer	1.461	0.0	3584
7200 min Summer	1.217	0.0	4392
8640 min Summer	1.048	0.0	5104
10080 min Summer	0.923	0.0	5848
15 min Winter	128.285	0.0	19

Hyder Consulting UK Ltd		Page 2
HCL House Fortran Road St Mellons Business Park Cardiff CF3 0EY	Bicester Infiltration Blanket Calcs Car Park South	
Date April 2015 File CAR PARK SOUTH 100YR + ...	Designed by PJ Checked by	
XP Solutions	Source Control 2014.1	

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

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m ³)	Status
30 min Winter	86.823	0.323	1.3	116.2	O K
60 min Winter	86.900	0.400	1.3	143.8	O K
120 min Winter	86.975	0.475	1.3	170.6	O K
180 min Winter	87.015	0.515	1.3	184.8	O K
240 min Winter	87.039	0.539	1.3	193.5	O K
360 min Winter	87.069	0.569	1.3	204.4	O K
480 min Winter	87.087	0.587	1.3	210.7	O K
600 min Winter	87.097	0.597	1.3	214.3	O K
720 min Winter	87.102	0.602	1.3	216.2	O K
960 min Winter	87.103	0.603	1.3	216.5	O K
1440 min Winter	87.084	0.584	1.3	209.9	O K
2160 min Winter	87.043	0.543	1.3	195.0	O K
2880 min Winter	87.004	0.504	1.3	181.1	O K
4320 min Winter	86.926	0.426	1.3	152.9	O K
5760 min Winter	86.851	0.351	1.3	126.1	O K
7200 min Winter	86.783	0.283	1.3	101.5	O K
8640 min Winter	86.721	0.221	1.3	79.3	O K
10080 min Winter	86.667	0.167	1.3	59.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Time-Peak (mins)
30 min Winter	84.226	0.0	33
60 min Winter	52.662	0.0	64
120 min Winter	31.800	0.0	122
180 min Winter	23.353	0.0	180
240 min Winter	18.644	0.0	240
360 min Winter	13.543	0.0	356
480 min Winter	10.792	0.0	474
600 min Winter	9.043	0.0	590
720 min Winter	7.823	0.0	704
960 min Winter	6.219	0.0	932
1440 min Winter	4.493	0.0	1368
2160 min Winter	3.241	0.0	1708
2880 min Winter	2.568	0.0	2160
4320 min Winter	1.847	0.0	3064
5760 min Winter	1.461	0.0	3912
7200 min Winter	1.217	0.0	4688
8640 min Winter	1.048	0.0	5448
10080 min Winter	0.923	0.0	6152

Hyder Consulting UK Ltd		Page 3
HCL House Forttran Road St Mellons Business Park Cardiff CF3 0EY	Bicester Infiltration Blanket Calcs Car Park South	
Date April 2015 File CAR PARK SOUTH 100YR + ...	Designed by PJ Checked by	
XP Solutions	Source Control 2014.1	


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

Time Area Diagram

Total Area (ha) 0.334

Time (mins)		Area
From:	To:	(ha)
0	4	0.334

Hyder Consulting UK Ltd		Page 4
HCL House Fortran Road St Mellons Business Park Cardiff CF3 0EY	Bicester Infiltration Blanket Calcs Car Park South	
Date April 2015	Designed by PJ	
File CAR PARK SOUTH 100YR + ...	Checked by	
XP Solutions	Source Control 2014.1	

Model Details

Storage is Online Cover Level (m) 88.500

Infiltration Blanket Structure

Infiltration Coefficient Base (m/hr)	0.03800	Diameter/Width (m)	34.6
Safety Factor	10.0	Length (m)	34.6
Porosity	0.30	Cap Volume Depth (m)	1.000
Invert Level (m)	86.500		



CALCULATIONS

DOCUMENT No

7023-UA001881-UP21B-01

OFFICE

CARDIFF

PROJECT TITLE

NW Bicester Eco Development

SUBJECT

Commercial centre north - Soakaway Sizing Calculation

SHEET No

1 OF 5

ISSUE	TOTAL SHEETS	AUTHOR	DATE	CHECKED BY	DATE	APPROVED BY	DATE	COMMENTS
1	5	DH	20/04/15	PJ	20/04/15	SAD	20/04/15	
2								
3								
4								
5								

SUPERSEDES DOC No

DATE

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

Introduction

This calculation is intended to establish the size of the soakaway to drain the commercial centre north of the spine road.

