APPENDIX A DATA SUMMARY

This appendix consists of the following:

Appendix A1	Site layout – Section 1
Appendix A2	Site layout – Section 2
Appendix A3	Copy of Questionnaire
Appendix A4	Participant Information Sheet
Appendix A5	Traffic Count Survey

QUESTIONNAIRE

Background of PhD Research - context for this survey
Despite the fact that the highway drainage infrastructure is designed to standards with appropriate maintenance regimes, flooding still occurs. This is due to a number of inherent uncertainties (unknown size of asset, age of drainage infrastructure, complexity of drainage infrastructure, maintenance, condition etc). These current and future uncertainties need to be quantified, in order to help the decision maker, to identify the areas at most risk of flooding, now and in the future, especially in the light of climate change impacts.

Aim of Survey
The aim of this survey is to gather appropriate data which can be then fed into a tool which will then be used to identify assets at risk of flooding.

Objectives of Survey
Assuming a typical positive drainage system (Figure 1), the objectives of this survey are:
1. Obtain verification of the uncertainties likely to have an impact on flooding of highway drainage infrastructure.
2. In relation to the uncertainties chosen in Objective 1 obtain respondents opinion on:
a. The most likely value of the chosen uncertainty.
b.The minimum value of the chosen uncertainty.
c.The maximum of the chosen uncertainty.
3. In relation to the values estimated as part of Objective 2 obtain an estimate of the probability of a flood occurring.

Site Background	
Road Classification	A Road
Age of system	9 years
Surface Type	Asphalt
Area Description	Industrial
Volumetric Run-off	0.75
Time of entry (mins)	5

Participant Details	
First Name	
Surname	
Company	
Position	
Engineering Discipline	
Years in position held	

Question 1 - Verifying identified uncertainties			
Please select the uncertainties which you think are associated with the flooding of highway drainage infrastructure, by putting a tick in the appropriate box. For those you don't think are likely to have an impact please put a cross.			
Asset	**Risk Category**	**Identified Uncertainty**	**✓or x**
Gully	As Built	Quality of workmanship	
		Diameter of gully pot (mm)	
		Depth of gully pot (mm)	
		Gully pot material	
		Grating size (mm)	
		Grating material	
		Grating type	
Pipe	As Built	Diameter of pipe (mm)	
		Length of pipe (mm)	
		Pipe gradient (1:X)	
		Pipe roughness	
		Pipe capacity	
		Pipe material	
		Catchment area	
Manhole	As Built	Diameter of manhole (mm)	
		Depth of manhole (mm)	
		Type of Manhole	
		Material of manhole chamber	
Gully, Pipe and Manhole	Maintenance	Unknown maintenance frequency	
		Unknown maintenance carried out	
	Deterioration	Unknown rate of deterioration	
		Unknown condition	
	Climate	Unknown design return period	
		Unknown future rainfall intensity	

Identifying other uncertainties			
Please identify any other uncertainties which you think are likely to have an impact on flooding of highway drainage infrastructure are not considered in previous table			
Asset	**Category**	**Identified Uncertainties**	

Question 2 - Semi Quantitative P-I Analysis		
For the uncertainties that you have identified (shown below), please assign a value for probability of occurrence (P) and Impact (I) using the range 1-5; 1= Very low, 2 = Low, 3 = Medium, 4 = High and 5 = Very high		
Identified Uncertainty	*Probability of Occurrence (P)*	*Impact (I)*
Quality of workmanship		
Diameter of gully pot (mm)		
Depth of gully pot (mm)		
Gully pot material		
Grating size (mm)		
Grating material		
Grating type		
Diameter of pipe (mm)		
Length of pipe (mm)		
Pipe gradient (1:X)		
Pipe roughness		
Pipe capacity		
Pipe material		
Catchment area		
Diameter of manhole (mm)		
Depth of manhole (mm)		
Type of Manhole		
Material of manhole chamber		
Unknown maintenance frequency		
Unknown maintenance carried out		
Unknown rate of deterioration		
Unknown condition		
Unknown design return period		
Unknown future rainfall intensity		

Identifying other uncertainties		
Identified Uncertainties	*Probability of Occurrence (P)*	*Impact (I)*

AS BUILT (Q3-Q6)

Question 3 - Quality of Workmanship

(i) Please select what you believe the current quality of workmanship in regard to highway drainage infrastructure

	✓
Very Poor	
Poor	
Good	
Very Good	
Excellent	

Question 4 - Size of Assets

(i) Please provide your opinion as to the most likely, minimum and maximum value of your identified uncertainties.

Asset	Identified Uncertainty	Most Likely (mm)	Minimum (mm)	Maximum (mm)
Pipe		150		
		225		
		300		
		375		
		450		
		600		
		750		
		900		
		1050		
		1200		
Gully			450	
			750	

(ii) Manholes should be designed and constructed in accordance with BS EN 752-3, the site contains both Type A and Type B manholes. The table below contains the minimum diameters permissible in accordance with Sewers for Adoption. What is your opinion as to the appropriate most likely and maximum manhole diameters for each specified pipe range?

Pipe Range	Internal diameter of manhole (mm)		
Diameter of largest pipe in manhole (mm)	**Minimum**	**Most Likely**	**Maximum**
Less than 375	1200		
375-700	1500		
750-900	1800		

(iii) The current standard with regard to depth (cover level to soffit of pipe) of both manhole types (A and B) are shown below. Where applicable, what is your opinion as to the appropriate minimum, most likely and maximum manhole heights for each type?

Manhole Type	Depth of manhole		
	Minimum (m)	Most Likely (m)	Maximum (m)
A	3		6
B	1.2		3

Question 5 - Pipe Gradient

(i) Assuming the most likely gradient of any pipe is X, please give your opinion as to the possible percentage change (±) of X? E.g. ±20%

± % Change	

Question 6 - Material and type of asset

(i) For each asset please select the least likely, likely and most likely material you believe it has been made out of.

	Please select material (drop down list)		
Asset	**Least Likely**	**Most Likely**	**Likely**
Gully Grating			
Gully Pot			
Gully Connector			
Main Pipe			
Pipe (Filter Drain)			
Manhole Frame			
Manhole Chamber			

(ii) When existing pipe conditions are unknown, a pipe roughness (ks) value of 0.6mm is assumed (most likely) for storm sewers (irrespective of pipe material). Please give your opinion as to the minimum and maximum pipe roughness value.

	Pipe Roughness (ks)
Minimum	
Maximum	

(iii) In accordance with the DMRB, please give your opinion by marking (X) the minimum, maximum and most likely type of grating that you would choose to install on the site.

Types	Minimum	Maximum	Most Likely
P			
Q			
R			
S			
T			

You may find it useful to look at the PDF drawings for the site (Section 1, 2) in order to answer Q7 and Q10.

MAINTENANCE (Q7-Q8)

Question 7 - Maintenance Options

(i) Do you agree that the list below shows the main types of maintenance options that assets receive? Please mark (X)

Maintenance Option		X
Do nothing	Yes	
Inspect asset (Do Nothing)	No	
Inspect asset (Remove debris from the asset)		
Inspect asset (Repair the asset)		
Inspect asset (Replace the whole asset)		

If no, please type below any other main types of maintenance

	Other maintenance options
1	
2	
3	
4	

(ii) If an asset is inspected, using the list above please indicate the minimum, the maximum and the most likely maintenance options

Minimum	Inspect asset (Do Nothing)
Maximum	Inspect asset (Replace the whole asset)
Most likely	Inspect asset (Remove debris from the asset)

(iii) Please comment as to the overall adequacy of highway drainage infrastructure maintenance.

Question 8 - Frequency of maintenance for each maintenance option identified in Q7

(i) Please refer to the drawings provided. As shown the site is divided into Section 1 and Section 2 and then subdivided. Given that the site is 9 years old please indicate the number for assets that you consider will have been: 1. Inspected (No further action taken). 2. Remove debris from asset and 3. Replace asset

					Inspect asset (Do Nothing)			**Inspect asset (Replace the whole asset)**			**Inspect asset (Remove debris from the asset)**		
NOTE: For example, Section 1 Part A shows there are 42 gully pots. Therefore If you consider 11 of these would have been examined, then 11 would be inserted as highlighted above.		Existing Number of			Opinion as to number of asset			Opinion as to number of asset			Opinion as to number of asset		
		Gully Pots	**Pipes**	**Manholes**	**Gully Pots**	**Pipes**	**Manholes**	**Gully Pots**	**Pipes**	**Manholes**	**Gully Pots**	**Pipes**	**Manholes**
		42			**11**								
Section 1	Part A	42	87	21									
	Part B	14	25	4									
	Part C	49	60	19									
Section 2	Part A	59	147	60									
	Part B	54	118	28									

(ii) Please provide an estimate as to the cost (£) for ONE occasion associated with each identified maintenance option. In respect of pipes assume an average excavation depth of 1.5m

	Gully	**Pipe**	**Manhole**
Inspect asset (Do Nothing)			
Inspect asset (Replace the whole asset)			
Inspect asset (Remove debris from the asset)			

DETERIORATION (Q9)

Question 9- Percentage change in asset as a result of maintenance frequency

(i) Using the dimensions you have already estimated in Q3 (automatically displayed below). Please provide your estimate as to the likely percentage loss of due to the asset being clogged with debris. Please take into account the maintenance frequency (removing debris from asset) identified in Q8.

Asset	Identified Uncertainty	Size (mm)	Estimated % Loss
Pipe	Pipe Diameter	100	
		150	
		225	
		300	
		375	
		450	
		600	
		750	
		900	
		1050	
		1200	
Gully	Gully Diameter	450	
	Gully Depth	750	
Manhole	Depth of Manhole Type A		
	Depth of Manhole Type B		

PROBABILITY (Q10)

For the risks identified in Q1, please assign a probability to the minimum, most likely & maximum values

Asset	**Risk Category**	**Uncertainty**	***Probability of***		
			minimum values	most likely values	maximum values
Gully	As Built	Quality of workmanship			
		Diameter of gully pot (mm)			
		Depth of gully pot (mm)			
		Gully pot material			
		Grating size (mm)			
		Grating material			
		Grating type			
Pipe	As Built	Diameter of pipe (mm)			
		Length of pipe (mm)			
		Pipe gradient (1:X)			
		Pipe roughness			
		Pipe capacity			
		Pipe material			
		Catchment area			
Manhole	As Built	Diameter of manhole (mm)			
		Depth of manhole (mm)			
		Type of Manhole			
		Material of manhole chamber			
Gully, Pipe and Manhole	Maintenance	Unknown maintenance frequency			
		Unknown maintenance carried out			
	Deterioration	Unknown rate of deterioration			
		Unknown condition			
	Climate	Unknown design return period			
		Unknown future rainfall intensity			

Participant Information Sheet

Title of research: The use of a risk based approach to identify the uncertainties associated with flooding of highway drainage infrastructure

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Background

Despite the fact that the highway drainage infrastructure is designed to standards with appropriate maintenance regimes, flooding still occurs due to a number of inherent uncertainties (unknown size of asset, age of drainage infrastructure, complexity of drainage infrastructure, maintenance, condition etc). These current and future uncertainties need to be quantified, in order to help the decision maker, to identify the areas at most risk of flooding, now and in the future, especially in the light of climate change impacts.

This research aims to develop a risk based tool to assist the highway drainage engineer identify the parts of highway drainage infrastructure at greatest flood risk.

Aim of Survey

The aim of this survey is to gather appropriate data which can be then fed into a tool that will then be used to identify assets at risk of flooding.

Objectives of Survey

The purpose of the questionnaire is to:

1. Obtain verification of the uncertainties likely to have an impact on flooding of highway drainage infrastructure.
2. In relation to the uncertainties identified in Q1 obtain respondents opinion on:
    a. The most likely value of the identified uncertainty.
    b. The minimum value of the identified uncertainty.
    c. The maximum of the identified uncertainty.

3. In relation to the values given at Q2 obtain an estimate of the probability of a flood occurring for each identified uncertainty.

Withdrawal and data confidentiality

Participant involvement will be completed by December 2013, notwithstanding that they are free to withdraw at any time. Should you choose to withdraw, you can also request that any data collected from your participation be withdrawn from the study. If you request this, any data collected from you will be located and destroyed.

Information entrusted to researcher will be treated as confidential within the study and will not be used for purposes other than those for which it was gathered, without the express consent of the client.

Further Information

This study has been reviewed by the Research Ethics Team of the University of Birmingham. If you have any concerns regarding the way this research has been conducted please contact the ethics team by email ethics-queries@contacts.bham.ac.uk.

Further information regarding this research can be obtained from Dr Michael Burrow or Sally Barnett, contact details are provided above.

Table 1 contains the set of criteria to be used in respect of the semi-quantitative analysis to be undertaken in Question 2 of the attached questionnaire.

Table 1 – Qualitative and semi quantitative description of the risk occurring

Category	**Score**	**Probability**	**Impact**
Very High	5	Highly likely to occur. Flooding has occurred on several occasions in the past.	Severe: direct tangible damage to buildings, contents, interrupted business, agricultural losses, cleaning up after flooding, and infrastructure damage to roads, utilities and communication. Indirect tangible damage, for example: disruption to road traffic, rail services, damage to companies outside flooded area.
High	4	Likely to occur. Flooding has occurred in the past.	Considerable: damage occurs as (5) above but to a lesser degree.
Medium	3	Possible to occur. Minor flooding has occurred.	Notable: very minor direct tangible flood damage, for example; minor cleaning up costs together with indirect tangible flood damage.
Low	2	Most likely will not occur. Very minor flooding has occurred.	Very Minor: only indirect tangible flood damage occurs, for example: minor disruption to road traffic, rail services, damage to companies outside flooded area.
Very Low	1	Highly unlikely to occur. Flooding has not occurred.	Negligible: no direct or indirect tangible flood damage occurred.

