

APPENDIX C

PREDEVELOPMENT GREENFIELD CALCULATIONS

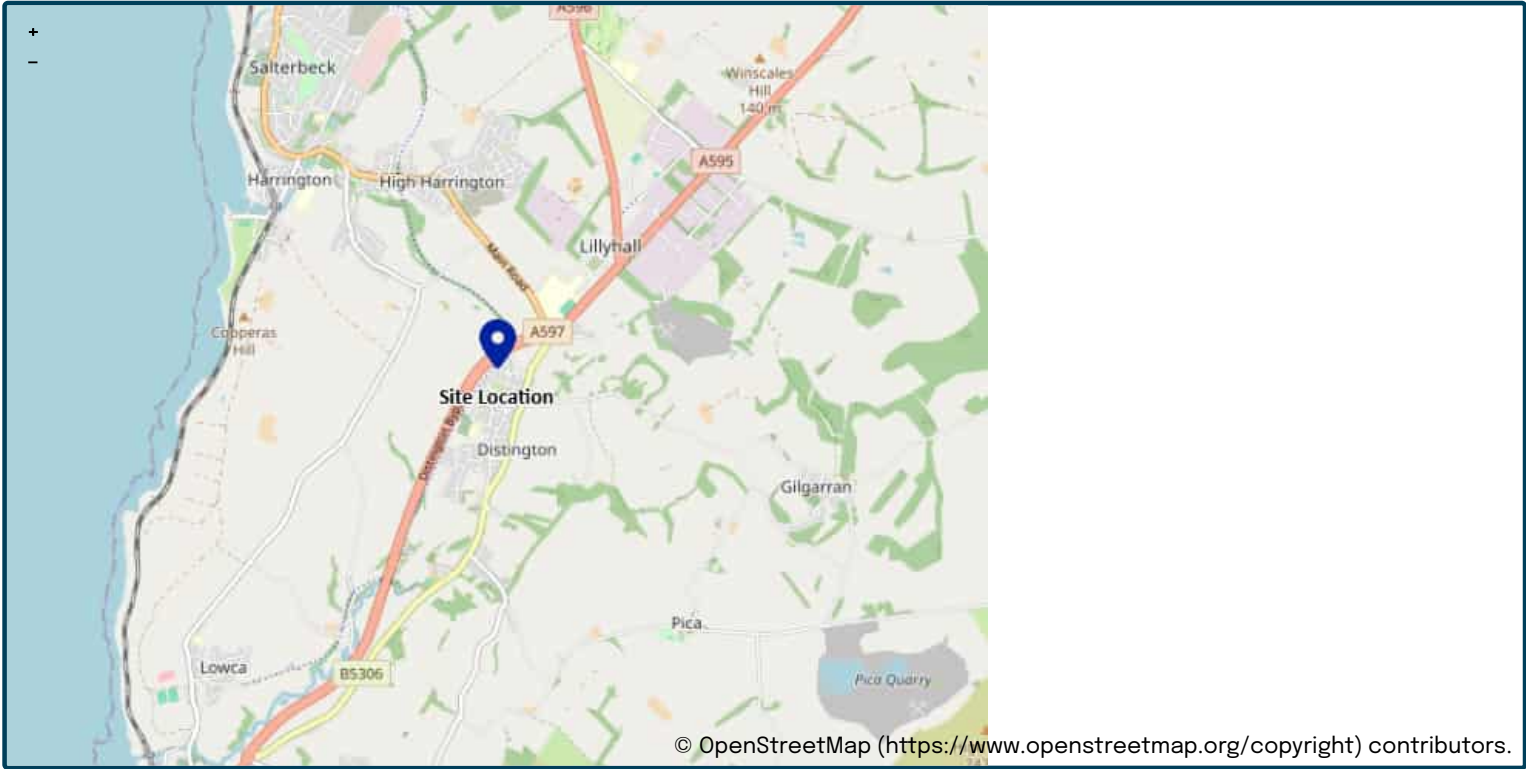
This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance “Rainfall runoff management for developments”, SC030219 (2013), the SuDS Manual C753 (CIRIA, 2015) and the non-statutory standards for SuDS (Defra, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Project details

Date	04/06/2026
Calculated by	Matthew Gornall
Reference	K42601
Model version	2.2.3

Location

Site name	Barfs Road, Distington
Site location	Barfs Road, Distington



Site easting (British National Grid)	300661
Site northing (British National Grid)	523841

Site details

Total site area (ha)	2.12322	ha
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Greenfield runoff