The soakaway has been assessed as an infiltration blanket (1441m² in plan) using WinDES (an industry standard drainage design package produced by Microdrainage).


Assumptions

- 1) Contributing area from commercial buildings, energy centre and car park (Catchment area of 2793m²)
- 2) Car Park to have impermeable surface with permeable construction underneath
- 3) Ground infiltration rates are assumed to be 38mm/hr
- 4) Design to accommodate events up to and including 100 yr rainfall events with a 30% allowance for climate change
- 5) Infiltration blanket used, as defined by WinDES (void formed by a blanket filled with gravel or similar porous material - for the purpose of this model porosity assumed as 30%)
- 6) Infiltration through all sides and base of blanket
- 7) Factor of Safety of 10 applied to soakage rate
- 8) Inflow to soakaway is via car park gullies and rain water downpipes from buildings

Results

- Maximum water depth - 390 mm (960 minute winter storm)
- Half drain time - 931 minutes

The results indicate that the soakaway can accommodate events up to and including 100yr + 30%CC without any flooding, and the half drain time of the system is less than the maximum recommended 1440 minutes (24 hours). Please refer to drawing 7711-UA001881-UP21D-01


Hyder Consulting UK Ltd		Page 1
HCL House Fortran Road St Mellons Business Park Cardiff CF3 0EY	Bicester Infiltration Blanket Calcs Car Park North	
Date April 2015 File Car Park North.srcx	Designed by PJ Checked by	
XP Solutions	Source Control 2014.1	

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

Half Drain Time : 931 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m ³)	Status
15 min Summer	84.654	0.154	1.5	66.2	O K
30 min Summer	84.700	0.200	1.5	86.2	O K
60 min Summer	84.746	0.246	1.5	106.2	O K
120 min Summer	84.789	0.289	1.5	124.7	O K
180 min Summer	84.811	0.311	1.5	133.8	O K
240 min Summer	84.822	0.322	1.5	138.8	O K
360 min Summer	84.834	0.334	1.5	143.9	O K
480 min Summer	84.838	0.338	1.5	145.6	O K
600 min Summer	84.837	0.337	1.5	145.3	O K
720 min Summer	84.834	0.334	1.5	143.7	O K
960 min Summer	84.825	0.325	1.5	140.0	O K
1440 min Summer	84.807	0.307	1.5	132.4	O K
2160 min Summer	84.781	0.281	1.5	121.0	O K
2880 min Summer	84.755	0.255	1.5	110.0	O K
4320 min Summer	84.709	0.209	1.5	89.9	O K
5760 min Summer	84.668	0.168	1.5	72.4	O K
7200 min Summer	84.634	0.134	1.5	57.6	O K
8640 min Summer	84.605	0.105	1.5	45.4	O K
10080 min Summer	84.583	0.083	1.5	35.8	O K
15 min Winter	84.672	0.172	1.5	74.2	O K


Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Time-Peak (mins)
15 min Summer	128.285	0.0	19
30 min Summer	84.226	0.0	34
60 min Summer	52.662	0.0	64
120 min Summer	31.800	0.0	122
180 min Summer	23.353	0.0	182
240 min Summer	18.644	0.0	242
360 min Summer	13.543	0.0	362
480 min Summer	10.792	0.0	480
600 min Summer	9.043	0.0	600
720 min Summer	7.823	0.0	702
960 min Summer	6.219	0.0	808
1440 min Summer	4.493	0.0	1050
2160 min Summer	3.241	0.0	1452
2880 min Summer	2.568	0.0	1848
4320 min Summer	1.847	0.0	2640
5760 min Summer	1.461	0.0	3400
7200 min Summer	1.217	0.0	4112
8640 min Summer	1.048	0.0	4832
10080 min Summer	0.923	0.0	5448
15 min Winter	128.285	0.0	19

Hyder Consulting UK Ltd		Page 2
HCL House Fortran Road St Mellons Business Park Cardiff CF3 0EY	Bicester Infiltration Blanket Calcs Car Park North	
Date April 2015 File Car Park North.srcx	Designed by PJ Checked by	
XP Solutions		Source Control 2014.1