Section 1 - A632						
Date	**Time**	**Cars**	**LGV**	**OGV 1**	**OGV 2**	**PSV**
01/09/2014	08:00 - 09:00	105	20	6	5	4
	09:00 - 10:00	79	20	6	5	4
	10:00 - 11:00	57	13	9	1	4
	11:00 - 12:00	39	10	7	4	4
	12:00 - 13:00	68	12	8	1	4
	13:00 - 14:00	37	3	16	11	4
	14:00 - 15:00	46	5	4	7	4
	15:00 - 16:00	40	3	5	9	4
	16:00 - 17:00	83	10	3	6	4
02/09/2014	08:00 - 09:00	97	16	1	8	4
	09:00 - 10:00	90	10	6	3	4
	10:00 - 11:00	49	6	5	9	4
	11:00 - 12:00	23	6	9	5	4
	12:00 - 13:00	68	6	10	3	4
	13:00 - 14:00	52	6	15	8	4
	14:00 - 15:00	53	8	7	5	4
	15:00 - 16:00	45	9	5	9	4
	16:00 - 17:00	90	8	7	10	4
03/09/2014	08:00 - 09:00	92	14	8	9	4
	09:00 - 10:00	83	20	6	5	4
	10:00 - 11:00	54	19	3	1	4
	11:00 - 12:00	29	10	2	3	4
	12:00 - 13:00	42	15	8	5	4
	13:00 - 14:00	45	8	6	7	4
	14:00 - 15:00	52	10	2	6	4
	15:00 - 16:00	60	4	4	3	4
	16:00 - 17:00	100	9	10	10	4
04/09/2014	08:00 - 09:00	100	11	2	8	4
	09:00 - 10:00	82	13	8	10	4
	10:00 - 11:00	52	9	0	1	4
	11:00 - 12:00	28	7	9	4	4
	12:00 - 13:00	50	15	12	9	4
	13:00 - 14:00	37	11	2	13	4
	14:00 - 15:00	60	4	2	9	4
	15:00 - 16:00	43	7	6	8	4
	16:00 - 17:00	70	6	4	10	4
05/09/2014	08:00 - 09:00	114	15	0	2	4
	09:00 - 10:00	80	12	9	4	4
	10:00 - 11:00	52	11	4	4	4
	11:00 - 12:00	25	9	0	4	4
	12:00 - 13:00	67	13	5	5	4
	13:00 - 14:00	31	3	2	19	4
	14:00 - 15:00	43	2	6	8	4
	15:00 - 16:00	40	5	5	10	4
	16:00 - 17:00	71	6	2	7	4
	Average	**61**	**10**	**6**	**7**	**4**

Section 1 and 2 - A6192						
Date	**Time**	**Cars**	**LGV**	**OGV 1**	**OGV 2**	**PSV**
01/09/2014	08:00 - 09:00	106	17	12	11	4
	09:00 - 10:00	77	12	7	8	4
	10:00 - 11:00	51	10	6	7	4
	11:00 - 12:00	40	7	6	9	4
	12:00 - 13:00	44	5	12	11	4
	13:00 - 14:00	34	17	10	13	4
	14:00 - 15:00	56	6	13	13	4
	15:00 - 16:00	57	4	6	6	4
	16:00 - 17:00	82	6	13	6	4
02/09/2014	08:00 - 09:00	90	15	7	15	4
	09:00 - 10:00	72	15	10	5	4
	10:00 - 11:00	47	18	8	7	4
	11:00 - 12:00	21	14	8	8	4
	12:00 - 13:00	55	13	7	5	4
	13:00 - 14:00	31	11	5	10	4
	14:00 - 15:00	44	2	8	12	4
	15:00 - 16:00	58	7	10	13	4
	16:00 - 17:00	89	6	14	5	4
03/09/2014	08:00 - 09:00	91	12	12	11	4
	09:00 - 10:00	88	20	12	14	4
	10:00 - 11:00	55	11	5	8	4
	11:00 - 12:00	24	5	9	10	4
	12:00 - 13:00	68	7	14	5	4
	13:00 - 14:00	38	3	5	11	4
	14:00 - 15:00	45	2	9	13	4
	15:00 - 16:00	55	9	6	14	4
	16:00 - 17:00	74	4	6	6	4
04/09/2014	08:00 - 09:00	100	10	15	16	4
	09:00 - 10:00	88	20	12	18	4
	10:00 - 11:00	46	10	5	9	4
	11:00 - 12:00	38	7	8	9	4
	12:00 - 13:00	67	6	7	11	4
	13:00 - 14:00	54	13	11	9	4
	14:00 - 15:00	46	10	13	15	4
	15:00 - 16:00	45	9	12	8	4
	16:00 - 17:00	71	9	12	8	4
05/09/2014	08:00 - 09:00	93	18	20	15	4
	09:00 - 10:00	100	18	19	13	4
	10:00 - 11:00	46	16	8	6	4
	11:00 - 12:00	25	9	7	9	4
	12:00 - 13:00	55	7	5	15	4
	13:00 - 14:00	36	4	13	14	4
	14:00 - 15:00	49	2	13	13	4
	15:00 - 16:00	46	9	10	6	4
	16:00 - 17:00	84	3	7	7	4
	Average	**60**	**10**	**10**	**10**	**4**

Section 2 - Markham Lane (A632 to A6192)						
Date	**Time**	**Cars**	**LGV**	**OGV 1**	**OGV 2**	**PSV**
01/09/2014	08:00 - 09:00	103	15	2	9	0
	09:00 - 10:00	80	17	3	7	0
	10:00 - 11:00	52	8	10	2	0
	11:00 - 12:00	27	13	0	6	0
	12:00 - 13:00	60	14	11	4	0
	13:00 - 14:00	34	4	19	16	0
	14:00 - 15:00	59	8	4	9	0
	15:00 - 16:00	41	4	6	3	0
	16:00 - 17:00	79	10	2	10	0
02/09/2014	08:00 - 09:00	101	10	1	7	0
	09:00 - 10:00	79	13	5	1	0
	10:00 - 11:00	52	20	2	8	0
	11:00 - 12:00	36	10	8	2	0
	12:00 - 13:00	58	10	5	6	0
	13:00 - 14:00	30	19	7	9	0
	14:00 - 15:00	56	10	6	7	0
	15:00 - 16:00	40	4	5	7	0
	16:00 - 17:00	91	6	4	5	0
03/09/2014	08:00 - 09:00	107	17	10	1	0
	09:00 - 10:00	86	19	9	2	0
	10:00 - 11:00	57	13	4	4	0
	11:00 - 12:00	36	6	8	2	0
	12:00 - 13:00	66	9	12	10	0
	13:00 - 14:00	54	6	10	5	0
	14:00 - 15:00	52	2	5	2	0
	15:00 - 16:00	60	7	10	9	0
	16:00 - 17:00	98	8	3	8	0
04/09/2014	08:00 - 09:00	110	10	4	1	0
	09:00 - 10:00	89	13	1	5	0
	10:00 - 11:00	59	16	5	5	0
	11:00 - 12:00	22	11	2	5	0
	12:00 - 13:00	62	11	9	10	0
	13:00 - 14:00	51	3	10	12	0
	14:00 - 15:00	48	7	8	7	0
	15:00 - 16:00	55	6	8	8	0
	16:00 - 17:00	98	7	2	8	0
05/09/2014	08:00 - 09:00	107	18	8	2	0
	09:00 - 10:00	70	10	1	7	0
	10:00 - 11:00	52	14	8	7	0
	11:00 - 12:00	23	12	8	7	0
	12:00 - 13:00	61	9	5	3	0
	13:00 - 14:00	55	10	5	12	0
	14:00 - 15:00	54	2	10	9	0
	15:00 - 16:00	42	2	8	8	0
	16:00 - 17:00	85	10	7	7	0
	Average	**63**	**10**	**6**	**6**	**0**

APPENDIX B DRAINAGE NETWORK ANALYSIS

This appendix consists of the following:

Appendix B1	Scenarios ranked by total volume of flood
Appendix B2	Number of pipes to flood/surcharge/flood risk/OK
Appendix B3	MicroDrainage Results Scenario 16 – 261year 15min
Appendix B4	15 Min Summary of all 24 scenarios over all return periods
Appendix B5	180 Min Summary of all 24 scenarios over all return periods

Section 1 - 15 Min (Ordered by scenario)									
Scenario	2 Yr	5 Yr	30 Yr	50 Yr	73 Yr	100 Yr	188 Yr	221 Yr	261 Yr
16	29.558	58.318	193.229	258.351	318.632	377.753	522.123	564.94	610.526
17	26.021	52.509	178.139	244.095	304.994	361.305	488.941	525.876	566.223
24	3.97	20.831	130.212	179.092	225.857	275.078	397.842	435.506	477.287
21	16.086	42.077	152.816	205.679	252.338	297.119	407.433	440.617	477.167
3	28.108	50.344	153.623	209.092	256.976	301.475	408.158	440.413	476.075
5	16.274	42.026	151.11	203.07	250.44	296.141	406.374	439.434	475.699
1	12.387	36.135	144.357	197.181	244.665	290.369	399.952	432.648	468.795
18	27.702	52.689	152.757	199.454	244.751	289.299	394.53	425.335	458.867
20	29.831	48.748	148.822	196.819	238.265	277.699	378.505	410.7	445.345
12	6.631	23.688	112.782	153.547	191.308	232.729	337.219	368.599	400.813
2	5.859	23.102	114.152	155.049	193.83	234.804	337.458	368.212	399.738
7	22.211	40.339	134.516	179.284	216.996	252.175	335.813	361.195	390.213
19	0	5.384	87.466	133.724	174.372	213.889	316.835	350.913	388.07
13	21.028	39.561	129.572	174.816	212.865	248.255	333.08	359.084	387.975
11	1.276	13.091	100.116	140.333	177.86	218.112	320.904	351.465	383.184
10	13.895	32.985	107.671	146.66	181.626	216.525	299.772	324.025	350.535
4	20.166	34.538	111.01	151.158	186.152	218.706	297.391	321.628	349.592
23	19.666	35.887	120.544	160.96	194.861	225.994	298.446	320.459	345.545
8	1.141	8.647	78.446	116.327	150.953	184.993	278.103	306.932	339.823
6	19.667	35.87	120.577	159.223	190.719	219.73	288.722	310.041	334.435
15	0	5.208	65.872	102.427	136.893	169.84	250.148	276.258	308.545
22	0	4.12	56.515	83.553	108.17	131.697	200.691	224.16	249.989
14	0	0	33.719	57.062	83.06	111.871	183.925	206.586	231.692
9	0	0	29.728	49.442	67.015	83.243	121.253	132.165	175.895

Section 1 - 180 Min (Ordered by scenario)									
Scenario	2 Yr	5 Yr	30 Yr	50 Yr	73 Yr	100 Yr	188 Yr	221 Yr	261 Yr
3	111.782	179.206	453.561	558.98	649.787	735.176	926.852	984.419	1046.386
20	112.973	165.972	391.879	484.857	570.108	649.86	834.095	887.585	945.404
23	81.212	132.478	338	420.486	491.191	558.46	714.038	757.905	805.994
7	83.285	133.231	330.427	411.526	480.555	548.132	704.209	748.6	796.743
10	66.167	108.892	311.055	397.511	472.965	538.336	699.499	744.818	793.584
13	80.27	131.488	335.291	419.069	487.842	551.608	701.647	745.404	792.506
6	78.711	128.387	323.854	403.016	472.05	538.686	692.551	735.426	782.439
4	84.162	126.354	312.842	391.711	458.952	523.492	674.913	718.172	764.743
17	29.214	65.206	212.875	284.795	351.868	412.928	549.687	591.025	636.379
18	20.913	52.668	196.403	254.79	312.616	367.44	496.205	533.037	572.088
16	10.526	33.92	152.605	210.463	258.881	302.621	413.888	449.403	485.788
21	0	5.17	96.422	145.763	188.364	233.466	333.212	359.392	396.765
5	0	5.128	95.56	144.072	186.913	232.124	331.173	357.373	394.199
1	0	0.539	90.23	140.049	183.357	227.169	326.714	356.22	390.684
12	0	0	29.5	57.601	87.196	119.084	201.319	225.214	251.384
2	0	0	25.142	53.447	82.331	114.161	194.331	218.531	245.338
11	0	0	13.152	37.958	66.167	94.765	175.001	199.13	225.626
9	0	0	0	1.331	24.908	54.201	145.033	175.895	210.74
24	0	0	0	10.123	27.349	49.289	109.837	129.406	151.121
19	0	0	0	0	4.901	16.584	63.929	78.732	95.112
8	0	0	0	0	5.77	17.943	54.705	67.155	80.944
15	0	0	0	0	1.218	9.244	36.027	49.93	65.441
22	0	0	0	0	0	4.364	35.226	45.54	57.556
14	0	0	0	0	0	0	0	0	0