Method

Method	FEH statistical (2025)
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FEH statistical (2025)

	<u>My value</u>	<u>Map value</u>
SAAR9120 (mm)	1198	mm
BFIHOST19scaled	0.333	
QMed-QBar conversion	1.075	1.075
QMed (l/s)	26	l/s
QBar (FEH statistical 2025) (l/s)	27.9	l/s

Growth curve factors

	<u>My value</u>	<u>Map value</u>
Hydrological region	10	10
1 year growth factor	0.87	
2 year growth factor	0.93	
10 year growth factor	1.38	
30 year growth factor	1.7	
100 year growth factor	2.08	
200 year growth factor	2.37	

Results

Method	FEH statistical (2025)
Flow rate 1 year (l/s)	24.3
Flow rate 2 year (l/s)	26.0
Flow rate 10 years (l/s)	38.6
Flow rate 30 years (l/s)	47.5
Flow rate 100 years (l/s)	58.1
Flow rate 200 years (l/s)	66.2

Please note runoff estimation is subject to significant uncertainty. Results are therefore normally reported to only 1 decimal place. Where 2 decimal places are provided, this does not indicate accuracy to this level, it has been adopted to prevent ‘zero’ figures from being reported. Outputs less than 0.01 l/s are reported as 0.01 l/s.

Disclaimer

This report was produced using the Greenfield runoff rate estimation tool (2.2.3) developed by HR Wallingford and available at uksuds.com (<https://www.uksuds.com/>). The use of this tool is subject to the UK SuDS terms and conditions and licence agreement, which can both be found at uksuds.com/terms-conditions (<https://www.uksuds.com/terms-conditions>). The outputs from this tool have been used to estimate Greenfield runoff rates. The use of these results is the responsibility of the users of this tool. No liability will be accepted by HR Wallingford, the Environment Agency, Centre for Ecology and Hydrology, Wallingford Hydrosolutions or any other organisation for the use of these data in the design or operational characteristics of any drainage scheme.

APPENDIX D

SURFACE WATER DRAINAGE DESIGN CALCULATIONS

Design Settings

Rainfall Methodology	FEH-22	Minimum Velocity (m/s)	1.00
Return Period (years)	100	Connection Type	Level Soffits
Additional Flow (%)	0	Minimum Backdrop Height (m)	0.200
CV	1.000	Preferred Cover Depth (m)	1.200
Time of Entry (mins)	4.00	Include Intermediate Ground	✓
Maximum Time of Concentration (mins)	30.00	Enforce best practice design rules	✓
Maximum Rainfall (mm/hr)	50.0		

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
SW01	0.296	4.00	77.871	1500	300612.804	523799.335	2.021
SW02	0.344	4.00	77.801	1800	300642.410	523793.089	3.741
Tank 1 inlet			77.767		300647.214	523791.703	3.957
Tank 1 outlet		4.00	77.358		300682.763	523781.443	3.548
SW04	0.113	4.00	77.316	2100	300686.606	523780.333	3.606
SW05			75.750	1500	300709.593	523775.127	2.300
SW06			74.222	1500	300721.102	523780.686	1.972
SW07			68.809	1500	300770.947	523757.438	1.559
SW03	0.479	4.00	76.523	1800	300721.301	523857.565	2.423
Tank 2 inlet			76.559		300719.586	523853.952	2.749
Tank 2 outlet		4.00	77.215		300688.221	523788.034	3.405
SW08			66.800	1500	300817.643	523801.202	1.500
SW09			64.800	1500	300867.892	523843.994	1.500
SW10			64.000		300895.677	523826.248	1.000