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

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m ³)	Status
30 min Winter	84.725	0.225	1.5	96.8	O K
60 min Winter	84.777	0.277	1.5	119.4	O K
120 min Winter	84.826	0.326	1.5	140.7	O K
180 min Winter	84.851	0.351	1.5	151.4	O K
240 min Winter	84.866	0.366	1.5	157.5	O K
360 min Winter	84.881	0.381	1.5	164.2	O K
480 min Winter	84.888	0.388	1.5	167.2	O K
600 min Winter	84.890	0.390	1.5	168.0	O K
720 min Winter	84.888	0.388	1.5	167.3	O K
960 min Winter	84.879	0.379	1.5	163.5	O K
1440 min Winter	84.855	0.355	1.5	153.1	O K
2160 min Winter	84.819	0.319	1.5	137.3	O K
2880 min Winter	84.781	0.281	1.5	121.1	O K
4320 min Winter	84.711	0.211	1.5	90.7	O K
5760 min Winter	84.650	0.150	1.5	64.6	O K
7200 min Winter	84.601	0.101	1.5	43.5	O K
8640 min Winter	84.566	0.066	1.5	28.4	O K
10080 min Winter	84.549	0.049	1.5	21.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Time-Peak (mins)
30 min Winter	84.226	0.0	33
60 min Winter	52.662	0.0	62
120 min Winter	31.800	0.0	122
180 min Winter	23.353	0.0	180
240 min Winter	18.644	0.0	238
360 min Winter	13.543	0.0	354
480 min Winter	10.792	0.0	470
600 min Winter	9.043	0.0	582
720 min Winter	7.823	0.0	694
960 min Winter	6.219	0.0	904
1440 min Winter	4.493	0.0	1126
2160 min Winter	3.241	0.0	1580
2880 min Winter	2.568	0.0	2020
4320 min Winter	1.847	0.0	2852
5760 min Winter	1.461	0.0	3584
7200 min Winter	1.217	0.0	4256
8640 min Winter	1.048	0.0	4840
10080 min Winter	0.923	0.0	5240

Hyder Consulting UK Ltd		Page 3
HCL House Forttran Road St Mellons Business Park Cardiff CF3 0EY	Bicester Infiltration Blanket Calcs Car Park North	
Date April 2015 File Car Park North.srcx	Designed by PJ Checked by	
XP Solutions	Source Control 2014.1	


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

Time Area Diagram

Total Area (ha) 0.280

Time (mins)		Area
From:	To:	(ha)
0	4	0.280


Hyder Consulting UK Ltd		Page 4
HCL House Fortran Road St Mellons Business Park Cardiff CF3 0EY	Bicester Infiltration Blanket Calcs Car Park North	
Date April 2015 File Car Park North.srcx	Designed by PJ Checked by	
XP Solutions	Source Control 2014.1	

Model Details

Storage is Online Cover Level (m) 86.500

Infiltration Blanket Structure


Infiltration Coefficient Base (m/hr)	0.03800	Diameter/Width (m)	37.9
Safety Factor	10.0	Length (m)	37.9
Porosity	0.30	Cap Volume Depth (m)	1.000
Invert Level (m)	84.500		

Hyder Consulting UK Ltd		Page 1
HCL House Forttran Road St Mellons Business Park Cardiff CF3 0EY	Bicester Commercial Centre Oversized Pipe 300mm	
Date Apr 15 File Oversized pipe 300mm.srcx	Designed by DH Checked by	
XP Solutions	Source Control 2014.1	

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m ³)	Status
15 min Summer	85.667	1.042	3.9	3.5	O K
30 min Summer	85.817	1.192	4.0	3.7	O K
60 min Summer	85.283	0.658	3.9	3.1	O K
120 min Summer	84.862	0.237	3.8	2.0	O K
180 min Summer	84.793	0.168	3.5	1.2	O K
240 min Summer	84.752	0.127	3.3	0.8	O K
360 min Summer	84.719	0.094	2.6	0.4	O K
480 min Summer	84.703	0.078	2.2	0.3	O K
600 min Summer	84.694	0.069	1.8	0.2	O K
720 min Summer	84.688	0.063	1.6	0.2	O K
960 min Summer	84.679	0.054	1.3	0.2	O K
1440 min Summer	84.670	0.045	0.9	0.1	O K
2160 min Summer	84.662	0.037	0.7	0.1	O K
2880 min Summer	84.658	0.033	0.5	0.1	O K
4320 min Summer	84.653	0.028	0.4	0.0	O K
5760 min Summer	84.650	0.025	0.3	0.0	O K
7200 min Summer	84.647	0.022	0.3	0.0	O K
8640 min Summer	84.646	0.021	0.2	0.0	O K
10080 min Summer	84.644	0.019	0.2	0.0	O K
15 min Winter	86.175	1.550	4.3	4.0	O K
30 min Winter	86.232	1.607	4.4	4.1	O K


Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Discharge Volume (m ³)	Time-Peak (mins)
15 min Summer	128.285	0.0	6.0	14
30 min Summer	84.226	0.0	7.9	22
60 min Summer	52.662	0.0	9.9	40
120 min Summer	31.800	0.0	11.9	70
180 min Summer	23.353	0.0	13.1	100
240 min Summer	18.644	0.0	14.0	128
360 min Summer	13.543	0.0	15.2	186
480 min Summer	10.792	0.0	16.2	246
600 min Summer	9.043	0.0	17.0	306
720 min Summer	7.823	0.0	17.6	366
960 min Summer	6.219	0.0	18.7	484
1440 min Summer	4.493	0.0	20.2	734
2160 min Summer	3.241	0.0	21.9	1100
2880 min Summer	2.568	0.0	23.1	1468
4320 min Summer	1.847	0.0	24.9	2184
5760 min Summer	1.461	0.0	26.3	2888
7200 min Summer	1.217	0.0	27.4	3672
8640 min Summer	1.048	0.0	28.3	4360
10080 min Summer	0.923	0.0	29.1	5056
15 min Winter	128.285	0.0	6.7	14
30 min Winter	84.226	0.0	8.8	23

Hyder Consulting UK Ltd		Page 2
HCL House Forttran Road St Mellons Business Park Cardiff CF3 0EY	Bicester Commercial Centre Oversized Pipe 300mm	
Date Apr 15 File Oversized pipe 300mm.srcx	Designed by DH Checked by	
XP Solutions	Source Control 2014.1	

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m ³)	Status
60 min Winter	85.480	0.855	3.9	3.3	O K
120 min Winter	84.823	0.198	3.7	1.6	O K
180 min Winter	84.747	0.122	3.2	0.7	O K
240 min Winter	84.720	0.095	2.7	0.5	O K
360 min Winter	84.698	0.073	2.0	0.3	O K
480 min Winter	84.687	0.062	1.6	0.2	O K
600 min Winter	84.681	0.056	1.3	0.2	O K
720 min Winter	84.676	0.051	1.2	0.1	O K
960 min Winter	84.670	0.045	0.9	0.1	O K
1440 min Winter	84.662	0.037	0.7	0.1	O K
2160 min Winter	84.656	0.031	0.5	0.1	O K
2880 min Winter	84.653	0.028	0.4	0.0	O K
4320 min Winter	84.648	0.023	0.3	0.0	O K
5760 min Winter	84.646	0.021	0.2	0.0	O K
7200 min Winter	84.644	0.019	0.2	0.0	O K
8640 min Winter	84.643	0.018	0.2	0.0	O K
10080 min Winter	84.641	0.016	0.1	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Discharge Volume (m ³)	Time-Peak (mins)
60 min Winter	52.662	0.0	11.1	42
120 min Winter	31.800	0.0	13.4	72
180 min Winter	23.353	0.0	14.7	98
240 min Winter	18.644	0.0	15.7	126
360 min Winter	13.543	0.0	17.1	184
480 min Winter	10.792	0.0	18.1	246
600 min Winter	9.043	0.0	19.0	306
720 min Winter	7.823	0.0	19.7	360
960 min Winter	6.219	0.0	20.9	488
1440 min Winter	4.493	0.0	22.6	734
2160 min Winter	3.241	0.0	24.5	1064
2880 min Winter	2.568	0.0	25.9	1432
4320 min Winter	1.847	0.0	27.9	2168
5760 min Winter	1.461	0.0	29.4	2896
7200 min Winter	1.217	0.0	30.7	3600
8640 min Winter	1.048	0.0	31.7	4320
10080 min Winter	0.923	0.0	32.6	4960

Hyder Consulting UK Ltd		Page 3
HCL House Fortran Road St Mellons Business Park Cardiff CF3 0EY	Bicester Commercial Centre Oversized Pipe 300mm	
Date Apr 15 File Oversized pipe 300mm.srcx	Designed by DH Checked by	
XP Solutions	Source Control 2014.1	


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

Time Area Diagram

Total Area (ha) 0.025

Time (mins)		Area
From:	To:	(ha)
0	4	0.025

Hyder Consulting UK Ltd		Page 4
HCL House Forttran Road St Mellons Business Park Cardiff CF3 0EY	Bicester Commercial Centre Oversized Pipe 300mm	
Date Apr 15 File Oversized pipe 300mm.srcx	Designed by DH Checked by	
XP Solutions	Source Control 2014.1	