Section 2 - 15 Min (Ordered by scenario)									
Scenario									
6	1.551	7.379	90.921	147.18	206.946	263.495	398.015	438.204	482.313
23	1.504	6.423	86.304	142.013	200.9	256.52	389.778	430.428	474.704
7	1.501	4.954	80.331	129.361	187.412	245.36	384.95	427.124	473.398
13	1.439	5.019	78.804	125.208	182.484	240.558	383.672	426.106	473.301
4	0.853	5.203	72.919	122.54	177.614	231.103	366.053	407.152	452.451
22	0.791	5.557	70.404	114.735	169.831	224.682	360.827	403.184	448.534
3	2.614	9.992	70.654	113.11	163.313	217.752	351.243	395.069	444.409
20	0.732	5.298	58.69	100.626	149.693	205.107	336.652	377.474	422.012
10	2.37	9.282	56.988	93.904	136.483	187.574	320.905	361.83	407.661
18	1.313	4.052	49.148	86.288	126.073	170.207	304.305	348.477	398.769
17	1.406	4.081	50.329	84.376	121.75	161.458	277.565	318.959	367.423
15	0	0	0	0	0.272	2.383	24.185	39.568	308.545
16	0	1.07	25.578	50.969	80.45	111.6	213.283	248.429	289.326
5	0	0.977	21.865	43.938	71.28	105.387	205.761	241.613	284.368
21	0	0.977	21.125	42.264	68.888	102.285	200.804	236.152	278.316
1	**0**	**0.87**	**21.512**	**41.138**	**67.96**	**99.652**	**195.436**	**229.585**	**269.675**
12	0	0	6.357	17.226	35.173	58.221	140.651	174.191	213.626
2	0	0	5.44	15.097	31.406	52.453	132.737	163.308	201.428
11	0	0	4.606	12.004	23.118	40.858	113.906	147.318	188.018
8	0	0	0	1.368	6.56	17.781	71.963	97.95	129.718
24	0	0	0	1.024	5.515	15.095	63.42	87.312	118.437
9	0	0	0	0.781	3.453	7.797	49.629	75.657	106.119
19	0	0	0	0	0.135	1.405	8.855	17.052	32.95
14	0	0	0	0	0	0	2.22	5.607	10.115

Section 2 - 180 Min (Ordered by scenario)									
Scenario	**2 Yr**	**5 Yr**	**30 Yr**	**50 Yr**	**73 Yr**	**100 Yr**	**188 Yr**	**221 Yr**	**261 Yr**
23	37.612	69.966	330.059	463.552	577.094	686.215	945.222	1017.67	1093.465
6	39.288	73.095	329.1	461.246	576.678	684.251	939.361	1012.914	1091.904
7	29.747	60.621	316.318	452.128	567.526	675.713	935.888	1009.738	1087.988
13	24.35	58.422	302.46	435.553	548.947	656.71	912.698	986.344	1065.024
4	21.498	54.826	274.166	398.959	512.383	617.164	862.492	933.337	1010.576
20	7.855	35.093	242.723	367.615	481.792	588.226	843.202	917.377	997.402
22	13.373	46.036	254.466	375.985	488.215	593.593	839.205	909.635	986.048
3	9.159	38.173	228.119	338.194	445.95	546.712	803.986	881.841	966.292
10	0.354	17.401	189.192	296.426	397.871	498.523	744.575	819.132	901.674
18	0	0	0.673	5.119	18.323	40.612	131.941	162.594	197.34
17	0	0	0.447	2.314	12.57	31.696	122.365	153.588	187.64
12	0	0	0	0	0	0	27.948	44.464	64.564
11	0	0	0	0	0	0	25.306	42.171	61.553
2	0	0	0	0	0	0	20.835	34.637	53.44
5	0	0	0	0	0	0	9.79	22.635	40.107
21	0	0	0	0	0	0	9.79	22.635	40.107
1	0	0	0	0	0	0	3.61	11.843	26.433
16	0	0	0	0	0	0	5.33	12.771	22.142
8	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0

	Section 1 - 15 Min: 2yr				Section 1 - 15 Min: 5yr				Section 1 - 15 Min: 30yr				Section 1 - 15 Min: 50yr				Section 1 - 15 Min: 73yr				Section 1 - 15 Min: 100yr				Section 1 - 15 Min: 188yr				Section 1 - 15 Min: 221yr				Section 1 - 15 Min: 261yr			
Scenario	FLOOD	FLOOD RISK	SURCHARGED	OK	FLOOD	FLOOD RISK	SURCHARGED	OK	FLOOD	FLOOD RISK	SURCHARGED	OK	FLOOD	FLOOD RISK	SURCHARGED	OK	FLOOD	FLOOD RISK	SURCHARGED	OK	FLOOD	FLOOD RISK	SURCHARGE	OK	FLOOD	FLOOD RISK	SURCHARGE	OK	FLOOD	FLOOD RISK	SURCHARGE	OK	FLOOD	FLOOD RISK	SURCHARGE	OK
1	8	8	19	137	13	5	21	133	19	19	39	95	24	27	33	88	30	30	30	82	35	31	27	79	44	29	28	71	46	30	27	69	46	32	27	67
2	4	10	16	142	9	2	25	136	10	14	28	120	12	21	35	104	16	26	35	95	21	29	32	90	26	35	26	85	26	36	27	83	27	38	26	81
3	5	32	44	91	8	47	37	80	21	64	27	60	24	68	25	55	27	71	24	50	30	75	19	48	35	78	17	42	35	80	17	40	37	83	13	39
4	3	29	45	95	5	39	45	83	14	69	27	62	18	73	25	56	19	80	20	53	22	82	19	49	26	90	10	46	30	89	10	43	30	90	10	42
5	11	7	18	136	12	6	25	129	19	16	42	95	24	26	33	89	29	30	31	82	36	29	29	78	44	28	30	70	46	29	28	69	46	31	27	68
6	3	41	37	91	5	56	32	79	12	80	19	61	12	84	23	53	13	87	22	50	13	91	21	47	16	101	13	42	17	105	8	42	17	106	8	41
7	4	37	39	92	6	50	35	81	13	76	22	61	15	76	25	56	16	82	21	53	16	85	19	52	20	92	17	43	20	98	11	43	21	99	10	42
8	1	6	11	154	3	8	12	149	10	6	22	134	11	5	26	130	12	9	29	122	14	15	29	114	21	26	28	97	22	27	29	94	24	28	28	92
9	0	0	14	158	0	3	21	148	11	6	15	140	13	5	18	136	13	6	20	133	13	6	20	133	13	6	24	129	13	7	24	128	9	7	16	140
10	5	23	38	106	6	32	48	86	14	59	32	67	17	65	25	65	20	69	24	59	21	70	24	57	24	81	18	49	24	84	15	49	26	85	12	49
11	2	8	19	143	7	9	17	139	10	13	28	121	12	17	35	108	15	24	33	100	19	26	36	91	23	34	30	85	25	38	25	84	25	38	26	83
12	4	10	14	144	7	10	17	138	9	13	31	119	11	22	35	104	14	28	37	93	22	29	31	90	26	36	28	82	27	36	29	80	27	38	27	80
13	5	31	42	94	7	43	40	82	16	71	22	63	16	73	24	59	17	78	22	55	17	80	22	53	21	87	20	44	21	90	17	44	23	94	11	44
14	0	1	5	166	0	3	8	161	3	8	18	143	6	11	17	138	11	6	20	135	12	6	19	135	13	6	22	131	13	6	23	130	13	9	26	124
15	0	7	9	156	1	9	13	149	7	12	19	134	8	12	22	130	9	13	23	127	10	15	23	124	12	25	27	108	13	31	24	104	16	37	22	97
16	9	10	19	134	13	8	29	122	23	24	39	86	32	31	32	77	39	31	29	73	43	32	25	72	50	31	31	60	51	31	30	60	52	37	23	60
17	8	13	39	112	9	18	41	104	24	53	26	69	33	49	24	66	38	48	22	64	41	46	25	60	45	51	21	55	47	51	20	54	47	55	20	50
18	8	12	31	121	10	12	44	106	18	35	45	74	25	49	29	69	30	50	27	65	37	47	25	63	40	50	25	57	41	53	22	56	41	55	21	55
19	0	3	13	156	2	6	14	150	9	10	19	134	9	11	25	127	10	12	24	126	10	16	29	117	15	34	24	99	17	38	26	91	20	41	22	89
20	3	35	45	89	5	48	40	79	17	66	28	61	19	74	25	54	21	83	19	49	23	86	15	48	30	90	10	42	31	93	6	42	34	92	4	42
21	11	7	18	136	12	6	25	129	19	12	44	97	23	23	39	87	27	30	34	81	34	32	29	77	44	29	30	69	47	29	28	68	48	30	28	66
22	0	5	14	153	2	11	13	146	4	14	21	133	5	13	25	129	5	20	25	122	5	28	25	114	11	42	25	94	11	43	26	92	11	46	23	92
23	3	41	37	91	5	56	32	79	12	80	19	61	13	83	23	53	15	85	22	50	15	89	21	47	17	98	15	42	18	103	9	42	18	105	8	41
24	3	9	15	145	8	9	14	141	13	6	24	129	15	12	27	118	20	17	28	107	21	23	30	98	30	24	27	91	31	24	29	88	33	25	27	87

Section 1 - 180 Min: 2yr				Section 1 - 180 Min: 5yr				Section 1 - 180 Min: 30yr				Section 1 - 180 Min: 50yr				Section 1 - 180 Min: 73yr				Section 1 - 180 Min: 100yr				Section 1 - 180 Min: 188yr				Section 1 - 180 Min: 221yr				Section 1 - 180 Min: 261yr			
FLOOD	FLOOD RISK	SURCHARGED	OK	FLOOD	FLOOD RISK	SURCHARGED	OK	FLOOD	FLOOD RISK	SURCHARGED	OK	FLOOD	FLOOD RISK	SURCHARGED	OK	FLOOD	FLOOD RISK	SURCHARGED	OK	FLOOD	FLOOD RISK	SURCHARGED	OK	FLOOD	FLOOD RISK	SURCHARGED	OK	FLOOD	FLOOD RISK	SURCHARGED	OK	FLOOD	FLOOD RISK	SURCHARGED	OK
0	0	13	159	2	4	14	152	9	7	16	140	12	5	17	138	12	5	18	137	13	4	20	135	14	12	22	124	15	15	21	121	18	16	21	117
0	0	3	169	0	1	7	164	2	11	15	144	5	10	16	141	7	10	16	139	9	9	16	138	10	9	16	137	10	9	16	137	10	9	17	136
9	22	30	111	13	40	26	93	23	55	22	72	26	64	15	67	28	67	19	58	29	74	21	48	32	87	10	43	35	87	7	43	35	87	8	42
6	29	35	102	10	47	24	91	17	65	15	75	22	68	12	70	25	70	12	65	28	69	17	58	30	85	11	46	30	89	7	46	30	89	7	46
0	1	15	156	2	7	16	147	8	9	17	138	12	6	17	137	12	6	18	136	13	5	18	136	15	9	24	124	15	14	24	119	18	15	22	117
6	42	30	94	7	55	23	87	13	77	14	68	14	83	11	64	15	85	23	49	16	90	23	43	17	106	6	43	17	108	4	43	18	108	3	43
6	36	32	98	9	50	25	88	16	71	17	68	17	79	9	67	18	80	19	55	18	84	26	44	20	102	7	43	20	102	7	43	21	104	4	43
0	1	0	171	0	1	1	170	0	1	9	162	0	5	9	158	1	6	10	155	2	5	13	152	3	6	14	149	3	6	16	147	3	8	16	145
0	0	0	172	0	0	1	171	0	0	11	161	2	2	15	153	3	5	16	148	3	10	16	143	7	9	16	140	9	7	16	140	9	8	16	139
8	13	29	122	8	23	31	110	17	50	20	85	19	56	16	81	22	61	17	72	26	65	12	69	32	66	17	57	32	70	20	50	33	78	15	46
0	0	2	170	0	0	8	164	2	8	18	144	5	10	16	141	6	10	15	141	9	8	15	140	10	8	15	139	10	8	16	138	10	8	17	137
0	1	4	167	0	1	9	162	3	10	15	144	5	10	14	143	7	10	15	140	9	8	17	138	9	8	18	137	9	8	19	136	9	8	19	136
8	27	37	100	11	44	25	92	18	66	18	70	19	74	12	67	20	77	16	59	21	76	26	49	22	98	8	44	23	97	8	44	24	99	5	44
0	1	0	171	0	1	0	171	0	1	0	171	0	1	1	170	0	1	1	170	0	1	2	169	0	1	4	167	0	1	5	166	0	1	6	165
0	1	0	171	0	1	0	171	0	2	4	166	0	4	9	159	1	5	8	158	1	6	9	156	2	7	12	151	3	6	12	151	3	6	12	151
3	5	10	154	3	6	15	148	9	8	18	137	12	5	20	135	12	6	19	135	12	8	26	126	16	18	18	120	17	17	20	118	18	16	22	116
4	8	15	145	8	8	18	138	13	19	19	121	15	23	20	114	18	23	20	111	18	24	21	109	18	31	26	97	19	31	30	92	22	31	28	91
5	10	17	140	8	9	18	137	10	10	26	126	12	20	20	120	14	23	19	116	15	25	20	112	17	26	29	100	17	27	30	98	17	32	28	95
0	0	1	171	0	0	2	170	0	0	8	164	0	1	11	160	1	5	8	158	2	5	11	154	3	5	14	150	3	5	14	150	3	6	17	146
6	43	28	95	10	54	21	87	21	69	12	70	26	71	15	60	29	72	21	50	30	83	13	46	34	88	4	46	34	88	4	46	35	87	5	45
0	2	14	156	2	7	16	147	8	9	17	138	12	6	17	137	12	6	18	136	13	5	18	136	15	10	23	124	15	16	20	121	19	14	19	120
0	0	0	172	0	0	1	171	0	0	7	165	0	2	10	160	0	6	10	156	1	6	14	151	2	7	15	148	2	8	19	143	2	11	18	141
7	42	29	94	8	57	20	87	15	74	15	68	15	82	11	64	16	83	23	50	16	89	24	43	17	105	7	43	17	107	5	43	18	107	4	43
0	0	1	171	0	0	2	170	0	3	11	158	2	5	13	152	3	6	14	149	3	6	16	147	5	11	16	140	5	12	15	140	6	11	16	139

