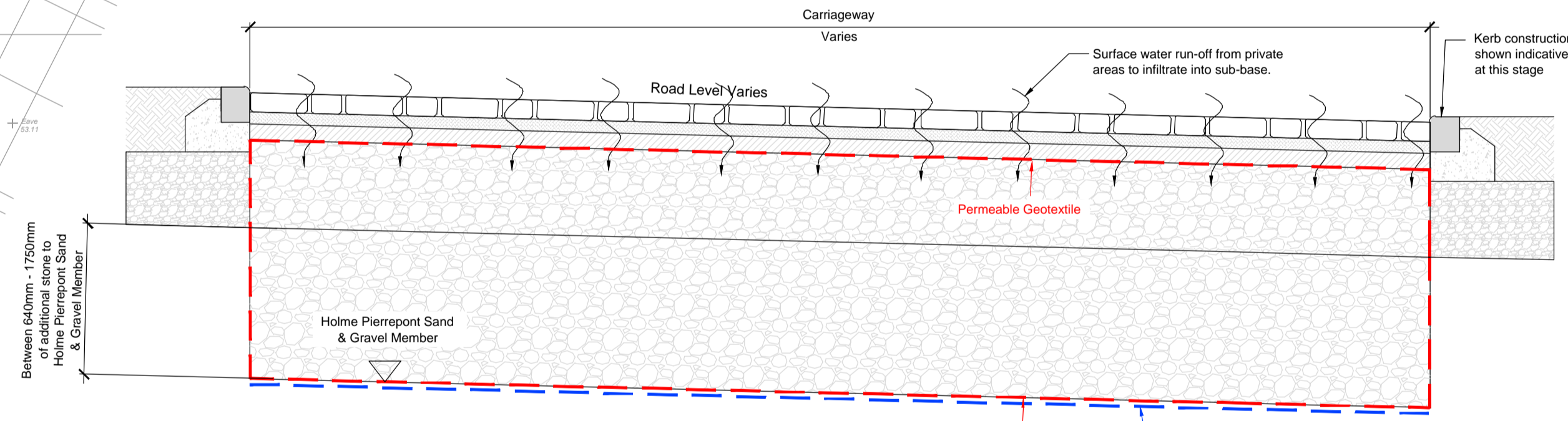
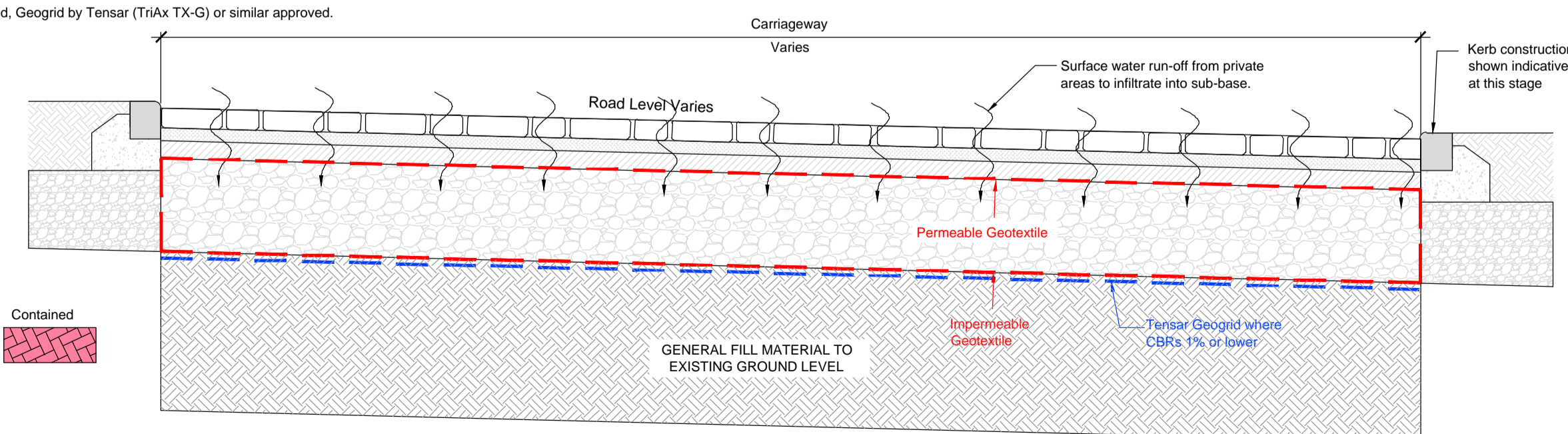