Model Details

Storage is Online Cover Level (m) 88.060

Pipe Structure

Diameter (m) 0.300 Length (m) 35.000
Slope (1:X) 500.000 Invert Level (m) 84.625


Hydro-Brake Optimum® Outflow Control

Unit Reference MD-SHE-0090-4000-1300-4000
Design Head (m) 1.300
Design Flow (l/s) 4.0
Flush-Flo™ Calculated
Objective Minimise upstream storage
Diameter (mm) 90
Invert Level (m) 84.625
Minimum Outlet Pipe Diameter (mm) 150
Suggested Manhole Diameter (mm) 1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.300	4.0
Flush-Flo™	0.390	4.0
Kick-Flo®	0.794	3.2
Mean Flow over Head Range	-	3.5

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake Optimum® as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated


Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	2.8	1.200	3.8	3.000	5.9	7.000	8.8
0.200	3.7	1.400	4.1	3.500	6.3	7.500	9.1
0.300	3.9	1.600	4.4	4.000	6.7	8.000	9.3
0.400	4.0	1.800	4.6	4.500	7.1	8.500	9.6
0.500	3.9	2.000	4.9	5.000	7.5	9.000	9.9
0.600	3.8	2.200	5.1	5.500	7.8	9.500	10.1
0.800	3.2	2.400	5.3	6.000	8.2		
1.000	3.5	2.600	5.5	6.500	8.5		

Hyder Consulting UK Ltd		Page 1
HCL House Forttran Road St Mellons Business Park Cardiff CF3 0EY	Bicester Commercial Centre 1050mm Pipe	
Date Apr 15 File Oversized pipe 1050mm a...	Designed by DH Checked by	
XP Solutions	Source Control 2014.1	

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m ³)	Status
15 min Summer	85.205	0.580	1.7	30.8	O K
30 min Summer	85.322	0.697	1.7	39.9	O K
60 min Summer	85.433	0.808	1.7	48.0	O K
120 min Summer	85.516	0.891	1.7	53.6	O K
180 min Summer	85.533	0.908	1.7	54.7	O K
240 min Summer	85.521	0.896	1.7	54.0	O K
360 min Summer	85.482	0.857	1.7	51.4	O K
480 min Summer	85.450	0.825	1.7	49.2	O K
600 min Summer	85.422	0.797	1.7	47.2	O K
720 min Summer	85.397	0.772	1.7	45.4	O K
960 min Summer	85.350	0.725	1.7	41.9	O K
1440 min Summer	85.261	0.636	1.7	35.1	O K
2160 min Summer	85.117	0.492	1.7	24.0	O K
2880 min Summer	84.999	0.374	1.7	15.4	O K
4320 min Summer	84.843	0.218	1.7	5.6	O K
5760 min Summer	84.758	0.133	1.5	1.9	O K
7200 min Summer	84.711	0.086	1.4	0.7	O K
8640 min Summer	84.697	0.072	1.2	0.4	O K
10080 min Summer	84.688	0.063	1.0	0.3	O K
15 min Winter	85.256	0.631	1.7	34.8	O K
30 min Winter	85.392	0.767	1.7	45.0	O K


Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Discharge Volume (m ³)	Time-Peak (mins)
15 min Summer	128.285	0.0	33.0	26
30 min Summer	84.226	0.0	43.3	40
60 min Summer	52.662	0.0	54.1	68
120 min Summer	31.800	0.0	65.3	126
180 min Summer	23.353	0.0	72.0	182
240 min Summer	18.644	0.0	76.6	240
360 min Summer	13.543	0.0	83.5	304
480 min Summer	10.792	0.0	88.7	366
600 min Summer	9.043	0.0	92.9	432
720 min Summer	7.823	0.0	96.5	502
960 min Summer	6.219	0.0	102.2	642
1440 min Summer	4.493	0.0	110.8	916
2160 min Summer	3.241	0.0	119.9	1296
2880 min Summer	2.568	0.0	126.7	1640
4320 min Summer	1.847	0.0	136.7	2296
5760 min Summer	1.461	0.0	144.1	2944
7200 min Summer	1.217	0.0	150.1	3656
8640 min Summer	1.048	0.0	155.0	4400
10080 min Summer	0.923	0.0	159.4	5072
15 min Winter	128.285	0.0	36.9	26
30 min Winter	84.226	0.0	48.5	39

Hyder Consulting UK Ltd		Page 2
HCL House Forttran Road St Mellons Business Park Cardiff CF3 0EY	Bicester Commercial Centre 1050mm Pipe	
Date Apr 15 File Oversized pipe 1050mm a...	Designed by DH Checked by	
XP Solutions	Source Control 2014.1	