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STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes Sally

FEH Rainfall Model

Return Period (years)	261	Foul Sewage (l/s/ha)	0.000
Site Location		Volumetric Runoff Coeff.	0.750
C (1km)	-0.027	Add Flow / Climate Change (%)	0
D1 (1km)	0.358	Minimum Backdrop Height (m)	0.200
D2 (1km)	0.395	Maximum Backdrop Height (m)	1.500
D3 (1km)	0.275	Min Design Depth for Optimisation (m)	1.200
E (1km)	0.299	Min Vel for Auto Design only (m/s)	1.00
F (1km)	2.415	Min Slope for Optimisation (1:X)	500
Maximum Rainfall (mm/hr)	250		
Maximum Time of Concentration (mins)	30		

Designed with Level Soffits

Time Area Diagram for Storm at outfall S (pipe S1.024)

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.200	4-8	0.170

Total Area Contributing (ha) = 0.370

Total Pipe Volume (m³) = 56.221

Time Area Diagram at outfall S (pipe S43.024)

Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.730	4-8	0.670	8-12	0.002

Total Area Contributing (ha) = 1.402

Total Pipe Volume (m³) = 82.042

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)

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Micro Drainage	Network 2013.1.1	

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)
S1.000	11.968	0.186	64.2	0.003	5.00	0.0	0.600	o	225
S1.001	13.563	0.211	64.4	0.000	0.00	0.0	0.600	o	300
S2.000	6.852	0.106	64.6	0.004	5.00	0.0	0.600	o	225
S1.002	4.867	0.075	64.5	0.000	0.00	0.0	0.600	o	300
S3.000	12.788	0.196	65.1	0.009	5.00	0.0	0.600	o	225
S1.003	15.374	0.239	64.4	0.000	0.00	0.0	0.600	o	300
S4.000	6.782	0.105	64.6	0.013	5.00	0.0	0.600	o	225
S1.004	20.626	0.321	64.2	0.000	0.00	0.0	0.600	o	300
S5.000	9.168	0.143	64.2	0.012	5.00	0.0	0.600	o	225
S1.005	13.141	0.205	64.2	0.000	0.00	0.0	0.600	o	300
S6.000	7.541	0.117	64.5	0.009	5.00	0.0	0.600	o	225
S1.006	3.016	0.047	63.8	0.000	0.00	0.0	0.600	o	300

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.000	250.00	5.12	80.113	0.003	0.0	0.0	0.0	1.63	65.0	2.0
S1.001	250.00	5.24	79.852	0.003	0.0	0.0	0.0	1.96	138.7	2.0
S2.000	250.00	5.07	80.021	0.004	0.0	0.0	0.0	1.63	64.8	2.7
S1.002	250.00	5.28	79.641	0.007	0.0	0.0	0.0	1.96	138.6	4.7
S3.000	250.00	5.13	80.236	0.009	0.0	0.0	0.0	1.62	64.5	6.1
S1.003	250.00	5.41	79.566	0.016	0.0	0.0	0.0	1.96	138.7	10.8
S4.000	250.00	5.07	80.141	0.013	0.0	0.0	0.0	1.63	64.8	8.8
S1.004	250.00	5.58	79.327	0.029	0.0	0.0	0.0	1.97	138.9	19.6
S5.000	250.00	5.09	79.990	0.012	0.0	0.0	0.0	1.63	65.0	8.1
S1.005	250.00	5.70	79.006	0.041	0.0	0.0	0.0	1.97	138.9	27.8
S6.000	250.00	5.08	79.756	0.009	0.0	0.0	0.0	1.63	64.9	6.1
S1.006	250.00	5.72	78.801	0.050	0.0	0.0	0.0	1.97	139.4	33.9

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Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)
S7.000	15.020	0.234	64.2	0.024	5.00	0.0	0.600	o	225
S1.007	1.938	0.030	64.6	0.000	0.00	0.0	0.600	o	300
S8.000	3.997	0.062	64.5	0.002	5.00	0.0	0.600	o	225
S1.008	3.740	0.058	64.2	0.000	0.00	0.0	0.600	o	300
S9.000	2.806	0.044	64.4	0.002	5.00	0.0	0.600	o	225
S1.009	4.349	0.067	64.7	0.000	0.00	0.0	0.600	o	300
S10.000	17.111	0.267	64.1	0.003	5.00	0.0	0.600	o	225
S1.010	3.104	0.094	33.1	0.000	0.00	0.0	0.600	o	300
S11.000	1.771	0.027	64.9	0.005	5.00	0.0	0.600	o	225
S1.011	12.887	0.189	68.2	0.000	0.00	0.0	0.600	o	300
S12.000	5.950	0.093	64.0	0.006	5.00	0.0	0.600	o	225

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S7.000	250.00	5.15	79.728	0.024	0.0	0.0	0.0	1.63	65.0	16.2
S1.007	250.00	5.74	78.284	0.074	0.0	0.0	0.0	1.96	138.5	50.1
S8.000	250.00	5.04	79.758	0.002	0.0	0.0	0.0	1.63	64.9	1.4
S1.008	250.00	5.77	78.254	0.076	0.0	0.0	0.0	1.97	138.9	51.5
S9.000	250.00	5.03	79.779	0.002	0.0	0.0	0.0	1.63	64.9	1.4
S1.009	250.00	5.81	78.196	0.078	0.0	0.0	0.0	1.96	138.4	52.8
S10.000	250.00	5.17	79.724	0.003	0.0	0.0	0.0	1.64	65.1	2.0
S1.010	250.00	5.83	78.129	0.081	0.0	0.0	0.0	2.74	193.8	54.8
S11.000	250.00	5.02	79.675	0.005	0.0	0.0	0.0	1.63	64.6	3.4
S1.011	250.00	5.94	78.035	0.086	0.0	0.0	0.0	1.91	134.8	58.2
S12.000	250.00	5.06	79.237	0.006	0.0	0.0	0.0	1.64	65.1	4.1

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Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)
S1.012	6.413	0.100	64.1	0.000	0.00	0.0	0.600	o	300
S13.000	4.818	0.074	64.7	0.003	5.00	0.0	0.600	o	225
S13.001	3.733	0.161	23.2	0.000	0.00	0.0	0.600	o	225
S14.000	1.863	0.036	51.8	0.006	5.00	0.0	0.600	o	225
S15.000	2.317	0.036	63.7	0.006	5.00	0.0	0.600	o	225
S14.001	9.482	0.154	61.4	0.000	0.00	0.0	0.600	o	225
S13.002	20.202	1.195	16.9	0.000	0.00	0.0	0.600	o	225
S16.000	10.808	0.168	64.3	0.010	5.00	0.0	0.600	o	225
S16.001	4.794	0.074	64.4	0.000	0.00	0.0	0.600	o	300
S17.000	3.268	0.197	16.6	0.008	5.00	0.0	0.600	o	225
S16.002	16.447	0.449	36.6	0.000	0.00	0.0	0.600	o	300
S18.000	18.840	0.291	64.7	0.014	5.00	0.0	0.600	o	225

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.012	250.00	5.99	77.846	0.092	0.0	0.0	0.0	1.97	139.0	62.3
S13.000	250.00	5.05	79.720	0.003	0.0	0.0	0.0	1.63	64.8	2.0
S13.001	250.00	5.07	78.314	0.003	0.0	0.0	0.0	2.73	108.5	2.0
S14.000	250.00	5.02	79.164	0.006	0.0	0.0	0.0	1.82	72.5	4.1
S15.000	250.00	5.02	79.163	0.006	0.0	0.0	0.0	1.64	65.3	4.1
S14.001	250.00	5.12	79.127	0.012	0.0	0.0	0.0	1.67	66.5	8.1
S13.002	250.00	5.22	78.153	0.015	0.0	0.0	0.0	3.20	127.2	10.2
S16.000	250.00	5.11	80.158	0.010	0.0	0.0	0.0	1.63	64.9	6.8
S16.001	250.00	5.15	79.047	0.010	0.0	0.0	0.0	1.96	138.7	6.8
S17.000	250.00	5.02	79.981	0.008	0.0	0.0	0.0	3.23	128.3	5.4
S16.002	250.00	5.26	78.973	0.018	0.0	0.0	0.0	2.61	184.3	12.2
S18.000	250.00	5.19	76.853	0.014	0.0	0.0	0.0	1.63	64.7	9.5

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Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)
S19.000	5.875	0.090	65.2	0.012	5.00	0.0	0.600	o	225
S18.001	22.873	0.401	57.1	0.000	0.00	0.0	0.600	o	300
S16.003	8.375	0.130	64.5	0.000	0.00	0.0	0.600	o	300
S20.000	5.973	0.093	64.2	0.011	5.00	0.0	0.600	o	225
S16.004	13.570	0.173	78.5	0.000	0.00	0.0	0.600	o	300
S21.000	10.017	0.607	16.5	0.011	5.00	0.0	0.600	o	225
S1.013	11.582	0.180	64.4	0.000	0.00	0.0	0.600	o	300
S22.000	11.107	0.673	16.5	0.003	5.00	0.0	0.600	o	225
S1.014	3.527	0.055	64.7	0.000	0.00	0.0	0.600	o	300
S23.000	3.723	0.222	16.8	0.005	5.00	0.0	0.600	o	225
S1.015	2.350	0.036	64.7	0.000	0.00	0.0	0.600	o	300

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S19.000	250.00	5.06	78.004	0.012	0.0	0.0	0.0	1.62	64.5	8.1
S18.001	250.00	5.38	76.487	0.026	0.0	0.0	0.0	2.08	147.4	17.6
S16.003	250.00	5.45	76.086	0.044	0.0	0.0	0.0	1.96	138.6	29.8
S20.000	250.00	5.06	79.476	0.011	0.0	0.0	0.0	1.63	65.0	7.4
S16.004	250.00	5.57	75.957	0.055	0.0	0.0	0.0	1.78	125.6	37.2
S21.000	250.00	5.05	78.735	0.011	0.0	0.0	0.0	3.24	128.7	7.4
S1.013	250.00	6.09	75.784	0.173	0.0	0.0	0.0	1.96	138.7	117.1
S22.000	250.00	5.06	78.302	0.003	0.0	0.0	0.0	3.24	128.7	2.0
S1.014	250.00	6.12	75.604	0.176	0.0	0.0	0.0	1.96	138.4	119.2
S23.000	250.00	5.02	78.162	0.005	0.0	0.0	0.0	3.21	127.6	3.4
S1.015	250.00	6.14	75.549	0.181	0.0	0.0	0.0	1.96	138.4	122.5

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Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)
S24.000	5.064	0.303	16.7	0.003	5.00	0.0	0.600	o	225
S1.016	13.393	0.299	44.8	0.000	0.00	0.0	0.600	o	300
S25.000	13.692	0.213	64.4	0.008	5.00	0.0	0.600	o	225
S26.000	7.026	0.213	33.0	0.008	5.00	0.0	0.600	o	225
S25.001	2.084	0.033	63.7	0.000	0.00	0.0	0.600	o	225
S1.017	1.909	0.030	63.6	0.000	0.00	0.0	0.600	o	300
S1.018	7.488	0.116	64.4	0.000	0.00	0.0	0.600	o	300
S27.000	3.689	0.207	17.8	0.010	5.00	0.0	0.600	o	225
S1.019	13.904	0.217	64.2	0.000	0.00	0.0	0.600	o	375
S28.000	6.436	0.362	17.8	0.005	5.00	0.0	0.600	o	225
S1.020	1.361	0.021	65.1	0.000	0.00	0.0	0.600	o	375

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S24.000	250.00	5.03	78.103	0.003	0.0	0.0	0.0	3.22	127.9	2.0
S1.016	250.00	6.24	75.513	0.184	0.0	0.0	0.0	2.36	166.5	124.6
S25.000	250.00	5.14	78.510	0.008	0.0	0.0	0.0	1.63	64.9	5.4
S26.000	250.00	5.05	78.285	0.008	0.0	0.0	0.0	2.29	90.9	5.4
S25.001	250.00	5.16	78.072	0.016	0.0	0.0	0.0	1.64	65.3	10.8
S1.017	250.00	6.25	75.214	0.200	0.0	0.0	0.0	1.97	139.6	135.4
S1.018	250.00	6.31	75.184	0.200	0.0	0.0	0.0	1.96	138.7	135.4
S27.000	250.00	5.02	78.118	0.010	0.0	0.0	0.0	3.12	123.9	6.8
S1.019	250.00	6.42	74.993	0.210	0.0	0.0	0.0	2.26	250.1	142.2
S28.000	250.00	5.03	77.554	0.005	0.0	0.0	0.0	3.12	124.0	3.4
S1.020	250.00	6.43	74.776	0.215	0.0	0.0	0.0	2.25	248.4	145.6