Typical Section Showing RWP Connection into Permeable Sub-base material
Scale 1:20



Typical Section Through Private Access Showing Permeable Paving in Areas of Infiltration
Scale 1:20

Carriageway Construction - Private Accessways & Driveways (Permeable)
60mm Permeable Paving Blockwork. Colour Brindle laid in herringbone pattern
30mm Laying Course 2/6.3mm clean crushed stone (no fines) to BS EN 13242:2002.
70mm 28mm size dense basecourse in accordance with clause 4.7, table 3&4 of BS4987:2001 punctured/coared at 750mm centres (75mmØ holes)
Permeable geotextile e.g. Charcon Permafilter or similar approved.
400mm Min. (Stone depth dictated by attenuation requirements) coarse graded aggregate type 4/20 to BS EN 13242:2002. For a soaked CBR greater than 1%. (For a soaked CBR value lower than 1% add 100mm).
Stone depth to be increased in infiltration areas of made ground and clay strata by the following amounts:
SA1 + 640mm Stone
SA2 + between 640mm & 1750mm stone
SA3 + 1040mm stone.
Permeable geotextile eg Charcon Permafilter or similar approved, in areas of good infiltration.
If required, Geogrid by Tensar (TriAx TX-G) or similar approved.



Typical Section Through Private Access Showing Permeable Paving in Contained Areas
Scale 1:20

Carriageway Construction - Private Accessways & Driveways (Permeable)
60mm Permeable Paving Blockwork. Colour Brindle laid in herringbone pattern
30mm Laying Course 2/6.3mm clean crushed stone (no fines) to BS EN 13242:2002.
70mm 28mm size dense basecourse in accordance with clause 4.7, table 3&4 of BS4987:2001 punctured/coared at 750mm centres (75mmØ holes)
Permeable geotextile e.g. Charcon Permafilter or similar approved.
400mm Min. (Stone depth dictated by attenuation requirements) coarse graded aggregate type 4/20 to BS EN 13242:2002. For a soaked CBR greater than 1%. (For a soaked CBR value lower than 1% add 100mm).
Provide Impermeable geotextile e.g. Charcon Geomembrane Polypropylene Membrane or similar approved placed at formation level in contained areas.
If required, Geogrid by Tensar (TriAx TX-G) or similar approved.

ASSOCIATED DRAWINGS

No.	TITLE

NOTES

DRAINAGE KEY
Proposed Foul Water Manhole (STW Adopted)
Proposed Foul Water Inspection Chamber (450mmØ) (private)
Proposed Foul Water Sewer (Private)

SURFACE WATER DRAINAGE CALCULATIONS HAVE BEEN BASED UPON A WORST CASE DRAFT INFILTRATION RATE OF 3.70x10-6 m/s (0.1332 m/hr) PROVIDED BY GRM DEVELOPMENT SOLUTIONS.

REV	DATE	BY	DETAILS	CHKD
A	07.03.18	BC	Permeable drive specifications amended to suit requirements of preliminary ground investigation by GRM Development Solutions, Letter Report Dated 16th Feb 18, Ref P8312_SAR_Let1	JMcK

AMENDMENTS

CLIENT
Urban Designs Ltd


PROJECT
Residential Development
Shobnall Street
Burton Upon Trent
Staffordshire

TITLE
Proposed Drainage Strategy

DRAWING No: MA10811 / 200
DRAWING STATUS: PLANNING

SCALE	DRAWN	ENGINEER
1:250 (A1)	BC	BC

DATE	CHECKED	APPROVED BY
February 2018	JMcK	JMcK


The Millward Partnership		Page 1
1 Malin Hill Nottingham NG1 1JQ	Residential Development Shobnall Street, Burton Upon Trent	
Date 01/02/2018 File SAL.srcx	Designed by BC Checked by JMcK	
XP Solutions		Source Control 2017.1.2