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
S1.000	SW01	SW02	30.258	0.600	75.850	75.440	0.410	73.8	300	4.28	50.0
S1.001	SW02	Tank 1 inlet	5.000	0.600	74.060	73.910	0.150	33.3	450	4.30	50.0
S1.002	Tank 1 outlet	SW04	4.000	0.600	73.810	73.710	0.100	40.0	300	4.03	50.0
S1.003	SW04	SW05	23.569	0.600	73.710	73.450	0.260	90.7	225	4.36	50.0
S1.004	SW05	SW06	12.781	0.600	73.450	72.250	1.200	10.7	225	4.41	50.0
S1.005	SW06	SW07	55.000	0.600	72.250	67.250	5.000	11.0	225	4.64	50.0
S2.000	SW03	Tank 2 inlet	3.999	0.600	74.100	74.000	0.100	40.0	450	4.02	50.0
S2.001	Tank 2 outlet	SW04	7.869	0.600	73.810	73.710	0.100	78.7	300	4.07	50.0
S3.000	SW07	SW08	63.998	0.600	67.250	65.300	1.950	32.8	225	5.11	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
S1.000	1.832	129.5	53.5	1.721	2.061	0.296	0.0	134	1.749
S1.001	3.530	561.5	115.6	3.291	3.407	0.640	0.0	138	2.804
S1.002	2.493	176.2	0.0	3.248	3.306	0.000	0.0	0	0.000
S1.003	1.374	54.6	20.4	3.381	2.075	0.113	0.0	95	1.278
S1.004	4.032	160.3	20.4	2.075	1.747	0.113	0.0	54	2.793
S1.005	3.967	157.7	20.4	1.747	1.334	0.113	0.0	54	2.748
S2.000	3.222	512.4	86.6	1.973	2.109	0.479	0.0	124	2.426
S2.001	1.774	125.4	0.0	3.105	3.306	0.000	0.0	0	0.000
S3.000	2.291	91.1	20.4	1.334	1.275	0.113	0.0	73	1.861

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
S3.001	SW08	SW09	66.001	0.600	65.300	63.300	2.000	33.0	225	5.59	50.0
S3.002	SW09	SW10	32.969	0.600	63.300	63.000	0.300	109.9	225	6.03	50.0

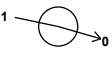
Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
S3.001	2.285	90.8	20.4	1.275	1.275	0.113	0.0	73	1.856
S3.002	1.246	49.6	20.4	1.275	0.775	0.113	0.0	101	1.188

Pipeline Schedule

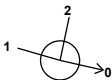
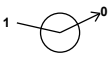
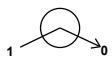
Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
S1.000	30.258	73.8	300	Circular	77.871	75.850	1.721	77.801	75.440	2.061
S1.001	5.000	33.3	450	Circular	77.801	74.060	3.291	77.767	73.910	3.407
S1.002	4.000	40.0	300	Circular	77.358	73.810	3.248	77.316	73.710	3.306
S1.003	23.569	90.7	225	Circular	77.316	73.710	3.381	75.750	73.450	2.075
S1.004	12.781	10.7	225	Circular	75.750	73.450	2.075	74.222	72.250	1.747
S1.005	55.000	11.0	225	Circular	74.222	72.250	1.747	68.809	67.250	1.334
S2.000	3.999	40.0	450	Circular	76.523	74.100	1.973	76.559	74.000	2.109
S2.001	7.869	78.7	300	Circular	77.215	73.810	3.105	77.316	73.710	3.306
S3.000	63.998	32.8	225	Circular	68.809	67.250	1.334	66.800	65.300	1.275
S3.001	66.001	33.0	225	Circular	66.800	65.300	1.275	64.800	63.300	1.275
S3.002	32.969	109.9	225	Circular	64.800	63.300	1.275	64.000	63.000	0.775

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
S1.000	SW01	1500	Manhole	Adoptable	SW02	1800	Manhole	Adoptable
S1.001	SW02	1800	Manhole	Adoptable	Tank 1 inlet		Junction	
S1.002	Tank 1 outlet		Junction		SW04	2100	Manhole	Adoptable
S1.003	SW04	2100	Manhole	Adoptable	SW05	1500	Manhole	Adoptable
S1.004	SW05	1500	Manhole	Adoptable	SW06	1500	Manhole	Adoptable
S1.005	SW06	1500	Manhole	Adoptable	SW07	1500	Manhole	Adoptable
S2.000	SW03	1800	Manhole	Adoptable	Tank 2 inlet		Junction	
S2.001	Tank 2 outlet		Junction		SW04	2100	Manhole	Adoptable
S3.000	SW07	1500	Manhole	Adoptable	SW08	1500	Manhole	Adoptable
S3.001	SW08	1500	Manhole	Adoptable	SW09	1500	Manhole	Adoptable
S3.002	SW09	1500	Manhole	Adoptable	SW10		Junction	

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
SW01	300612.804	523799.335	77.871	2.021	1500				
						0	S1.000	75.850	300
SW02	300642.410	523793.089	77.801	3.741	1800				
						1	S1.000	75.440	300
						0	S1.001	74.060	450