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Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)
S29.000	6.998	0.393	17.8	0.008	5.00	0.0	0.600	o	225
S1.021	25.037	0.389	64.4	0.000	0.00	0.0	0.600	o	375
S30.000	9.064	0.498	18.2	0.009	5.00	0.0	0.600	o	225
S1.022	27.117	0.422	64.2	0.000	0.00	0.0	0.600	o	375
S31.000	10.483	0.570	18.4	0.008	5.00	0.0	0.600	o	225
S1.023	19.313	0.300	64.4	0.000	0.00	0.0	0.600	o	375
S32.000	11.665	0.181	64.5	0.015	5.00	0.0	0.600	o	225
S32.001	22.992	0.357	64.4	0.000	0.00	0.0	0.600	o	300
S33.000	11.125	0.172	64.5	0.010	5.00	0.0	0.600	o	225
S32.002	3.743	0.058	64.4	0.000	0.00	0.0	0.600	o	300
S34.000	4.133	0.065	64.0	0.015	5.00	0.0	0.600	o	225
S32.003	24.502	0.380	64.4	0.000	0.00	0.0	0.600	o	300

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S29.000	250.00	5.04	77.521	0.008	0.0	0.0	0.0	3.12	123.9	5.4
S1.021	250.00	6.61	74.755	0.223	0.0	0.0	0.0	2.26	249.7	151.0
S30.000	250.00	5.05	76.303	0.009	0.0	0.0	0.0	3.08	122.5	6.1
S1.022	250.00	6.81	74.367	0.232	0.0	0.0	0.0	2.26	250.1	157.1
S31.000	250.00	5.06	75.197	0.008	0.0	0.0	0.0	3.06	121.9	5.4
S1.023	250.00	6.95	73.944	0.240	0.0	0.0	0.0	2.26	249.7	162.5
S32.000	250.00	5.12	82.489	0.015	0.0	0.0	0.0	1.63	64.9	10.2
S32.001	250.00	5.31	82.233	0.015	0.0	0.0	0.0	1.96	138.7	10.2
S33.000	250.00	5.11	81.069	0.010	0.0	0.0	0.0	1.63	64.9	6.8
S32.002	250.00	5.35	80.822	0.025	0.0	0.0	0.0	1.96	138.7	16.9
S34.000	250.00	5.04	80.761	0.015	0.0	0.0	0.0	1.64	65.1	10.2
S32.003	250.00	5.55	80.039	0.040	0.0	0.0	0.0	1.96	138.7	27.1

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Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)
S35.000	2.548	0.040	63.7	0.012	5.00	0.0	0.600	o	225
S32.004	20.846	0.323	64.5	0.000	0.00	0.0	0.600	o	300
S36.000	10.406	0.162	64.4	0.014	5.00	0.0	0.600	o	225
S32.005	3.543	0.055	63.9	0.000	0.00	0.0	0.600	o	300
S37.000	2.449	0.038	64.1	0.013	5.00	0.0	0.600	o	225
S32.006	4.607	0.072	64.1	0.000	0.00	0.0	0.600	o	300
S32.007	10.594	0.210	50.5	0.000	0.00	0.0	0.600	o	300
S38.000	4.113	0.065	63.7	0.008	5.00	0.0	0.600	o	225
S32.008	20.679	0.322	64.2	0.000	0.00	0.0	0.600	o	300
S39.000	2.209	0.035	63.9	0.013	5.00	0.0	0.600	o	225
S32.009	23.288	0.362	64.4	0.000	0.00	0.0	0.600	o	300

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S35.000	250.00	5.03	80.003	0.012	0.0	0.0	0.0	1.64	65.3	8.1
S32.004	250.00	5.73	79.659	0.052	0.0	0.0	0.0	1.96	138.6	35.2
S36.000	250.00	5.11	79.978	0.014	0.0	0.0	0.0	1.63	64.9	9.5
S32.005	250.00	5.76	79.335	0.066	0.0	0.0	0.0	1.97	139.3	44.7
S37.000	250.00	5.02	79.620	0.013	0.0	0.0	0.0	1.64	65.1	8.8
S32.006	250.00	5.80	79.280	0.079	0.0	0.0	0.0	1.97	139.0	53.5
S32.007	250.00	5.88	77.851	0.079	0.0	0.0	0.0	2.22	156.8	53.5
S38.000	250.00	5.04	79.136	0.008	0.0	0.0	0.0	1.64	65.3	5.4
S32.008	250.00	6.06	77.641	0.087	0.0	0.0	0.0	1.97	138.9	58.9
S39.000	250.00	5.02	78.012	0.013	0.0	0.0	0.0	1.64	65.2	8.8
S32.009	250.00	6.25	77.319	0.100	0.0	0.0	0.0	1.96	138.7	67.7

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Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)
S40.000	3.216	0.050	64.4	0.011	5.00	0.0	0.600	o	225
S32.010	29.809	0.464	64.3	0.000	0.00	0.0	0.600	o	300
S41.000	4.064	0.064	63.9	0.013	5.00	0.0	0.600	o	225
S32.011	33.480	0.520	64.4	0.000	0.00	0.0	0.600	o	300
S32.012	19.880	0.309	64.4	0.000	0.00	0.0	0.600	o	300
S42.000	10.311	0.161	64.0	0.006	5.00	0.0	0.600	o	225
S1.024	17.222	0.267	64.5	0.000	0.00	0.0	0.600	o	450
S43.000	11.977	0.187	64.2	0.024	5.00	0.0	0.600	o	225
S43.001	5.865	0.091	64.6	0.000	0.00	0.0	0.600	o	300
S44.000	2.613	0.041	63.7	0.003	5.00	0.0	0.600	o	225
S43.002	20.694	0.321	64.4	0.000	0.00	0.0	0.600	o	300
S45.000	3.091	0.048	64.1	0.019	5.00	0.0	0.600	o	225

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S40.000	250.00	5.03	76.957	0.011	0.0	0.0	0.0	1.63	64.9	7.4
S32.010	250.00	6.51	76.832	0.111	0.0	0.0	0.0	1.96	138.8	75.2
S41.000	250.00	5.04	75.611	0.013	0.0	0.0	0.0	1.64	65.2	8.8
S32.011	250.00	6.79	75.472	0.124	0.0	0.0	0.0	1.96	138.7	84.0
S32.012	250.00	6.96	74.953	0.124	0.0	0.0	0.0	1.96	138.7	84.0
S42.000	250.00	5.10	74.326	0.006	0.0	0.0	0.0	1.64	65.1	4.1
S1.024	250.00	7.07	73.569	0.370	0.0	0.0	0.0	2.53	403.1	250.5
S43.000	250.00	5.12	79.974	0.024	0.0	0.0	0.0	1.63	65.0	16.2
S43.001	250.00	5.17	79.674	0.024	0.0	0.0	0.0	1.96	138.5	16.2
S44.000	250.00	5.03	80.239	0.003	0.0	0.0	0.0	1.64	65.2	2.0
S43.002	250.00	5.35	79.583	0.027	0.0	0.0	0.0	1.96	138.7	18.3
S45.000	250.00	5.03	80.133	0.019	0.0	0.0	0.0	1.64	65.1	12.9

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Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)
S43.003	17.985	0.279	64.5	0.000	0.00	0.0	0.600	o	300
S46.000	2.669	0.042	63.5	0.022	5.00	0.0	0.600	o	225
S43.004	9.988	0.156	64.2	0.000	0.00	0.0	0.600	o	300
S43.005	12.435	0.194	64.2	0.000	0.00	0.0	0.600	o	300
S47.000	9.572	0.149	64.2	0.015	5.00	0.0	0.600	o	225
S43.006	1.254	0.019	65.7	0.000	0.00	0.0	0.600	o	300
S48.000	2.158	0.034	63.5	0.009	5.00	0.0	0.600	o	225
S43.007	29.799	0.509	58.5	0.000	0.00	0.0	0.600	o	300
S49.000	2.206	0.035	63.9	0.020	5.00	0.0	0.600	o	225
S50.000	9.019	0.145	62.2	0.020	5.00	0.0	0.600	o	225
S43.008	18.807	0.293	64.2	0.000	0.00	0.0	0.600	o	300
S51.000	2.206	0.035	63.9	0.013	5.00	0.0	0.600	o	225

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S43.003	250.00	5.50	79.262	0.046	0.0	0.0	0.0	1.96	138.6	31.1
S46.000	250.00	5.03	79.980	0.022	0.0	0.0	0.0	1.64	65.3	14.9
S43.004	250.00	5.59	78.983	0.068	0.0	0.0	0.0	1.97	138.9	46.0
S43.005	250.00	5.69	78.827	0.068	0.0	0.0	0.0	1.97	138.9	46.0
S47.000	250.00	5.10	79.613	0.015	0.0	0.0	0.0	1.63	65.0	10.2
S43.006	250.00	5.70	78.634	0.083	0.0	0.0	0.0	1.94	137.3	56.2
S48.000	250.00	5.02	79.704	0.009	0.0	0.0	0.0	1.64	65.4	6.1
S43.007	250.00	5.94	78.615	0.092	0.0	0.0	0.0	2.06	145.6	62.3
S49.000	250.00	5.02	79.316	0.020	0.0	0.0	0.0	1.64	65.2	13.5
S50.000	250.00	5.09	79.189	0.020	0.0	0.0	0.0	1.66	66.0	13.5
S43.008	250.00	6.10	77.160	0.132	0.0	0.0	0.0	1.97	138.9	89.4
S51.000	250.00	5.02	78.966	0.013	0.0	0.0	0.0	1.64	65.2	8.8

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Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)
S52.000	8.810	0.137	64.3	0.015	5.00	0.0	0.600	o	225
S43.009	29.666	0.461	64.4	0.000	0.00	0.0	0.600	o	300
S53.000	2.796	0.044	64.1	0.046	5.00	0.0	0.600	o	225
S43.010	12.936	0.201	64.4	0.000	0.00	0.0	0.600	o	375
S43.011	39.140	0.758	51.7	0.000	0.00	0.0	0.600	o	375
S54.000	2.735	1.642	1.7	0.129	5.00	0.0	0.600	o	150
S55.000	20.094	0.313	64.2	0.129	5.00	0.0	0.600	o	300
S55.001	11.717	0.183	64.1	0.000	0.00	0.0	0.600	o	300
S43.012	31.808	0.494	64.4	0.000	0.00	0.0	0.600	o	450
S43.013	16.736	0.260	64.4	0.000	0.00	0.0	0.600	o	450
S56.000	2.800	0.044	64.1	0.099	5.00	0.0	0.600	o	300
S43.014	22.383	0.349	64.2	0.000	0.00	0.0	0.600	o	300

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S52.000	250.00	5.09	78.961	0.015	0.0	0.0	0.0	1.63	64.9	10.2
S43.009	250.00	6.35	76.867	0.160	0.0	0.0	0.0	1.96	138.7	108.3
S53.000	250.00	5.03	78.383	0.046	0.0	0.0	0.0	1.64	65.1	31.1
S43.010	250.00	6.45	76.331	0.206	0.0	0.0	0.0	2.26	249.7	139.5
S43.011	250.00	6.71	76.131	0.206	0.0	0.0	0.0	2.53	279.0	139.5
S54.000	250.00	5.01	77.240	0.129	0.0	0.0	0.0	7.87	139.1	87.3
S55.000	250.00	5.17	77.412	0.129	0.0	0.0	0.0	1.97	138.9	87.3
S55.001	250.00	5.27	76.676	0.129	0.0	0.0	0.0	1.97	139.0	87.3
S43.012	250.00	6.92	75.298	0.464	0.0	0.0	0.0	2.54	403.4	314.2
S43.013	250.00	7.03	74.804	0.464	0.0	0.0	0.0	2.54	403.4	314.2
S56.000	250.00	5.02	75.762	0.099	0.0	0.0	0.0	1.97	139.0	67.0
S43.014	250.00	5.19	74.544	0.000	76.8	0.0	0.0	1.97	138.9	76.8

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Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)
S57.000	13.472	0.255	52.8	0.075	5.00	0.0	0.600	o	225
S58.000	8.001	0.124	64.4	0.084	5.00	0.0	0.600	o	225
S57.001	8.295	0.129	64.2	0.000	0.00	0.0	0.600	o	300
S57.002	12.581	0.197	64.0	0.000	0.00	0.0	0.600	o	300
S43.015	23.317	0.363	64.2	0.000	0.00	0.0	0.600	o	375
S59.000	2.514	0.039	64.5	0.080	5.00	0.0	0.600	o	225
S43.016	25.641	0.398	64.4	0.000	0.00	0.0	0.600	o	375
S43.017	12.505	0.195	64.0	0.000	0.00	0.0	0.600	o	375
S60.000	2.150	0.034	63.9	0.025	5.00	0.0	0.600	o	225
S43.018	4.444	0.067	66.1	0.000	0.00	0.0	0.600	o	450
S43.019	18.324	0.363	50.4	0.000	0.00	0.0	0.600	o	450
S61.000	4.914	0.076	64.7	0.014	5.00	0.0	0.600	o	225
S43.020	16.249	0.253	64.2	0.000	0.00	0.0	0.600	o	450