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m ³)	Status
60 min Winter	85.529	0.904	1.7	54.5	O K
120 min Winter	85.661	1.036	1.8	61.5	O K
180 min Winter	85.719	1.094	1.8	63.4	O K
240 min Winter	85.709	1.084	1.8	63.2	O K
360 min Winter	85.638	1.013	1.8	60.5	O K
480 min Winter	85.582	0.957	1.7	57.6	O K
600 min Winter	85.538	0.913	1.7	55.0	O K
720 min Winter	85.498	0.873	1.7	52.5	O K
960 min Winter	85.424	0.799	1.7	47.4	O K
1440 min Winter	85.287	0.662	1.7	37.2	O K
2160 min Winter	85.064	0.439	1.7	20.1	O K
2880 min Winter	84.900	0.275	1.7	8.9	O K
4320 min Winter	84.735	0.110	1.5	1.2	O K
5760 min Winter	84.698	0.073	1.2	0.5	O K
7200 min Winter	84.685	0.060	1.0	0.3	O K
8640 min Winter	84.678	0.053	0.9	0.2	O K
10080 min Winter	84.673	0.048	0.7	0.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Discharge Volume (m ³)	Time-Peak (mins)
60 min Winter	52.662	0.0	60.6	68
120 min Winter	31.800	0.0	73.2	124
180 min Winter	23.353	0.0	80.6	180
240 min Winter	18.644	0.0	85.8	236
360 min Winter	13.543	0.0	93.5	338
480 min Winter	10.792	0.0	99.4	384
600 min Winter	9.043	0.0	104.1	462
720 min Winter	7.823	0.0	108.0	540
960 min Winter	6.219	0.0	114.5	694
1440 min Winter	4.493	0.0	124.1	994
2160 min Winter	3.241	0.0	134.3	1364
2880 min Winter	2.568	0.0	141.9	1672
4320 min Winter	1.847	0.0	153.1	2248
5760 min Winter	1.461	0.0	161.4	2872
7200 min Winter	1.217	0.0	168.1	3624
8640 min Winter	1.048	0.0	173.7	4264
10080 min Winter	0.923	0.0	178.5	4992

Hyder Consulting UK Ltd		Page 3
HCL House Forttran Road St Mellons Business Park Cardiff CF3 0EY	Bicester Commercial Centre 1050mm Pipe	
Date Apr 15 File Oversized pipe 1050mm a...	Designed by DH Checked by	
XP Solutions	Source Control 2014.1	


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

Time Area Diagram

Total Area (ha) 0.137

Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)
From:	To:	From:	To:	From:	To:
0	4	4	8	8	12
	0.046		0.046		0.046

Hyder Consulting UK Ltd		Page 4
HCL House Forttran Road St Mellons Business Park Cardiff CF3 0EY	Bicester Commercial Centre 1050mm Pipe	
Date Apr 15 File Oversized pipe 1050mm a...	Designed by DH Checked by	
XP Solutions	Source Control 2014.1	

Model Details

Storage is Online Cover Level (m) 88.060

Pipe Structure

Diameter (m) 1.050 Length (m) 73.000
Slope (1:X) 500.000 Invert Level (m) 84.625

Hydro-Brake Optimum® Outflow Control

Unit Reference MD-SHE-0063-2000-1300-2000
Design Head (m) 1.300
Design Flow (l/s) 2.0
Flush-Flo™ Calculated
Objective Minimise upstream storage
Diameter (mm) 63
Invert Level (m) 84.625
Minimum Outlet Pipe Diameter (mm) 100
Suggested Manhole Diameter (mm) 1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.300	2.0
Flush-Flo™	0.280	1.7
Kick-Flo®	0.564	1.4
Mean Flow over Head Range	-	1.6

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake Optimum® as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	1.4	1.200	1.9	3.000	2.9	7.000	4.4
0.200	1.7	1.400	2.1	3.500	3.2	7.500	4.5
0.300	1.7	1.600	2.2	4.000	3.4	8.000	4.6
0.400	1.6	1.800	2.3	4.500	3.5	8.500	4.8
0.500	1.5	2.000	2.4	5.000	3.7	9.000	4.9
0.600	1.4	2.200	2.5	5.500	3.9	9.500	5.0
0.800	1.6	2.400	2.6	6.000	4.1		
1.000	1.8	2.600	2.7	6.500	4.2		