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
Tank 1 inlet	300647.214	523791.703	77.767	3.957		 1	S1.001	73.910	450
Tank 1 outlet	300682.763	523781.443	77.358	3.548		 0			
SW04	300686.606	523780.333	77.316	3.606	2100	 1 2	S1.002 S2.001	73.710 73.710	300 300
SW05	300709.593	523775.127	75.750	2.300	1500	 1	S1.003	73.710	225
SW06	300721.102	523780.686	74.222	1.972	1500	 1	S1.004	73.450	225
SW07	300770.947	523757.438	68.809	1.559	1500	 1	S1.005	72.250	225
SW03	300721.301	523857.565	76.523	2.423	1800	 1	S3.000	67.250	225
Tank 2 inlet	300719.586	523853.952	76.559	2.749		 0	S2.000	74.100	450
Tank 2 outlet	300688.221	523788.034	77.215	3.405		 0	S2.000	74.000	450
SW08	300817.643	523801.202	66.800	1.500	1500	 1	S3.001	65.300	225
SW09	300867.892	523843.994	64.800	1.500	1500	 1	S3.001	63.300	225
SW10	300895.677	523826.248	64.000	1.000		 1	S3.002	63.000	225

Simulation Settings

Rainfall Methodology	FEH-22	Analysis Speed	Detailed	Starting Level (m)	
Rainfall Events	Singular	Skip Steady State	x	Check Discharge Rate(s)	x
Summer CV	0.750	Drain Down Time (mins)	240	Check Discharge Volume	x
Winter CV	1.000	Additional Storage (m ³ /ha)	20.0		

Storm Durations

15	60	180	360	600	960	2160	4320	7200	10080
30	120	240	480	720	1440	2880	5760	8640	

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
2	0	0	0
30	0	0	0
100	50	0	0

Node SW04 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	x	Sump Available	✓
Invert Level (m)	73.710	Product Number	CTL-SHE-0209-2790-2400-2790
Design Depth (m)	2.400	Min Outlet Diameter (m)	0.225
Design Flow (l/s)	27.9	Min Node Diameter (mm)	2100

Node Tank 1 outlet Tank Storage Structure

Invert Level (m)	73.810	Time to half empty (mins)	320	Analyse flow through structure	x
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Inlets

Tank 1 inlet

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	166.5	1.600	166.5

Node Tank 2 outlet Tank Storage Structure

Invert Level (m)	73.810	Time to half empty (mins)	320	Analyse flow through structure	x
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Inlets

Tank 2 inlet

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	328.5	1.600	328.5

Results for 2 year Critical Storm Duration. Lowest mass balance: 99.93%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	SW01	10	75.984	0.134	48.8	0.6271	0.0000	OK
15 minute winter	SW02	10	74.208	0.148	105.5	0.6497	0.0000	OK
240 minute winter	Tank 1 inlet	164	74.116	0.306	27.9	0.0000	0.0000	OK
240 minute winter	Tank 1 outlet	164	74.102	0.292	25.1	48.3342	0.0000	OK
240 minute winter	SW04	164	74.101	0.391	33.8	1.5983	0.0000	SURCHARGED
240 minute winter	SW05	164	73.512	0.062	24.2	0.1097	0.0000	OK
240 minute winter	SW06	164	72.309	0.059	24.2	0.1048	0.0000	OK
240 minute winter	SW07	164	67.330	0.080	24.2	0.1414	0.0000	OK
15 minute winter	SW03	10	74.234	0.134	79.0	0.8712	0.0000	OK
240 minute winter	Tank 2 inlet	164	74.112	0.302	20.9	0.0000	0.0000	OK
240 minute winter	Tank 2 outlet	164	74.102	0.292	21.0	95.1108	0.0000	OK
240 minute winter	SW08	164	65.379	0.079	24.2	0.1394	0.0000	OK
240 minute winter	SW09	168	63.412	0.112	24.2	0.1983	0.0000	OK
240 minute winter	SW10	168	63.110	0.110	24.2	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	SW01	S1.000	SW02	48.8	1.670	0.377	0.8844	
15 minute winter	SW02	S1.001	Tank 1 inlet	105.5	2.532	0.188	0.2085	
240 minute winter	Tank 1 outlet	S1.002	SW04	30.0	0.706	0.170	0.2806	
240 minute winter	SW04	S1.003	SW05	24.2	1.662	0.443	0.3468	
240 minute winter	SW05	S1.004	SW06	24.2	2.807	0.151	0.1101	
240 minute winter	SW06	S1.005	SW07	24.2	2.316	0.153	0.5769	
240 minute winter	SW07	S3.000	SW08	24.2	1.933	0.265	0.8008	
15 minute winter	SW03	S2.000	Tank 2 inlet	79.0	2.181	0.154	0.1450	
240 minute winter	Tank 2 outlet	S2.001	SW04	29.6	0.726	0.236	0.5520	
240 minute winter	SW08	S3.001	SW09	24.2	1.508	0.266	1.0616	
240 minute winter	SW09	S3.002	SW10	24.2	1.239	0.488	0.6435	303.1