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S57.000	250.00	5.12	75.735	0.075	0.0	0.0	0.0	1.80	71.7	50.8
S58.000	250.00	5.08	75.772	0.084	0.0	0.0	0.0	1.63	64.9	56.9
S57.001	250.00	5.19	75.405	0.159	0.0	0.0	0.0	1.97	138.9	107.7
S57.002	250.00	5.30	75.276	0.159	0.0	0.0	0.0	1.97	139.1	107.7
S43.015	250.00	5.47	74.120	0.159	76.8	0.0	0.0	2.26	250.1	184.5
S59.000	250.00	5.03	74.463	0.080	0.0	0.0	0.0	1.63	64.9	54.2
S43.016	250.00	5.66	73.757	0.239	76.8	0.0	0.0	2.26	249.7	238.6
S43.017	250.00	5.75	73.359	0.239	76.8	0.0	0.0	2.27	250.5	238.6
S60.000	250.00	5.02	73.464	0.025	0.0	0.0	0.0	1.64	65.2	16.9
S43.018	250.00	5.78	73.089	0.264	76.8	0.0	0.0	2.50	398.2	255.5
S43.019	250.00	5.89	73.021	0.264	76.8	0.0	0.0	2.87	456.2	255.5
S61.000	250.00	5.05	72.959	0.014	0.0	0.0	0.0	1.63	64.8	9.5
S43.020	250.00	6.00	72.658	0.278	76.8	0.0	0.0	2.54	404.1	265.0

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Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)
S43.021	11.391	0.177	64.2	0.000	0.00	0.0	0.600	o	450
S62.000	2.137	0.034	63.7	0.006	5.00	0.0	0.600	o	225
S43.022	13.882	0.215	64.5	0.000	0.00	0.0	0.600	o	450
S43.023	27.459	0.428	64.2	0.022	0.00	0.0	0.600	o	450
S63.000	3.145	0.136	23.1	0.091	5.00	0.0	0.600	o	225
S64.000	8.791	0.136	64.5	0.011	5.00	0.0	0.600	o	225
S63.001	11.763	0.183	64.4	0.000	0.00	0.0	0.600	o	300
S65.000	5.684	0.088	64.6	0.118	5.00	0.0	0.600	o	300
S63.002	8.091	0.126	64.4	0.000	0.00	0.0	0.600	o	225
S63.003	32.158	0.499	64.5	0.000	0.00	0.0	0.600	o	225
S63.004	16.034	0.250	64.1	0.000	0.00	0.0	0.600	o	225
S66.000	3.518	0.055	64.5	0.005	5.00	0.0	0.600	o	225
S67.000	3.482	0.055	63.3	0.004	5.00	0.0	0.600	o	225

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S43.021	250.00	6.07	72.405	0.278	76.8	0.0	0.0	2.54	404.1	265.0
S62.000	250.00	5.02	73.227	0.006	0.0	0.0	0.0	1.64	65.3	4.1
S43.022	250.00	6.16	72.227	0.284	76.8	0.0	0.0	2.53	403.1	269.1
S43.023	250.00	6.34	72.012	0.306	76.8	0.0	0.0	2.54	404.1	284.0
S63.000	250.00	5.02	73.106	0.091	0.0	0.0	0.0	2.73	108.6	61.6
S64.000	250.00	5.09	73.061	0.011	0.0	0.0	0.0	1.63	64.9	7.4
S63.001	250.00	5.19	72.850	0.102	0.0	0.0	0.0	1.96	138.7	69.1
S65.000	250.00	5.05	72.979	0.118	0.0	0.0	0.0	1.96	138.5	79.9
S63.002	250.00	5.08	72.667	0.000	14.7	0.0	0.0	1.63	64.9	14.7
S63.003	250.00	5.33	72.248	0.000	14.7	0.0	0.0	1.63	64.9	14.7
S63.004	250.00	5.16	71.749	0.000	14.7	0.0	0.0	1.64	65.1	14.7
S66.000	250.00	5.04	72.786	0.005	0.0	0.0	0.0	1.63	64.9	3.4
S67.000	250.00	5.04	72.895	0.004	0.0	0.0	0.0	1.65	65.5	2.7

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Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)
S68.000	2.258	0.035	63.7	0.003	5.00	0.0	0.600	o	225
S69.000	2.049	0.032	64.0	0.016	5.00	0.0	0.600	o	225
S70.000	2.104	0.038	55.5	0.020	5.00	0.0	0.600	o	225
S71.000	8.591	0.135	63.6	0.027	5.00	0.0	0.600	o	225
S70.001	24.976	0.396	63.1	0.000	0.00	0.0	0.600	o	375
S72.000	8.866	0.141	63.1	0.028	5.00	0.0	0.600	o	225
S73.000	1.515	0.024	63.1	0.015	5.00	0.0	0.600	o	225
S70.002	22.180	0.344	64.4	0.000	0.00	0.0	0.600	o	375
S74.000	12.133	0.324	37.5	0.009	5.00	0.0	0.600	o	225
S75.000	20.807	0.324	64.2	0.036	5.00	0.0	0.600	o	225
S74.001	12.189	0.189	64.5	0.000	0.00	0.0	0.600	o	225

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S68.000	250.00	5.02	73.043	0.003	0.0	0.0	0.0	1.64	65.3	2.0
S69.000	250.00	5.02	73.108	0.016	0.0	0.0	0.0	1.64	65.1	10.8
S70.000	250.00	5.02	73.473	0.020	0.0	0.0	0.0	1.76	70.0	13.5
S71.000	250.00	5.09	73.323	0.027	0.0	0.0	0.0	1.64	65.3	18.3
S70.001	250.00	5.27	73.114	0.047	0.0	0.0	0.0	2.28	252.3	31.8
S72.000	250.00	5.09	73.210	0.028	0.0	0.0	0.0	1.65	65.6	19.0
S73.000	250.00	5.02	73.389	0.015	0.0	0.0	0.0	1.65	65.6	10.2
S70.002	250.00	5.43	72.718	0.090	0.0	0.0	0.0	2.26	249.7	60.9
S74.000	250.00	5.09	73.610	0.009	0.0	0.0	0.0	2.14	85.2	6.1
S75.000	250.00	5.21	73.493	0.036	0.0	0.0	0.0	1.63	65.0	24.4
S74.001	250.00	5.34	73.169	0.045	0.0	0.0	0.0	1.63	64.9	30.5

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Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)
S74.002	7.758	0.121	64.1	0.000	0.00	0.0	0.600	o	225
S76.000	2.200	0.035	63.7	0.041	5.00	0.0	0.600	o	225
S74.003	5.864	0.091	64.5	0.000	0.00	0.0	0.600	o	225
S74.004	14.647	0.227	64.5	0.000	0.00	0.0	0.600	o	225
S77.000	2.492	0.039	63.9	0.029	5.00	0.0	0.600	o	225
S78.000	2.086	0.033	63.7	0.019	5.00	0.0	0.600	o	225
S74.005	12.505	0.195	64.2	0.000	0.00	0.0	0.600	o	375
S74.006	12.643	0.196	64.4	0.000	0.00	0.0	0.600	o	375
S74.007	4.384	0.068	64.4	0.000	0.00	0.0	0.600	o	375
S79.000	1.875	0.029	64.5	0.037	5.00	0.0	0.600	o	225
S74.008	1.000	0.015	64.7	0.000	0.00	0.0	0.600	o	375
S80.000	7.421	0.116	64.2	0.024	5.00	0.0	0.600	o	225
S74.009	18.452	0.287	64.2	0.000	0.00	0.0	0.600	o	375

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S74.002	250.00	5.42	72.849	0.045	0.0	0.0	0.0	1.64	65.1	30.5
S76.000	250.00	5.02	73.517	0.041	0.0	0.0	0.0	1.64	65.3	27.8
S74.003	250.00	5.48	72.728	0.086	0.0	0.0	0.0	1.63	64.9	58.2
S74.004	250.00	5.63	72.612	0.086	0.0	0.0	0.0	1.63	64.9	58.2
S77.000	250.00	5.03	72.972	0.029	0.0	0.0	0.0	1.64	65.2	19.6
S78.000	250.00	5.02	72.942	0.019	0.0	0.0	0.0	1.64	65.3	12.9
S74.005	250.00	5.72	71.886	0.134	0.0	0.0	0.0	2.26	250.1	90.7
S74.006	250.00	5.81	71.691	0.134	0.0	0.0	0.0	2.26	249.7	90.7
S74.007	250.00	5.84	71.495	0.134	0.0	0.0	0.0	2.26	249.7	90.7
S79.000	250.00	5.02	72.911	0.037	0.0	0.0	0.0	1.63	64.9	25.1
S74.008	250.00	5.85	71.427	0.171	0.0	0.0	0.0	2.26	249.1	115.8
S80.000	250.00	5.08	72.968	0.024	0.0	0.0	0.0	1.63	65.0	16.2
S74.009	250.00	5.99	71.411	0.195	0.0	0.0	0.0	2.26	250.1	132.0

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Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)
S69.001	9.641	0.150	64.2	0.000	0.00	0.0	0.600	o	375
S69.002	20.596	0.320	64.4	0.000	0.00	0.0	0.600	o	375
S68.001	9.771	0.152	64.4	0.000	0.00	0.0	0.600	o	375
S67.001	13.348	0.207	64.4	0.000	0.00	0.0	0.600	o	375
S66.001	12.088	0.189	63.9	0.000	0.00	0.0	0.600	o	375
S43.024	14.915	0.232	64.4	0.000	0.00	0.0	0.600	o	300

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S69.001	250.00	6.06	71.124	0.301	0.0	0.0	0.0	2.26	250.1	203.8
S69.002	250.00	6.21	70.974	0.301	0.0	0.0	0.0	2.26	249.7	203.8
S68.001	250.00	6.28	70.654	0.304	0.0	0.0	0.0	2.26	249.7	205.8
S67.001	250.00	6.38	70.502	0.308	0.0	0.0	0.0	2.26	249.7	208.5
S66.001	250.00	6.47	70.295	0.313	0.0	0.0	0.0	2.27	250.7	211.9
S43.024	250.00	5.13	70.106	0.000	50.0	0.0	0.0	1.96	138.7	50.0

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S1.024	S	74.387	73.302	0.000	300	0

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S43.024	S	73.231	69.874	0.000	450	0

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Simulation Criteria for Storm

Volumetric Runoff Coeff	0.840	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	0.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

Number of Input Hydrographs	0	Number of Storage Structures	0
Number of Online Controls	0	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FEH	D2 (1km)	0.395	Winter Storms	Yes
Return Period (years)	261	D3 (1km)	0.275	Cv (Summer)	0.750
Site Location		E (1km)	0.299	Cv (Winter)	0.840
C (1km)	-0.027	F (1km)	2.415	Storm Duration (mins)	15
D1 (1km)	0.358	Summer Storms	No		

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Summary of Results for 15 minute 261 year Winter (Storm)

Margin for Flood Risk Warning (mm) 300.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
S1.000	S477	80.154	-0.184	0.000	0.08	0.0	2.4	OK
S1.001	S478	79.889	-0.263	0.000	0.04	0.0	2.4	OK
S2.000	S479	80.071	-0.175	0.000	0.11	0.0	3.2	OK
S1.002	S479	79.713	-0.228	0.000	0.13	0.0	5.5	OK*
S3.000	S481	80.309	-0.152	0.000	0.23	0.0	7.2	OK
S1.003	S480	79.648	-0.217	0.000	0.17	0.0	12.6	OK*
S4.000	S483	80.234	-0.132	0.000	0.36	0.0	10.4	OK
S1.004	S481	79.441	-0.186	0.000	0.30	0.0	22.9	OK*
S5.000	S485	80.077	-0.138	0.000	0.31	0.0	9.6	OK
S1.005	S482	79.148	-0.157	0.000	0.45	0.0	32.4	OK*
S6.000	S487	79.831	-0.150	0.000	0.24	0.0	7.2	OK
S1.006	S483	79.053	-0.047	0.000	1.00	0.0	38.5	OK*
S7.000	S489	79.854	-0.099	0.000	0.60	0.0	19.1	OK
S1.007	S484	78.836	0.252	0.000	1.21	0.0	55.6	SURCHARGED
S8.000	S491	79.798	-0.185	0.000	0.07	0.0	1.6	OK
S1.008	S485	78.751	0.197	0.000	1.45	0.0	56.0	OK*
S9.000	S493	79.823	-0.181	0.000	0.08	0.0	1.6	OK
S1.009	S486	78.630	0.134	0.000	1.40	0.0	57.2	OK*
S10.000	S495	79.764	-0.185	0.000	0.07	0.0	2.4	OK
S1.010	S487	78.501	0.072	0.000	1.22	0.0	58.9	OK*
S11.000	S497	79.745	-0.155	0.000	0.21	0.0	4.0	OK
S1.011	S488	78.361	0.027	0.000	0.90	0.0	61.8	OK*
S12.000	S503	79.301	-0.161	0.000	0.18	0.0	4.8	OK
S1.012	S490	78.206	0.060	0.000	1.31	0.0	65.4	OK*
S13.000	S517	79.767	-0.178	0.000	0.10	0.0	2.4	OK
S13.001	S518	78.352	-0.187	0.000	0.07	0.0	2.4	OK
S14.000	S519	79.241	-0.148	0.000	0.25	0.0	4.8	OK
S15.000	S520	79.240	-0.148	0.000	0.25	0.0	4.8	OK
S14.001	S520	79.207	-0.145	0.000	0.27	0.0	9.4	OK*
S13.002	S479	78.216	-0.162	0.000	0.17	0.0	11.9	OK*
S16.000	S505	80.235	-0.148	0.000	0.26	0.0	8.0	OK
S16.001	S506	79.134	-0.213	0.000	0.18	0.0	7.9	OK
S17.000	S507	80.041	-0.165	0.000	0.16	0.0	6.4	OK
S16.002	S507	79.048	-0.224	0.000	0.14	0.0	14.1	OK*
S18.000	S509	77.403	0.325	0.000	0.34	0.0	11.2	FLOOD RISK*
S19.000	S510	78.097	-0.132	0.000	0.36	0.0	9.6	OK
S18.001	S510	77.725	0.938	0.000	0.25	0.0	18.4	SURCHARGED
S16.003	S508	77.705	1.318	0.000	0.54	0.0	30.5	SURCHARGED
S20.000	S513	79.564	-0.137	0.000	0.32	0.0	8.8	OK
S16.004	S509	77.688	1.431	0.000	0.56	0.0	36.7	OK*
S21.000	S515	78.792	-0.168	0.000	0.14	0.0	8.8	OK
S1.013	S491	77.662	1.578	0.000	1.49	0.0	94.4	SURCHARGED
S22.000	S524	78.331	-0.196	0.000	0.04	0.0	2.4	OK
S1.014	S492	77.292	1.389	0.000	2.43	0.0	93.9	OK*
S23.000	S526	78.209	-0.178	0.000	0.10	0.0	4.0	OK
S1.015	S493	76.946	1.096	0.000	2.46	0.0	95.1	OK*

