



john newton & partners

jnpgroup

Consulting Engineers

Report on

Drainage Detailed Design Statement

**Proposed Residential Development
Royal Quay
Harefield**

For

Oakford Homes

Prepared by

Anthony McNevin
Principal Engineer

Approved by

Khai Tran
Associate

Date

May 2014

Ref.

MS40837-R100 Issue 01

**Southern
Brighthouse
Midlands
Sheffield
Teesside**

Revision Record

Revision	Date	Description
01	19.05.2014	First created

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APPENDICES

Appendix A	Letter from the Environment Agency dated 3 January 2014
Appendix B	Drainage area plan for the proposed development
Appendix C	Micro Drainage design calculations
Appendix D	Letter from Thames Water regarding foul water discharge

1.0 INTRODUCTION

- 1.1 jnp group were appointed by Oakford Homes to develop a detailed drainage design for a proposed residential development at Royal Quay, Harefield.
- 1.2 The development comprises of refurbishment of an existing building to provide 4 no. flats and construction of 6 no. new build flats and 19 new build houses. The scheme has been granted planning by the London Borough of Hillingdon under planning application reference 43159/APP/2013/1094.
- 1.3 The detailed drainage design shall address the following planning conditions:

Condition 20 – The provision of sustainable water management.

Condition 22 – Details of a scheme for the disposal of surface water and sewage.

Condition 31 – The detailed surface water drainage scheme for the development shall be based on the agreed Flood Risk Assessment (FRA) by RSK, dated April 2013, reference 13872-R3(1)-FRA. The scheme shall include a restriction in run off to 46.8 l/s and provision of storage onsite for the 1 in 100 plus climate change event, as outlined in the FRA.
- 1.4 In addition to the above FRA report RSK prepared an Addendum FRA Report, dated November 2013, reference 131872 R4 (1). This report was submitted to the Environment Agency (EA) who responded by letter dated 03 January 2014 acknowledging proposed design strategy to the addendum report. A copy of the EA letter is provided in Appendix A.
- 1.5 This drainage detailed design statement is provided to highlight the measures that are proposed in the drainage design to address the aforementioned planning conditions. It should be read in conjunction with the following drawings:

Drawing no. MS30837 D408 Detailed Drainage Strategy Sheet 1 of 2
Drawing no. MS30837 D409 Detailed Drainage Strategy Sheet 1 of 2
- 1.6 Copies of Micro Drainage calculations to support the drainage design are provided in Appendix B.

2.0 DRAINAGE DETAILED DESIGN STATEMENT

2.1 The following table provides a summary of the key information for the drainage design for the development:

Item	Planning Condition	Design Requirement	Action
1	20	Design storm period and intensity.	Design has been prepared for a 1 in 100 year event plus 30% allowance for climate change. The storm duration is 6 hours. Refer to the drainage calculations provided in Appendix B.
2	31	Peak runoff rate for the new development.	As in accordance to the FRA the rate of runoff has been restricted to 46.8 l/s by the use of Hydrobrake flow controls. There are 3 surface water systems onsite each discharging: System 1 = 36.8 l/s into the existing onsite drainage system which discharges into the Grand Union Canal downstream System 2 = 5 l/s via new connection into the Grand Union Canal System 3 = 5 l/s via new connection into the Grand Union Canal
3	20, 31	SuDs techniques incorporated into the design	Site investigation has proven that infiltration is not possible across the development site due to slow infiltration rates and potential contamination issues. Underground cellular storage tanks are being provided for attenuation. In addition tanked permeable paving is being provided at the new car park adjacent to the Long Room. Water butts are being provided to the new build house where rain water downpipes are accessible in rear gardens for reuse and recycling. The following restrictions onsite preclude the use of other techniques in the SuDS

			hierarchy: • Potential contamination issues and the proposed strategy to cap the existing ground on the north and the south islands. • Existing services present onsite and the earth embankment to the rear of plots 5 to 14 which limit the areas available to provide retention ponds. • Shallow storage systems are required under the car park areas as the attenuation must be provided below the existing low point on the existing drainage system.
4	20, 31	Water Quality	Tanked permeable paving has been provided at the new car park adjacent to the Long Room to filtrate and cleanse all water from the car park before entering the surface water network. The presence of existing underground services at the small car park adjacent to the Watermill precludes the use of tanked permeable paving at this location. For the south island a propriety system has been specified to provide shallow storage and filtration within the car park sub base. Permavoid channel drains will collect surface runoff, which will be discharged via a biofilter and then into the Permavoid storage system before discharging into the Grand Union Canal. Catch pits are provided immediately upstream of all flow control chambers to remove silt, particularly where surface water runoff from access roads and car parks discharge into the system. Road gullies and Aco drains are specified to include sumps. Drainage tracing of the existing surface water network onsite has determined that there is an existing interceptor onsite. The flow from the new build housing for plots 4 to 15 and associated external works and car