Results for 30 year Critical Storm Duration. Lowest mass balance: 99.93%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	SW01	10	76.063	0.213	99.6	1.0023	0.0000	OK
240 minute winter	SW02	176	74.449	0.389	49.5	1.7034	0.0000	OK
240 minute winter	Tank 1 inlet	176	74.448	0.638	127.4	0.0000	0.0000	OK
240 minute winter	Tank 1 outlet	176	74.430	0.620	44.5	101.7874	0.0000	SURCHARGED
240 minute winter	SW04	176	74.429	0.719	41.6	2.9406	0.0000	SURCHARGED
240 minute winter	SW05	176	73.517	0.067	27.7	0.1180	0.0000	OK
240 minute winter	SW06	180	72.314	0.064	27.7	0.1122	0.0000	OK
240 minute winter	SW07	180	67.336	0.086	27.7	0.1521	0.0000	OK
180 minute winter	SW03	136	74.448	0.348	64.0	2.2617	0.0000	OK
240 minute winter	Tank 2 inlet	180	74.443	0.633	83.6	0.0000	0.0000	OK
240 minute winter	Tank 2 outlet	176	74.430	0.620	26.1	200.8539	0.0000	SURCHARGED
240 minute winter	SW08	180	65.385	0.085	27.7	0.1497	0.0000	OK
240 minute winter	SW09	180	63.422	0.122	27.7	0.2152	0.0000	OK
240 minute winter	SW10	180	63.119	0.119	27.7	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	SW01	S1.000	SW02	99.6	1.952	0.769	1.5429	
240 minute winter	SW02	S1.001	Tank 1 inlet	127.4	1.786	0.227	0.7599	
240 minute winter	Tank 1 outlet	S1.002	SW04	32.9	0.763	0.187	0.2817	
240 minute winter	SW04	S1.003	SW05	27.7	1.714	0.507	0.3833	
240 minute winter	SW05	S1.004	SW06	27.7	2.909	0.173	0.1216	
240 minute winter	SW06	S1.005	SW07	27.7	2.401	0.175	0.6362	
240 minute winter	SW07	S3.000	SW08	27.7	2.004	0.304	0.8834	
180 minute winter	SW03	S2.000	Tank 2 inlet	96.0	1.803	0.187	0.5785	
240 minute winter	Tank 2 outlet	S2.001	SW04	26.6	0.718	0.212	0.5541	
240 minute winter	SW08	S3.001	SW09	27.7	1.558	0.304	1.1741	
240 minute winter	SW09	S3.002	SW10	27.7	1.280	0.558	0.7127	528.1

Results for 100 year +50% CC Critical Storm Duration. Lowest mass balance: 99.93%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	SW01	10	76.694	0.844	186.2	3.9665	0.0000	SURCHARGED
480 minute winter	SW02	384	75.356	1.296	59.0	5.6837	0.0000	SURCHARGED
480 minute winter	Tank 1 inlet	384	75.356	1.546	117.3	0.0000	0.0000	OK
480 minute winter	Tank 1 outlet	384	75.337	1.527	47.3	248.5616	0.0000	SURCHARGED
480 minute winter	SW04	384	75.337	1.627	40.6	6.6525	0.0000	SURCHARGED
30 minute winter	SW05	21	73.517	0.067	27.8	0.1183	0.0000	OK
180 minute summer	SW06	100	72.314	0.064	27.8	0.1125	0.0000	OK
60 minute winter	SW07	35	67.336	0.086	27.8	0.1525	0.0000	OK
480 minute winter	SW03	384	75.351	1.251	44.2	8.1272	0.0000	SURCHARGED
480 minute winter	Tank 2 inlet	384	75.351	1.541	112.8	0.0000	0.0000	OK
480 minute winter	Tank 2 outlet	384	75.337	1.527	27.6	491.9608	0.0000	SURCHARGED
30 minute winter	SW08	81	65.385	0.085	27.8	0.1501	0.0000	OK
120 minute winter	SW09	314	63.422	0.122	27.8	0.2158	0.0000	OK
60 minute summer	SW10	96	63.119	0.119	27.8	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	SW01	S1.000	SW02	180.5	2.563	1.394	2.1092	
480 minute winter	SW02	S1.001	Tank 1 inlet	117.3	1.467	0.209	0.7922	
480 minute winter	Tank 1 outlet	S1.002	SW04	32.8	0.708	0.186	0.2817	
480 minute winter	SW04	S1.003	SW05	27.8	1.716	0.509	0.3846	
30 minute winter	SW05	S1.004	SW06	27.8	2.912	0.173	0.1220	
180 minute summer	SW06	S1.005	SW07	27.8	2.404	0.176	0.6383	
60 minute winter	SW07	S3.000	SW08	27.8	2.007	0.305	0.8863	
480 minute winter	SW03	S2.000	Tank 2 inlet	112.8	1.505	0.220	0.6336	
480 minute winter	Tank 2 outlet	S2.001	SW04	28.4	0.682	0.226	0.5541	
30 minute winter	SW08	S3.001	SW09	27.8	1.561	0.306	1.1781	
120 minute winter	SW09	S3.002	SW10	27.8	1.281	0.561	0.7151	529.6