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Summary of Results for 15 minute 261 year Winter (Storm)

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
S24.000	S528	78.135	-0.193	0.000	0.05	0.0	2.4	OK
S1.016	S494	76.581	0.768	0.000	1.11	0.0	95.8	OK*
S25.000	S530	78.578	-0.157	0.000	0.20	0.0	6.4	OK
S26.000	S531	78.344	-0.166	0.000	0.16	0.0	6.4	OK
S25.001	S531	78.209	-0.088	0.000	0.66	0.0	12.6	OK*
S1.017	S495	76.208	0.694	0.000	2.61	0.0	100.9	OK*
S1.018	S496	75.797	0.313	0.000	1.88	0.0	101.1	SURCHARGED
S27.000	S535	78.186	-0.157	0.000	0.20	0.0	8.0	OK
S1.019	S497	75.386	0.018	0.000	0.79	0.0	103.8	OK*
S28.000	S537	77.595	-0.184	0.000	0.07	0.0	4.0	OK
S1.020	S498	75.250	0.099	0.000	1.36	0.0	105.2	OK*
S29.000	S539	77.572	-0.174	0.000	0.11	0.0	6.4	OK
S1.021	S499	74.978	-0.152	0.000	0.66	0.0	107.3	OK*
S30.000	S541	76.356	-0.172	0.000	0.13	0.0	7.2	OK
S1.022	S540	74.593	-0.149	0.000	0.67	0.0	110.1	OK*
S31.000	S543	75.247	-0.175	0.000	0.11	0.0	6.4	OK
S1.023	S541	74.183	-0.136	0.000	0.73	0.0	113.0	OK*
S32.000	S546	82.586	-0.128	0.000	0.38	0.0	11.9	OK
S32.001	S547	82.318	-0.216	0.000	0.17	0.0	11.8	OK
S33.000	S548	81.146	-0.148	0.000	0.26	0.0	7.9	OK
S32.002	S548	80.976	-0.146	0.000	0.51	0.0	19.8	OK
S34.000	S550	80.878	-0.108	0.000	0.53	0.0	11.9	OK
S32.003	S549	80.183	-0.156	0.000	0.46	0.0	31.6	OK
S35.000	S552	80.117	-0.111	0.000	0.50	0.0	9.5	OK
S32.004	S550	79.849	-0.109	0.000	0.59	0.0	40.0	OK
S36.000	S554	80.072	-0.131	0.000	0.36	0.0	11.1	OK
S32.005	S551	79.738	0.103	0.000	1.30	0.0	50.1	SURCHARGED
S37.000	S556	79.740	-0.105	0.000	0.54	0.0	10.3	OK
S32.006	S552	79.637	0.057	0.000	1.40	0.0	59.2	SURCHARGED
S32.007	S553	78.063	-0.088	0.000	0.84	0.0	59.4	OK
S38.000	S559	79.217	-0.144	0.000	0.28	0.0	6.3	OK
S32.008	S554	77.904	-0.037	0.000	0.93	0.0	63.2	OK
S39.000	S561	78.132	-0.105	0.000	0.54	0.0	10.3	OK
S32.009	S555	77.626	0.007	0.000	1.03	0.0	70.4	SURCHARGED
S40.000	S563	77.190	0.008	0.000	0.42	0.0	8.4	SURCHARGED
S32.010	S556	77.185	0.053	0.000	1.07	0.0	74.7	SURCHARGED
S41.000	S565	75.942	0.106	0.000	0.42	0.0	9.4	FLOOD RISK
S32.011	S557	75.936	0.163	0.000	1.14	0.0	80.3	SURCHARGED
S32.012	S540	75.256	0.004	0.499	1.03	0.0	69.7	FLOOD
S42.000	S541	74.385	-0.166	0.000	0.15	0.0	4.8	OK
S1.024	S519	73.878	-0.141	0.000	0.81	0.0	184.9	OK
S43.000	S169	80.102	-0.097	0.000	0.61	0.0	19.1	OK
S43.001	S170	79.807	-0.167	0.000	0.40	0.0	18.9	OK
S44.000	S171	80.292	-0.172	0.000	0.13	0.0	2.4	OK
S43.002	S171	79.693	-0.190	0.000	0.28	0.0	21.3	OK*
S45.000	S173	80.283	-0.075	0.000	0.77	0.0	15.1	OK
S43.003	S172	79.410	-0.152	0.000	0.48	0.0	36.4	OK*
S46.000	S175	80.151	-0.054	0.000	0.93	0.0	17.5	OK
S43.004	S173	79.363	0.080	0.000	0.81	0.0	50.2	OK*
S43.005	S174	79.313	0.186	0.000	0.75	0.0	48.1	SURCHARGED

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Summary of Results for 15 minute 261 year Winter (Storm)

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
S47.000	S178	79.711	-0.127	0.000	0.39	0.0	12.0	OK
S43.006	S175	79.249	0.315	0.000	1.50	0.0	58.0	OK*
S48.000	S180	79.800	-0.129	0.000	0.38	0.0	7.2	OK
S43.007	S176	79.166	0.251	0.000	0.78	0.0	61.8	OK*
S49.000	S182	79.476	-0.065	0.000	0.84	0.0	15.9	OK
S50.000	S199	79.304	-0.110	0.000	0.52	0.0	16.0	OK
S43.008	S177	78.960	1.500	0.000	1.02	0.0	76.8	OK*
S51.000	S184	79.086	-0.105	0.000	0.55	0.0	10.4	OK
S52.000	S185	79.060	-0.126	0.000	0.40	0.0	12.0	OK
S43.009	S178	78.683	1.516	0.000	1.27	0.0	88.9	SURCHARGED
S53.000	S187	78.726	0.118	0.000	1.93	0.0	36.5	FLOOD RISK
S43.010	S179	77.928	1.222	0.000	0.90	0.0	113.6	OK*
S43.011	S180	77.757	1.251	0.000	0.68	0.0	114.5	SURCHARGED
S54.000	S190	77.790	0.400	0.000	2.35	0.0	69.5	FLOOD RISK*
S55.000	S112	77.960	0.248	0.000	1.20	0.0	101.7	SURCHARGED
S55.001	S113	77.599	0.623	0.000	1.13	0.0	89.7	SURCHARGED
S43.012	S181	77.406	1.658	0.000	1.01	0.0	263.0	FLOOD RISK
S43.013	S182	76.896	1.642	6.795	0.99	0.0	224.0	FLOOD
S56.000	S193	76.390	0.328	77.619	2.47	0.0	113.6	FLOOD
S43.014	S183	76.018	1.174	0.000	1.70	0.0	128.0	OK*
S57.000	S638	76.435	0.475	0.000	1.67	0.0	58.5	FLOOD RISK*
S58.000	S118	76.476	0.479	4.313	1.88	0.0	56.0	FLOOD
S57.001	S119	75.873	0.168	0.000	1.43	0.0	96.9	OK*
S57.002	S120	76.011	0.435	0.000	1.21	0.0	97.1	FLOOD RISK
S43.015	S184	75.730	1.235	13.260	1.33	0.0	191.5	FLOOD
S59.000	S196	75.013	0.325	0.000	3.27	0.0	61.9	FLOOD RISK*
S43.016	S185	74.649	0.517	0.000	1.41	0.0	230.0	OK*
S43.017	S186	74.513	0.779	16.259	1.79	0.0	224.7	FLOOD
S60.000	S199	74.040	0.351	25.771	2.88	0.0	54.4	FLOOD
S43.018	S187	73.656	0.117	0.000	1.80	0.0	239.2	OK*
S43.019	S188	74.003	0.532	0.000	0.84	0.0	225.2	FLOOD RISK
S61.000	S122	73.509	0.325	0.000	0.42	0.0	10.3	FLOOD RISK*
S43.020	S189	73.108	0.000	0.000	0.89	0.0	198.0	OK*
S43.021	S190	73.793	0.938	0.000	0.98	0.0	182.2	FLOOD RISK
S62.000	S204	73.686	0.234	0.000	0.25	0.0	4.8	FLOOD RISK
S43.022	S191	73.683	1.006	0.000	0.83	0.0	171.6	SURCHARGED
S43.023	S152	73.567	1.105	0.000	0.68	0.0	173.9	FLOOD RISK
S63.000	S233	73.656	0.325	0.000	2.13	0.0	70.0	FLOOD RISK*
S64.000	S234	73.651	0.365	40.404	1.43	0.0	43.3	FLOOD
S63.001	S234	73.195	0.045	0.000	0.54	0.0	43.6	OK*
S65.000	S236	73.529	0.250	0.000	1.62	0.0	90.5	FLOOD RISK*
S63.002	S235	73.191	0.299	0.000	2.50	0.0	79.0	OK*
S63.003	S236	73.868	1.395	10.352	1.63	0.0	55.1	FLOOD
S63.004	S176	73.564	1.589	0.000	1.48	0.0	48.0	SURCHARGED
S66.000	S176	73.343	0.332	7.086	1.07	0.0	22.3	FLOOD
S67.000	S175	73.445	0.325	0.000	0.15	0.0	3.2	FLOOD RISK*
S68.000	S173	73.552	0.284	0.000	0.13	0.0	2.4	FLOOD RISK
S69.000	S223	73.658	0.325	0.000	0.67	0.0	12.8	FLOOD RISK*
S70.000	S224	73.709	0.011	0.000	0.84	0.0	15.9	SURCHARGED
S71.000	S225	73.738	0.190	0.000	0.71	0.0	21.5	FLOOD RISK*

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Summary of Results for 15 minute 261 year Winter (Storm)

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
S70.001	S225	73.699	0.210	0.000	0.18	0.0	37.0	SURCHARGED
S72.000	S227	73.726	0.291	0.000	0.73	0.0	22.3	FLOOD RISK
S73.000	S228	73.687	0.073	0.000	0.63	0.0	12.0	FLOOD RISK*
S70.002	S226	73.682	0.589	0.000	0.31	0.0	62.3	SURCHARGED
S74.000	S208	74.160	0.325	0.434	0.17	0.0	7.2	FLOOD
S75.000	S209	74.193	0.475	0.000	0.83	0.0	27.4	FLOOD RISK*
S74.001	S209	73.511	0.117	0.000	0.71	0.0	25.0	OK*
S74.002	S210	74.117	1.043	0.000	0.67	0.0	19.9	FLOOD RISK
S76.000	S212	74.068	0.326	0.646	1.72	0.0	32.6	FLOOD
S74.003	S211	73.707	0.754	0.000	1.70	0.0	45.8	OK*
S74.004	S212	73.910	1.073	0.000	1.27	0.0	40.7	FLOOD RISK
S77.000	S215	73.522	0.325	0.000	1.22	0.0	23.1	FLOOD RISK*
S78.000	S224	73.504	0.337	11.747	1.53	0.0	29.0	FLOOD
S74.005	S213	73.627	1.366	1.539	0.35	0.0	57.8	FLOOD
S74.006	S214	73.642	1.575	0.000	0.28	0.0	46.5	FLOOD RISK
S74.007	S182	73.655	1.785	0.000	0.46	0.0	46.4	FLOOD RISK
S79.000	S183	73.613	0.477	2.065	1.56	0.0	29.5	FLOOD
S74.008	S183	73.107	1.305	0.000	0.54	0.0	55.2	OK*
S80.000	S185	73.668	0.475	0.127	0.65	0.0	19.1	FLOOD
S74.009	S184	73.077	1.291	0.000	0.31	0.0	62.2	OK*
S69.001	S185	73.652	2.153	0.000	0.63	0.0	90.8	FLOOD RISK
S69.002	S186	73.616	2.267	0.000	0.42	0.0	82.7	FLOOD RISK
S68.001	S187	73.551	2.522	0.000	0.61	0.0	87.9	FLOOD RISK
S67.001	S188	73.065	2.188	0.000	0.70	0.0	89.9	OK*
S66.001	S189	73.426	2.756	0.000	0.77	0.0	95.0	FLOOD RISK
S43.024	S153	73.391	2.985	0.000	3.73	0.0	244.9	SURCHARGED