			parks connect upstream of the interceptor. The 36.8 l/s flow is significantly less than the existing flow which is currently entering the surface water drainage system from the existing contributing area.
5	21	Disposal of surface water and sewage.	Three new surface water systems are proposed to serve the new build housing. The systems for the north and south islands will be private and discharge directly into the Grand Union Canal. The surface water drainage system for plots 5 to 14 and associated external works and car parks discharge into an existing private drainage system. The development is served by an existing private foul water pumping station which discharges sewage into the public sewer just outside the development site boundary. The existing foul sewerage system and rising main has been traced and CCTV surveyed. It is proposed to retain and reuse the existing private pumping station onsite. Thames Water has advised that a proposed development of 30 units can be accommodated within the existing sewage network, please refer to Appendix D. However, the existing pumping station will deliver flow into the public sewer at the same flow rate as the existing development site. An additional two small foul water private package pumping stations are required to serve the north and south islands. The rising mains from the pumping stations will cross over the foot and road bridges over the canal, and discharge into suitable points on the gravity sewer network onsite. The sewers for the new build housing onsite will not be offered for adoption as they connect into an existing private drainage system downstream within the development site.
6	20	Drainage Management and Maintenance Plan	As existing the foul and surface water drainage systems onsite will be managed and maintained by a management company.

Appendix A

Mr Clive Maynard
RSK Group Plc

Our ref: NE/2013/119329/01-L02
Your ref: 131872/L07/CM

By email: cmaynard@rsk.co.uk

Date: 3 January 2013

Dear Clive

Royal Quay, Coppermill Lock, Park Lane, Harefield, UB9 6RJ

Addendum FRA to inform the detailed surface water strategy conditioned for planning application 43159/APP/2013/1094.

Thank you for sending us the FRA addendum in respect of the above planning application. We received the document on 12 December 2013.

We are pleased to see that the proposals include a restriction in runoff rates to 46.8l/s rate in accordance with the requirements of the surface water condition. We also encourage the use of green roofs as proposed and these should also be included in the final drainage design.

Appendix D refers to the SUDs hierarchy and states that a number of SUDs features could possibly be included at detailed design. These include sand filters, bioretention, rain gardens, filter strips/trenches/drains and retention ponds. We would encourage further consideration is given to these and where possible incorporated into final drainage design.

A significant volume of the attenuation required is proposed within tanks. If there are opportunities to include other surface water features such as ponds then these options should be explored.

I hope the above comments are helpful as you prepare the detailed surface water drainage design. If you have any further queries please contact me on the details below.

Yours sincerely

**Ms Jane Wilkin
Planning Advisor**

Telephone: 020 3263 8052
E-mail: northlondonplanning@environment-agency.gov.uk
Based at: Ergon House, Horseferry Road, London, SW1P 2AL

End



Appendix B



- Notes:-
1. Where this drawing has been issued in electronic .dwg format it has been done so in good faith. jnp group do not take any responsibility for any inaccuracies in the electronic data, which should be checked against the paper (or .pdf) drawing issue. Any apparent discrepancies should be immediately reported to jnp group. The electronic .dwg file should not be assumed to be to scale and should not be used for 'overlying', setting out or checking of any third party information. All dimensions should be taken from the paper (or .pdf) version of the drawing. Electronic drawings may contain third party information, jnp group take no responsibility for this information, which should be checked against the originators paper drawing(s).
 2. All working dimensions to be checked on site.
 3. Do not scale.
 4. Any discrepancies between drawings of different scales, and between drawings and specification where appropriate to be notified to The Engineer for decision.
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Health and Safety Note:
The details on this drawing have been prepared on the assumption that a competent contractor will be carrying out the works. If the contractor(s) considers that there is insufficient Health and Safety information on this drawing, this should immediately be brought to the attention of the designer.