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

Half Drain Time : 514 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m ³)	Status
15 min Summer	46.678	0.178	0.2	4.6	O K
30 min Summer	46.729	0.229	0.2	6.1	O K
60 min Summer	46.778	0.278	0.2	7.6	Flood Risk
120 min Summer	46.820	0.320	0.2	8.9	Flood Risk
180 min Summer	46.838	0.338	0.2	9.4	Flood Risk
240 min Summer	46.845	0.345	0.2	9.6	Flood Risk
360 min Summer	46.844	0.344	0.2	9.6	Flood Risk
480 min Summer	46.838	0.338	0.2	9.4	Flood Risk
600 min Summer	46.830	0.330	0.2	9.2	Flood Risk
720 min Summer	46.822	0.322	0.2	8.9	Flood Risk
960 min Summer	46.807	0.307	0.2	8.5	Flood Risk
1440 min Summer	46.776	0.276	0.2	7.5	Flood Risk
2160 min Summer	46.734	0.234	0.2	6.3	O K
2880 min Summer	46.695	0.195	0.2	5.1	O K
4320 min Summer	46.632	0.132	0.2	3.2	O K
5760 min Summer	46.587	0.087	0.2	1.9	O K
7200 min Summer	46.561	0.061	0.2	1.1	O K
8640 min Summer	46.550	0.050	0.2	0.7	O K
10080 min Summer	46.547	0.047	0.2	0.7	O K
15 min Winter	46.699	0.199	0.2	5.2	O K


Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Time-Peak (mins)
15 min Summer	132.861	0.0	19
30 min Summer	87.290	0.0	33
60 min Summer	54.663	0.0	64
120 min Summer	33.095	0.0	122
180 min Summer	24.358	0.0	182
240 min Summer	19.485	0.0	242
360 min Summer	14.144	0.0	360
480 min Summer	11.275	0.0	420
600 min Summer	9.449	0.0	482
720 min Summer	8.176	0.0	542
960 min Summer	6.502	0.0	674
1440 min Summer	4.700	0.0	940
2160 min Summer	3.392	0.0	1344
2880 min Summer	2.689	0.0	1732
4320 min Summer	1.935	0.0	2464
5760 min Summer	1.531	0.0	3120
7200 min Summer	1.276	0.0	3752
8640 min Summer	1.099	0.0	4408
10080 min Summer	0.968	0.0	5136
15 min Winter	132.861	0.0	19

The Millward Partnership		Page 2
1 Malin Hill Nottingham NG1 1JQ	Residential Development Shobnall Street, Burton Upon Trent	
Date 01/02/2018 File SAL.srcx	Designed by BC Checked by JMcK	
XP Solutions		Source Control 2017.1.2

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

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m ³)	Status
30 min Winter	46.756	0.256	0.2	6.9	O K
60 min Winter	46.812	0.312	0.2	8.6	Flood Risk
120 min Winter	46.861	0.361	0.2	10.1	Flood Risk
180 min Winter	46.883	0.383	0.2	10.8	Flood Risk
240 min Winter	46.894	0.394	0.2	11.1	Flood Risk
360 min Winter	46.898	0.398	0.2	11.2	Flood Risk
480 min Winter	46.893	0.393	0.2	11.0	Flood Risk
600 min Winter	46.883	0.383	0.2	10.7	Flood Risk
720 min Winter	46.872	0.372	0.2	10.4	Flood Risk
960 min Winter	46.852	0.352	0.2	9.8	Flood Risk
1440 min Winter	46.808	0.308	0.2	8.5	Flood Risk
2160 min Winter	46.743	0.243	0.2	6.5	O K
2880 min Winter	46.685	0.185	0.2	4.8	O K
4320 min Winter	46.594	0.094	0.2	2.1	O K
5760 min Winter	46.550	0.050	0.2	0.8	O K
7200 min Winter	46.546	0.046	0.2	0.6	O K
8640 min Winter	46.542	0.042	0.1	0.5	O K
10080 min Winter	46.540	0.040	0.1	0.5	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Time-Peak (mins)
30 min Winter	87.290	0.0	33
60 min Winter	54.663	0.0	62
120 min Winter	33.095	0.0	120
180 min Winter	24.358	0.0	178
240 min Winter	19.485	0.0	236
360 min Winter	14.144	0.0	350
480 min Winter	11.275	0.0	458
600 min Winter	9.449	0.0	560
720 min Winter	8.176	0.0	584
960 min Winter	6.502	0.0	732
1440 min Winter	4.700	0.0	1026
2160 min Winter	3.392	0.0	1452
2880 min Winter	2.689	0.0	1844
4320 min Winter	1.935	0.0	2512
5760 min Winter	1.531	0.0	2944
7200 min Winter	1.276	0.0	3600
8640 min Winter	1.099	0.0	4408
10080 min Winter	0.968	0.0	5112