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APPENDIX B4

CURRENT DESIGN STANDARD

MICRODRAINAGE 15MIN

RESULTS SUMMARY

(1-24 SCENARIOS) SECTION 1

APPENDIX B5

2040 CLIMATE SCENARIO

MICRODRAINAGE 15MIN

RESULTS SUMMARY

(1-24 SCENARIOS) SECTION 1

APPENDIX B6

2060 CLIMATE SCENARIO

MICRODRAINAGE 15MIN

RESULTS SUMMARY

(1-24 SCENARIOS) SECTION 1

APPENDIX B7

2080 CLIMATE SCENARIO

MICRODRAINAGE 15MIN

RESULTS SUMMARY

(1-24 SCENARIOS) SECTION 1

APPENDIX B8

CURRENT DESIGN STANDARD

MICRODRAINAGE 180MIN

RESULTS SUMMARY

(1-24 SCENARIOS) SECTION 1

APPENDIX B9

2040 CLIMATE SCENARIO

MICRODRAINAGE 180MIN

RESULTS SUMMARY

(1-24 SCENARIOS) SECTION 1

APPENDIX B10

2060 CLIMATE SCENARIO

MICRODRAINAGE 180MIN

RESULTS SUMMARY

(1-24 SCENARIOS) SECTION 1

APPENDIX B11

2080 CLIMATE SCENARIO

MICRODRAINAGE 180MIN

RESULTS SUMMARY

(1-24 SCENARIOS) SECTION 1

APPENDIX B12

CURRENT DESIGN STANDARD

MICRODRAINAGE 15MIN

RESULTS SUMMARY

(1-24 SCENARIOS) SECTION 2

APPENDIX B13

2040 CLIMATE SCENARIO

MICRODRAINAGE 15MIN

RESULTS SUMMARY

(1-24 SCENARIOS) SECTION 2

APPENDIX B14

2060 CLIMATE SCENARIO

MICRODRAINAGE 15MIN

RESULTS SUMMARY

(1-24 SCENARIOS) SECTION 2

APPENDIX B15

2080 CLIMATE SCENARIO

MICRODRAINAGE 15MIN

RESULTS SUMMARY

(1-24 SCENARIOS) SECTION 2

APPENDIX B16

CURRENT DESIGN STANDARD

MICRODRAINAGE 180MIN

RESULTS SUMMARY

(1-24 SCENARIOS) SECTION 2

APPENDIX B17

2040 CLIMATE SCENARIO

MICRODRAINAGE 180MIN

RESULTS SUMMARY

(1-24 SCENARIOS) SECTION 2

APPENDIX B18

2060 CLIMATE SCENARIO

MICRODRAINAGE 180MIN

RESULTS SUMMARY

(1-24 SCENARIOS) SECTION 2

APPENDIX B19

2080 CLIMATE SCENARIO

MICRODRAINAGE 180MIN

RESULTS SUMMARY

(1-24 SCENARIOS) SECTION 2

APPENDIX C

RISK QUANTIFICATION (MONTE CARLO SIMULATION)

This appendix consists of the following:

Appendix C1	Prices in relation to non-residential properties flooding
Appendix C2	Prices in relation to roads flooding (pence/km)
Appendix C3	Example of the road disruption cost for A6192 - 15 minute storm duration
Appendix C4	Example of how the total flood impact distribution was calculated for 261 yr 15Minute Section 1 Part B

Appendix C1 - Prices in relation to non-residential properties flooding		(extracted from Multi Coloured Handbook data tables (2013))																	
		2013-2014 price base (No Cellar) Short Duration No Warning																	
		£ per square metre																	
MCM CODE	**PROPERTY TYPE**	**Data Quality Score**	**-1.00**	**-0.75**	**-0.50**	**-0.25**	**0.00**	**0.25**	**0.50**	**0.75**	**1.00**	**1.25**	**1.50**	**1.75**	**2.00**	**2.25**	**2.50**	**2.75**	**3.00**
2	Retail	1	0	0	0	0	38	244	406	587	753	878	980	1,070	1,221	1,308	1,370	1,398	1,435
3	Offices	1	0	0	0	0	48	256	405	516	640	708	782	874	1,016	1,102	1,169	1,196	1,235
4	Warehouses	2	0	0	0	0	16	373	724	980	1,173	1,335	1,455	1,575	1,697	1,717	1,729	1,738	1,749
5	Leisure and Sport		NOT APPLICABLE - CONSTITUENT CATEGORIES TOO DIVERSE																
51	Leisure	1	0	0	0	0	171	490	596	690	788	860	938	1,024	1,149	1,245	1,310	1,337	1,376
52	Sport		NOT APPLICABLE - CONSTITUENT CATEGORIES TOO DIVERSE																
521	Playing Field	1	0	0	0	0	1	3	5	6	8	8	9	10	11	12	13	14	14
523	Sports Centre	1	0	0	0	0	20	117	160	197	240	265	316	370	448	503	532	542	559
526	Marina	1	0	0	0	0	10	32	46	72	93	109	119	131	150	168	184	195	210
525	Sports Stadium	1	0	0	0	0	4	27	44	59	77	86	98	107	126	135	143	146	149
6	Public Buildings	1	0	0	0	0	24	147	212	271	336	380	432	489	574	637	676	690	711
8	Industry	3	0	0	0	0	8	56	91	119	149	173	197	223	262	285	309	325	345
9	Miscellaneous		NOT APPLICABLE - CONSTITUENT CATEGORIES TOO DIVERSE																
910	Car park	1	0	0	0	0	2	8	11	14	17	21	27	33	46	76	88	93	104
960	SubStation	1	0	0	0	0	12	849	1,140	1,423	2,235	2,782	3,589	3,882	5,480	5,502	5,526	5,540	5,556
NRP sector average			0	0	0	0	29	266	398	527	720	853	1,013	1,107	1,402	1,460	1,503	1,523	1,550

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Appendix C2 - Prices in relation to roads flooding (pence/km)								
(extracted from Multi Coloured Handbook data tables (2013))								
	Speed (km/hr)							
	5	10	20	40	50	80	100	120
Vehicle Category	***Total resource cost (p/km)***							
Car average	256	131	69	38	32	22	20	18
LGV average	300	156	83	47	40	30	28	27
OGV1	331	175	96	55	47	36		
OGV2	423	229	130	79	68	54		
PSV	1901	974	510	276	229			

Appendix C3 - Example of the road disruption cost for A6192 - 15 minute storm duration

The Delayed Hour Method - A6192 (15 Minute)

Number of vehicles delayed per hour		60	Type	**Car Average**
Additional cost per vehicle	Pence	32	Speed	50
Total cost from Vehicle Type	£	19.06		(Appendix A5)

Number of vehicles delayed per hour		10	Type	**LGV Average**
Additional cost per vehicle	Pence	40	Speed	50
Total cost from Vehicle Type	£	3.89		(Appendix A5)

Number of vehicles delayed per hour		10	Type	**OGV1 Average**
Additional cost per vehicle	Pence	47	Speed	50
Total cost from Vehicle Type	£	4.56		(Appendix A5)

Number of vehicles delayed per hour		10	Type	**OGV2 Average**
Additional cost per vehicle	Pence	68	Speed	50
Total cost from Vehicle Type	£	6.91		(Appendix A5)

Number of vehicles delayed per hour		4	Type	**PSV Average**
Additional cost per vehicle	Pence	229	Speed	50
Total cost from Vehicle Type	£	9.16		(Appendix A5)

TOTAL	**£**	**43.59**
Flood duration	**Hours**	**1**

Total road disruption cost	**£**	**43.59**

Appendix C4
Example of how the total flood impact distribution was calculated for 261yr 15Minute Section 1 Part B

Appendix C4 - Example of how the total flood impact distribution was calculated for 261 yr 15Minute Section 1 Part B

Event: Section 1 - 261yr 15Min							
Run	ID Number Affected	Location	Area (m^2)	Non Residential Property (£)	Road disruption (£)	Emergency Maintenance (£)	Total Cost (£) (Equation 9.1)
1.00	8.00	Part B	402	3,208.00		12.00	**3,263.59**
1.00	A6192	Part B and C			43.59		
2.00	8.00	Part B	402	3,208.00		12.00	**3,263.59**
2.00	A6192	Part B and C			43.59		
3.00	2.00	Part B	1,390	11,120.00		12.00	**1,253,862.59**
3.00	3.00	Part B	1,461	544,953.00			
3.00	4.00	Part B	402	149,573.00			
3.00	5.00	Part B	1,461	544,953.00			
3.00	8.00	Part B	402	3,208.00			
3.00	A6192	Part B and C			43.59		
4.00	2.00	Part B	1,390	11,120.00		12.00	**559,336.59**
4.00	3.00	Part B	1,461	544,953.00			
4.00	8.00	Part B	402	3,208.00			
4.00	A6192	Part B and C			43.59		
5.00	8.00	Part B	402	3,208.00		12.00	**790,666.59**
5.00	11.00	Part B	1,517	565,468.00			
5.00	12.00	Part B	595	221,935.00			
5.00	A6192	Part B and C			43.59		
6.00	2.00	Part B	1,390	11,120.00		12.00	**559,336.59**
6.00	3.00	Part B	1,461	544,953.00			
6.00	8.00	Part B	402	3,208.00			
6.00	A6192	Part B and C			43.59		
7.00	2.00	Part B	1,390	11,120.00		12.00	**559,336.59**
7.00	3.00	Part B	1,461	544,953.00			
7.00	8.00	Part B	402	3,208.00			
7.00	A6192	Part B and C			43.59		
8.00	8.00	Part B	402	3,208.00		12.00	**3,263.59**
8.00	A6192	Part B and C			43.59		
9.00	8.00	Part B	402	3,208.00		12.00	**3,263.59**
9.00	A6192	Part B and C			43.59		
10.00	2.00	Part B	1,390	11,120.00		12.00	**708,909.59**
10.00	3.00	Part B	1,461	544,953.00			
10.00	4.00	Part B	402	149,573.00			
10.00	8.00	Part B	402	3,208.00			
10.00	A6192	Part B and C			43.59		
11.00	4.00	Part B	402	149,573.00		12.00	**152,836.59**
11.00	8.00	Part B	402	3,208.00			
11.00	A6192	Part B and C			43.59		

Appendix C4
Example of how the total flood impact distribution was calculated for 261yr 15Minute Section 1 Part B

Appendix C4 - Example of how the total flood impact distribution was calculated for 261 yr 15Minute Section 1 Part B

Event: Section 1 - 261yr 15Min							
Run	**ID Number Affected**	**Location**	**Area (m^2)**	**Non Residential Property (£)**	**Road disruption (£)**	**Emergency Maintenance (£)**	**Total Cost (£) (Equation 9.1)**
12.00	4.00	Part B	402	149,573.00		12.00	**152,836.59**
12.00	8.00	Part B	402	3,208.00			
12.00	A6192	Part B and C			43.59		
13.00	3.00	Part B	1,461	544,953.00		12.00	**548,216.59**
13.00	8.00	Part B	402	3,208.00			
13.00	A6192	Part B and C			43.59		
14.00	8.00	Part B	402	3,208.00		12.00	**3,263.59**
14.00	A6192	Part B and C			43.59		
15.00	8.00	Part B	402	3,208.00		12.00	**3,263.59**
15.00	A6192	Part B and C			43.59		
16.00	4.00	Part B	402	149,573.00		12.00	**697,789.59**
16.00	5.00	Part B	1,461	544,953.00			
16.00	8.00	Part B	402	3,208.00			
16.00	A6192	Part B and C			43.59		
17.00	4.00	Part B	402	149,573.00		12.00	**152,836.59**
17.00	8.00	Part B	402	3,208.00			
17.00	A6192	Part B and C			43.59		
18.00	8.00	Part B	402	3,208.00		12.00	**3,263.59**
18.00	A6192	Part B and C			43.59		
19.00	2.00	Part B	1,390	11,120.00		12.00	**559,336.59**
19.00	3.00	Part B	1,461	544,953.00			
19.00	8.00	Part B	402	3,208.00			
19.00	A6192	Part B and C			43.59		
20.00	2.00	Part B	1,390	11,120.00		12.00	**559,336.59**
20.00	3.00	Part B	1,461	544,953.00			
20.00	8.00	Part B	402	3,208.00			
20.00	A6192	Part B and C			43.59		
21.00	8.00	Part B	402	3,208.00		12.00	**3,263.59**
21.00	A6192	Part B and C			43.59		
22.00	8.00	Part B	402	3,208.00		12.00	**3,263.59**
22.00	A6192	Part B and C			43.59		
23.00	A6192	Part B and C			43.59		**697,789.59**
23.00	4.00	Part B	402	149,573.00		12.00	
23.00	5.00	Part B	1,461	544,953.00			
23.00	8.00	Part B	402	3,208.00			
24.00	A6192	Part B and C			43.59	12.00	**55.59**