APPENDIX E

HIGHWAYS DRAINAGE PIPE CAPACITY CALCULATIONS

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PIPE FLOW CAPACITY DESIGN CHECK COLEBROOK WHITE FORMULATION

Barfs Road, Distington
Highways Drainage System - 150mm

Job Number

K39346

Calc by

TM

Date

20/07/2026

Page Number

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check by

OS

Revised

Roughness 0.6 mm
Diam(mm) 150 mm
Length 67.5 m

0.0006
0.15

U/S level 76.760 m
D/S level 76.280 m
Gradient 0.0071 1 in 141

PROPOR'N DEPTH	WETTED PERIMETER (mm)	AREA OF FLOW (m2)	HYDRAULIC MEAN DEPTH	(32mg/l) ^{1.5}	Ks 14.8m	LOG	VELOCITY (m/s)	DISCHARGE (l/s)	DEPTH (mm)	SURFACE WIDTH (mm)	V ² /2g
1%	0.03005023	2.99098E-05	0.0009953	0.047	0.040730826	-1.39007679	0.07	0.00	2	30	0.00
2%	0.04256912	8.43419E-05	0.0019813	0.066	0.020461665	-1.68905903	0.11	0.01	3	42	0.00
3%	0.0522249	0.000154474	0.0029579	0.081	0.013706033	-1.86308823	0.15	0.02	5	51	0.00
4%	0.06040738	0.000237099	0.0039250	0.094	0.010328794	-1.9859504	0.19	0.04	6	59	0.00
5%	0.06765402	0.000330333	0.0048827	0.104	0.008302921	-2.08076911	0.22	0.07	8	65	0.00
10%	0.09652517	0.000919694	0.0095280	0.146	0.004254876	-2.37111314	0.35	0.32	15	90	0.01
15%	0.11930982	0.001662181	0.0139316	0.176	0.002909963	-2.53611257	0.45	0.74	23	107	0.01
20%	0.13909428	0.002516036	0.0180887	0.201	0.002241207	-2.64951797	0.53	1.34	30	120	0.01
25%	0.15707963	0.00345479	0.0219939	0.222	0.001843265	-2.73441221	0.61	2.09	38	130	0.02
30%	0.17389192	0.004458788	0.0256411	0.239	0.001581074	-2.80104788	0.67	2.99	45	137	0.02
35%	0.18991555	0.005512061	0.0290237	0.255	0.001396806	-2.85486393	0.73	4.01	53	143	0.03
40%	0.20541576	0.006600821	0.0321340	0.268	0.001261611	-2.89907464	0.78	5.12	60	147	0.03
45%	0.22059434	0.007712607	0.0349629	0.279	0.001159532	-2.93571732	0.82	6.32	68	149	0.03
50%	0.23561945	0.008835729	0.0375000	0.289	0.001081081	-2.96614173	0.86	7.58	75	150	0.04
55%	0.25064456	0.009958852	0.0397330	0.298	0.001020325	-2.99126144	0.89	8.87	83	149	0.04
60%	0.26582314	0.011070638	0.0416466	0.305	0.000973441	-3.01169034	0.92	10.16	90	147	0.04
65%	0.28132335	0.012159398	0.0432221	0.311	0.000937958	-3.02781676	0.94	11.43	98	143	0.05
70%	0.29734698	0.013212671	0.0444352	0.315	0.000912352	-3.03983755	0.96	12.64	105	137	0.05
75%	0.31415927	0.014216669	0.0452531	0.318	0.000895863	-3.04775844	0.97	13.78	113	130	0.05
80%	0.33214462	0.015155423	0.0456290	0.319	0.000888482	-3.05135131	0.97	14.76	120	120	0.05
85%	0.35192907	0.016009278	0.0454901	0.319	0.000891195	-3.05002706	0.97	15.56	128	107	0.05
90%	0.37471373	0.016751765	0.0447055	0.316	0.000906836	-3.04247143	0.96	16.10	135	90	0.05
95%	0.40358488	0.017341125	0.0429677	0.310	0.000943511	-3.02525286	0.94	16.25	143	65	0.04
100%	0.4712389	0.017671459	0.0375000	0.289	0.001081081	-2.96614173	0.86	15.16	150	0	0.04