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1 Malin Hill Nottingham NG1 1JQ	Residential Development Shobnall Street, Burton Upon Trent	
Date 01/02/2018 File SA1.srcx	Designed by BC Checked by JMcK	
XP Solutions	Source Control 2017.1.2	

Model Details

Storage is Online Cover Level (m) 47.060

Porous Car Park Structure

Infiltration Coefficient Base (m/hr)	0.01332	Width (m)	4.0
Membrane Percolation (mm/hr)	1000	Length (m)	25.0
Max Percolation (l/s)	27.8	Slope (1:X)	500.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	46.500	Cap Volume Depth (m)	0.400


The Millward Partnership		Page 1
1 Malin Hill Nottingham NG1 1JQ	Residential Development Shobnall Street, Burton Upon Trent	
Date 01/02/2018 File SA2.srcx	Designed by BC Checked by JMcK	
XP Solutions	Source Control 2017.1.2	

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

Half Drain Time : 385 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m ³)	Status
15 min Summer	47.004	0.204	2.3	44.4	O K
30 min Summer	47.044	0.244	2.3	59.5	O K
60 min Summer	47.082	0.282	2.3	73.9	Flood Risk
120 min Summer	47.114	0.314	2.3	86.1	Flood Risk
180 min Summer	47.126	0.326	2.3	90.8	Flood Risk
240 min Summer	47.130	0.330	2.3	92.3	Flood Risk
360 min Summer	47.128	0.328	2.3	91.5	Flood Risk
480 min Summer	47.124	0.324	2.3	90.1	Flood Risk
600 min Summer	47.120	0.320	2.3	88.2	Flood Risk
720 min Summer	47.114	0.314	2.3	86.1	Flood Risk
960 min Summer	47.102	0.302	2.3	81.5	Flood Risk
1440 min Summer	47.076	0.276	2.3	71.8	Flood Risk
2160 min Summer	47.041	0.241	2.3	58.5	O K
2880 min Summer	47.011	0.211	2.3	47.3	O K
4320 min Summer	46.971	0.171	2.3	32.2	O K
5760 min Summer	46.950	0.150	2.0	24.5	O K
7200 min Summer	46.933	0.133	1.8	19.3	O K
8640 min Summer	46.919	0.119	1.6	15.6	O K
10080 min Summer	46.908	0.108	1.5	12.8	O K
15 min Winter	47.020	0.220	2.3	50.7	O K


Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Time-Peak (mins)
15 min Summer	132.861	0.0	19
30 min Summer	87.290	0.0	33
60 min Summer	54.663	0.0	62
120 min Summer	33.095	0.0	122
180 min Summer	24.358	0.0	182
240 min Summer	19.485	0.0	240
360 min Summer	14.144	0.0	316
480 min Summer	11.275	0.0	378
600 min Summer	9.449	0.0	438
720 min Summer	8.176	0.0	506
960 min Summer	6.502	0.0	642
1440 min Summer	4.700	0.0	910
2160 min Summer	3.392	0.0	1300
2880 min Summer	2.689	0.0	1672
4320 min Summer	1.935	0.0	2336
5760 min Summer	1.531	0.0	3056
7200 min Summer	1.276	0.0	3752
8640 min Summer	1.099	0.0	4496
10080 min Summer	0.968	0.0	5240
15 min Winter	132.861	0.0	18

The Millward Partnership		Page 2
1 Malin Hill Nottingham NG1 1JQ	Residential Development Shobnall Street, Burton Upon Trent	
Date 01/02/2018 File SA2.srcx	Designed by BC Checked by JMcK	
XP Solutions	Source Control 2017.1.2	