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PIPE FLOW CAPACITY DESIGN CHECK COLEBROOK WHITE FORMULATION

Barfs Road, Distington
Highways Drainage System - 225mm

Job Number

K39346

Calc by

TM

Date

20/07/2026

Page Number

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check by

OS

Revised

Roughness 0.6 mm
Diam(mm) 225 mm
Length 37 m

0.0006
0.225

U/S level 77.000 m
D/S level 76.685 m
Gradient 0.0085 1 in 117.5

PROPOR'N DEPTH	WETTED PERIMETER (mm)	AREA OF FLOW (m2)	HYDRAULIC MEAN DEPTH	(32mg/l) ^{1.49}	Ks 14.8m	LOG	VELOCITY (m/s)	DISCHARGE (l/s)	DEPTH (mm)	SURFACE WIDTH (mm)	V ² /2g
1%	0.04507534	6.72971E-05	0.0014930	0.063	0.027153884	-1.56616805	0.10	0.00	2	45	0.00
2%	0.06385367	0.000189769	0.0029719	0.089	0.01364111	-1.86515029	0.17	0.03	5	63	0.00
3%	0.07833735	0.000347567	0.0044368	0.109	0.009137355	-2.03917949	0.22	0.08	7	77	0.00
4%	0.09061106	0.000533473	0.0058875	0.125	0.006885862	-2.16204166	0.27	0.14	9	88	0.00
5%	0.10148103	0.00074325	0.0073240	0.140	0.005535281	-2.25686036	0.32	0.23	11	98	0.01
10%	0.14478775	0.002069311	0.0142920	0.195	0.002836584	-2.54720439	0.50	1.03	23	135	0.01
15%	0.17896474	0.003739907	0.0208975	0.236	0.001939975	-2.71220382	0.64	2.40	34	161	0.02
20%	0.20864142	0.00566108	0.0271331	0.269	0.001494138	-2.82560923	0.76	4.31	45	180	0.03
25%	0.23561945	0.007773277	0.0329908	0.297	0.001228843	-2.91050347	0.86	6.72	56	195	0.04
30%	0.26083788	0.010032273	0.0384617	0.321	0.001054049	-2.97713914	0.95	9.57	68	206	0.05
35%	0.28487333	0.012402137	0.0435356	0.341	0.000931204	-3.03095519	1.03	12.82	79	215	0.05
40%	0.30812364	0.014851846	0.0482009	0.359	0.000841074	-3.07516589	1.10	16.40	90	220	0.06
45%	0.3308915	0.017353366	0.0524443	0.374	0.000773021	-3.11180858	1.17	20.22	101	224	0.07
50%	0.35342917	0.019880391	0.0562500	0.388	0.000720721	-3.14223299	1.22	24.21	113	225	0.08
55%	0.37596684	0.022407416	0.0595994	0.399	0.000680217	-3.16735269	1.26	28.32	124	224	0.08
60%	0.39873471	0.024908936	0.0624699	0.409	0.000648961	-3.1877816	1.30	32.43	135	220	0.09
65%	0.42198502	0.027358645	0.0648332	0.416	0.000625305	-3.20390802	1.33	36.47	146	215	0.09
70%	0.44602046	0.029728509	0.0666528	0.422	0.000608235	-3.21592881	1.36	40.34	158	206	0.09
75%	0.4712389	0.031987505	0.0678796	0.426	0.000597242	-3.2238497	1.37	43.92	169	195	0.10
80%	0.49821692	0.034099702	0.0684435	0.428	0.000592321	-3.22744257	1.38	47.06	180	180	0.10
85%	0.52789361	0.036020875	0.0682351	0.427	0.00059413	-3.22611832	1.38	49.60	191	161	0.10
90%	0.5620706	0.037691471	0.0670583	0.423	0.000604557	-3.21856269	1.36	51.34	203	135	0.09
95%	0.60537731	0.039017532	0.0644516	0.415	0.000629008	-3.20134412	1.33	51.82	214	98	0.09
100%	0.70685835	0.039760782	0.0562500	0.388	0.000720721	-3.14223299	1.22	48.43	225	0	0.08

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PIPE FLOW CAPACITY DESIGN CHECK COLEBROOK WHITE FORMULATION

Barfs Road, Distington
Highways Drainage System - 300mm

Job Number

K39346

Calc by

TM

Date

20/07/2026

Page Number

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check by

OS

Revised

Roughness 0.6 mm
Diam(mm) 300 mm
Length 67.5 m

0.0006
0.3

U/S level 76.610 m
D/S level 76.240 m
Gradient 0.0055 1 in 182.4

PROPOR'N DEPTH	WETTED PERIMETER (mm)	AREA OF FLOW (m2)	HYDRAULIC MEAN DEPTH	(32mg/l) ^{1.49}	Ks 14.8m	LOG	VELOCITY (m/s)	DISCHARGE (l/s)	DEPTH (mm)	SURFACE WIDTH (mm)	V ² /2g
1%	0.06010045	0.000119639	0.0019907	0.059	0.020365413	-1.69110678	0.10	0.00	3	60	0.00
2%	0.08513823	0.000337367	0.0039626	0.083	0.010230833	-1.99008902	0.16	0.06	6	84	0.00
3%	0.10444981	0.000617896	0.0059157	0.101	0.006853016	-2.16411823	0.22	0.13	9	102	0.00
4%	0.12081475	0.000948396	0.0078500	0.116	0.005164397	-2.2869804	0.27	0.25	12	118	0.00
5%	0.13530804	0.001321333	0.0097654	0.130	0.00415146	-2.3817991	0.31	0.41	15	131	0.00
10%	0.19305033	0.003678775	0.0190560	0.181	0.002127438	-2.67214313	0.48	1.78	30	180	0.01
15%	0.23861965	0.006648724	0.0278633	0.219	0.001454981	-2.83714256	0.62	4.13	45	214	0.02
20%	0.27818857	0.010064142	0.0361774	0.249	0.001120604	-2.95054796	0.74	7.41	60	240	0.03
25%	0.31415927	0.013819159	0.0439877	0.275	0.000921633	-3.03544221	0.84	11.54	75	260	0.04
30%	0.34778384	0.017835152	0.0512823	0.297	0.000790537	-3.10207788	0.92	16.43	90	275	0.04
35%	0.3798311	0.022048243	0.0580475	0.316	0.000698403	-3.15589393	1.00	21.98	105	286	0.05
40%	0.41083152	0.026403283	0.0642679	0.332	0.000630805	-3.20010463	1.06	28.09	120	294	0.06
45%	0.44118867	0.030850429	0.0699257	0.347	0.000579766	-3.23674731	1.12	34.65	135	298	0.06
50%	0.4712389	0.035342917	0.0750000	0.359	0.000540541	-3.26717173	1.17	41.49	150	300	0.07
55%	0.50128912	0.039835406	0.0794659	0.370	0.000510163	-3.29229143	1.22	48.48	165	298	0.08
60%	0.53164627	0.044282552	0.0832933	0.379	0.000486721	-3.31272033	1.25	55.53	180	294	0.08
65%	0.56264669	0.048637592	0.0864443	0.386	0.000468979	-3.32884676	1.28	62.45	195	286	0.08
70%	0.59469395	0.052850683	0.0888704	0.391	0.000456176	-3.34086754	1.31	69.02	210	275	0.09
75%	0.62831853	0.056866676	0.0905061	0.395	0.000447931	-3.34878844	1.32	75.12	225	260	0.09
80%	0.66428923	0.060621692	0.0912580	0.396	0.000444241	-3.35238131	1.33	80.51	240	240	0.09
85%	0.70385815	0.064037111	0.0909801	0.396	0.000445598	-3.35105705	1.33	84.91	255	214	0.09
90%	0.74942746	0.06700706	0.0894110	0.392	0.000453418	-3.34350142	1.31	87.85	270	180	0.09
95%	0.80716975	0.069364502	0.0859355	0.384	0.000471756	-3.32628286	1.28	88.72	285	131	0.08
100%	0.9424778	0.070685835	0.0750000	0.359	0.000540541	-3.26717173	1.17	82.99	300	0	0.07