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

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m ³)	Status
30 min Winter	47.065	0.265	2.3	67.7	Flood Risk
60 min Winter	47.109	0.309	2.3	84.1	Flood Risk
120 min Winter	47.146	0.346	2.3	98.3	Flood Risk
180 min Winter	47.162	0.362	2.3	104.2	Flood Risk
240 min Winter	47.168	0.368	2.3	106.6	Flood Risk
360 min Winter	47.168	0.368	2.3	106.5	Flood Risk
480 min Winter	47.161	0.361	2.3	104.1	Flood Risk
600 min Winter	47.155	0.355	2.3	101.5	Flood Risk
720 min Winter	47.147	0.347	2.3	98.6	Flood Risk
960 min Winter	47.129	0.329	2.3	91.9	Flood Risk
1440 min Winter	47.091	0.291	2.3	77.4	Flood Risk
2160 min Winter	47.038	0.238	2.3	57.5	O K
2880 min Winter	46.996	0.196	2.3	41.6	O K
4320 min Winter	46.953	0.153	2.1	25.5	O K
5760 min Winter	46.927	0.127	1.7	17.7	O K
7200 min Winter	46.909	0.109	1.5	12.9	O K
8640 min Winter	46.895	0.095	1.3	9.8	O K
10080 min Winter	46.884	0.084	1.1	7.7	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Time-Peak (mins)
30 min Winter	87.290	0.0	33
60 min Winter	54.663	0.0	62
120 min Winter	33.095	0.0	120
180 min Winter	24.358	0.0	178
240 min Winter	19.485	0.0	234
360 min Winter	14.144	0.0	344
480 min Winter	11.275	0.0	440
600 min Winter	9.449	0.0	472
720 min Winter	8.176	0.0	548
960 min Winter	6.502	0.0	700
1440 min Winter	4.700	0.0	984
2160 min Winter	3.392	0.0	1384
2880 min Winter	2.689	0.0	1732
4320 min Winter	1.935	0.0	2420
5760 min Winter	1.531	0.0	3112
7200 min Winter	1.276	0.0	3816
8640 min Winter	1.099	0.0	4504
10080 min Winter	0.968	0.0	5240


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1 Malin Hill Nottingham NG1 1JQ	Residential Development Shobnall Street, Burton Upon Trent	
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XP Solutions	Source Control 2017.1.2	

Model Details

Storage is Online Cover Level (m) 47.360

Porous Car Park Structure

Infiltration Coefficient Base (m/hr)	0.01332	Width (m)	14.6
Membrane Percolation (mm/hr)	1000	Length (m)	86.4
Max Percolation (l/s)	350.4	Slope (1:X)	500.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	46.800	Cap Volume Depth (m)	0.400


The Millward Partnership		Page 1
1 Malin Hill Nottingham NG1 1JQ	Residential Development Shobnall Street, Burton Upon Trent	
Date 01/02/2018 File SA3.srcx	Designed by BC Checked by JMcK	
XP Solutions		Source Control 2017.1.2

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

Half Drain Time : 462 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m ³)	Status
15 min Summer	46.658	0.158	0.4	9.5	O K
30 min Summer	46.704	0.204	0.4	12.7	O K
60 min Summer	46.749	0.249	0.4	15.7	O K
120 min Summer	46.787	0.287	0.4	18.3	Flood Risk
180 min Summer	46.803	0.303	0.4	19.4	Flood Risk
240 min Summer	46.808	0.308	0.4	19.8	Flood Risk
360 min Summer	46.806	0.306	0.4	19.6	Flood Risk
480 min Summer	46.800	0.300	0.4	19.2	Flood Risk
600 min Summer	46.793	0.293	0.4	18.7	Flood Risk
720 min Summer	46.786	0.286	0.4	18.2	Flood Risk
960 min Summer	46.771	0.271	0.4	17.2	Flood Risk
1440 min Summer	46.741	0.241	0.4	15.2	O K
2160 min Summer	46.700	0.200	0.4	12.4	O K
2880 min Summer	46.664	0.164	0.4	9.9	O K
4320 min Summer	46.606	0.106	0.4	6.0	O K
5760 min Summer	46.569	0.069	0.4	3.5	O K
7200 min Summer	46.550	0.050	0.4	2.2	O K
8640 min Summer	46.544	0.044	0.4	1.8	O K
10080 min Summer	46.539	0.039	0.3	1.5	O K
15 min Winter	46.677	0.177	0.4	10.8	O K


Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Time-Peak (mins)
15 min Summer	132.861	0.0	19
30 min Summer	87.290	0.0	33
60 min Summer	54.663	0.0	62
120 min Summer	33.095	0.0	122
180 min Summer	24.358	0.0	182
240 min Summer	19.485	0.0	242
360 min Summer	14.144	0.0	356
480 min Summer	11.275	0.0	406
600 min Summer	9.449	0.0	466
720 min Summer	8.176	0.0	528
960 min Summer	6.502	0.0	662
1440 min Summer	4.700	0.0	926
2160 min Summer	3.392	0.0	1324
2880 min Summer	2.689	0.0	1704
4320 min Summer	1.935	0.0	2420
5760 min Summer	1.531	0.0	3064
7200 min Summer	1.276	0.0	3680
8640 min Summer	1.099	0.0	4408
10080 min Summer	0.968	0.0	5144
15 min Winter	132.861	0.0	18

The Millward Partnership		Page 2
1 Malin Hill Nottingham NG1 1JQ	Residential Development Shobnall Street, Burton Upon Trent	
Date 01/02/2018 File SA3.srcx	Designed by BC Checked by JMcK	
XP Solutions		Source Control 2017.1.2

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

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m ³)	Status
30 min Winter	46.730	0.230	0.4	14.4	O K
60 min Winter	46.781	0.281	0.4	17.9	Flood Risk
120 min Winter	46.825	0.325	0.4	20.9	Flood Risk
180 min Winter	46.845	0.345	0.4	22.2	Flood Risk
240 min Winter	46.853	0.353	0.4	22.8	Flood Risk
360 min Winter	46.855	0.355	0.4	22.9	Flood Risk
480 min Winter	46.849	0.349	0.4	22.5	Flood Risk
600 min Winter	46.839	0.339	0.4	21.8	Flood Risk
720 min Winter	46.829	0.329	0.4	21.2	Flood Risk
960 min Winter	46.809	0.309	0.4	19.8	Flood Risk
1440 min Winter	46.766	0.266	0.4	16.8	Flood Risk
2160 min Winter	46.703	0.203	0.4	12.6	O K
2880 min Winter	46.648	0.148	0.4	8.9	O K
4320 min Winter	46.570	0.070	0.4	3.5	O K
5760 min Winter	46.545	0.045	0.4	1.9	O K
7200 min Winter	46.538	0.038	0.3	1.4	O K
8640 min Winter	46.535	0.035	0.3	1.1	O K
10080 min Winter	46.532	0.032	0.2	1.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Time-Peak (mins)
30 min Winter	87.290	0.0	33
60 min Winter	54.663	0.0	62
120 min Winter	33.095	0.0	120
180 min Winter	24.358	0.0	178
240 min Winter	19.485	0.0	236
360 min Winter	14.144	0.0	348
480 min Winter	11.275	0.0	454
600 min Winter	9.449	0.0	542
720 min Winter	8.176	0.0	566
960 min Winter	6.502	0.0	720
1440 min Winter	4.700	0.0	1012
2160 min Winter	3.392	0.0	1428
2880 min Winter	2.689	0.0	1816
4320 min Winter	1.935	0.0	2460
5760 min Winter	1.531	0.0	3000
7200 min Winter	1.276	0.0	3680
8640 min Winter	1.099	0.0	4368
10080 min Winter	0.968	0.0	5144

The Millward Partnership		Page 3
1 Malin Hill Nottingham NG1 1JQ	Residential Development Shobnall Street, Burton Upon Trent	
Date 01/02/2018 File SA3.srcx	Designed by BC Checked by JMcK	
XP Solutions	Source Control 2017.1.2	

Model Details

Storage is Online Cover Level (m) 47.060

Porous Car Park Structure

Infiltration Coefficient Base (m/hr)	0.01332	Width (m)	12.6
Membrane Percolation (mm/hr)	1000	Length (m)	18.0
Max Percolation (l/s)	63.0	Slope (1:X)	500.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	46.500	Cap Volume Depth (m)	0.400