Legend

- Site Boundary
- System 1 Proposed Drainage Areas = 2789m²
- System 2 Proposed Drainage Areas = 1198m²
- System 3 Proposed Drainage Areas = 193m²

Rev.	Date	Amendment	By	Chk.
Status				
Preliminary				

OAKFORD HOMES

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Client	Oakford Homes
Job	Royal Quay Park Lane Harefield
Title	Proposed Drainage Areas

Scale 1:200	@ A1	Date May 2014
Drawn By IS	Eng. Check	Tech. Check

Drawing No.	MS40837-SK400	Rev.	-
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QA Ref: Q00190 Rev 6

Appendix C

JNP Group		Page 1								
Sycamore House Woodside Road Amersham HP6 6AA										
Date 19/05/2014 14:14 File SYSTEM 1.MDX	Designed by Anthony.Mcnevin Checked by									
Micro Drainage		Network 2014.1.1								
<u>Time Area Diagram for Storm</u> <table border="1"> <thead> <tr> <th>Time (mins)</th> <th>Area (ha)</th> <th>Time (mins)</th> <th>Area (ha)</th> </tr> </thead> <tbody> <tr> <td>0-4</td> <td>0.214</td> <td>4-8</td> <td>0.066</td> </tr> </tbody> </table> Total Area Contributing (ha) = 0.280 Total Pipe Volume (m³) = 9.441			Time (mins)	Area (ha)	Time (mins)	Area (ha)	0-4	0.214	4-8	0.066
Time (mins)	Area (ha)	Time (mins)	Area (ha)							
0-4	0.214	4-8	0.066							
©1982-2014 XP Solutions										

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Micro Drainage		Network 2014.1.1

Existing Network Details 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)
1.000	35.000	0.175	200.0	0.064	5.00	0.0	0.600	o	225
1.001	7.000	0.035	200.0	0.018	0.00	0.0	0.600	o	225
2.000	11.000	0.253	43.5	0.022	5.00	0.0	0.600	o	225
1.002	24.500	0.123	199.2	0.000	0.00	0.0	0.600	o	300
1.003	22.000	0.112	196.4	0.088	0.00	0.0	0.600	o	450
3.000	14.000	0.225	62.2	0.039	5.00	0.0	0.600	o	225
1.004	3.500	0.050	70.0	0.049	0.00	0.0	0.600	o	450
1.005	14.000	0.170	82.4	0.000	0.00	0.0	0.600	o	300

Network Results Table

PN	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Vel (m/s)	Cap (l/s)
1.000	41.220	0.064	0.0	0.92	36.6
1.001	41.045	0.082	0.0	0.92	36.6
2.000	41.263	0.022	0.0	1.99	79.1
1.002	40.935	0.104	0.0	1.11	78.5
1.003	40.662	0.192	0.0	1.45	230.1
3.000	41.000	0.039	0.0	1.66	66.0
1.004	40.550	0.280	0.0	2.43	386.9
1.005	40.500	0.280	0.0	1.73	122.6

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Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam., L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
1	42.850	1.630	Open Manhole	1200	1.000	41.220	225				
2	42.600	1.555	Open Manhole	1200	1.001	41.045	225	1.000	41.045	225	
3	42.850	1.587	Open Manhole	1200	2.000	41.263	225				
4	42.750	1.815	Open Manhole	1200	1.002	40.935	300	1.001	41.010	225	
								2.000	41.010	225	
5	42.750	2.088	Open Manhole	1200	1.003	40.662	450	1.002	40.812	300	
6	42.730	1.730	Open Manhole	1200	3.000	41.000	225				
6	42.780	2.230	Open Manhole	1200	1.004	40.550	450	1.003	40.550	450	
								3.000	40.775	225	
8	42.730	2.230	Open Manhole	1200	1.005	40.500	300	1.004	40.500	450	
	42.330	2.000	Open Manhole	1200		OUTFALL		1.005	40.330	300	

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PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	o	225	1	42.850	41.220	1.405	Open Manhole	1200
1.001	o	225	2	42.600	41.045	1.330	Open Manhole	1200
2.000	o	225	3	42.850	41.263	1.362	Open Manhole	1200
1.002	o	300	4	42.750	40.935	1.515	Open Manhole	1200
1.003	o	450	5	42.750	40.662	1.638	Open Manhole	1200
3.000	o	225	6	42.730	41.000	1.505	Open Manhole	1200
1.004	o	450	6	42.780	40.550	1.780	Open Manhole	1200
1.005	o	300	8	42.730	40.500	1.930	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	35.000	200.0	2	42.600	41.045	1.330	Open Manhole	1200
1.001	7.000	200.0	4	42.750	41.010	1.515	Open Manhole	1200
2.000	11.000	43.5	4	42.750	41.010	1.515	Open Manhole	1200
1.002	24.500	199.2	5	42.750	40.812	1.638	Open Manhole	1200
1.003	22.000	196.4	6	42.780	40.550	1.780	Open Manhole	1200
3.000	14.000	62.2	6	42.780	40.775	1.780	Open Manhole	1200
1.004	3.500	70.0	8	42.730	40.500	1.780	Open Manhole	1200
1.005	14.000	82.4		42.330	40.330	1.700	Open Manhole	1200

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Micro Drainage	Network 2014.1.1

Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	-	-	100	0.064	0.064	0.064
1.001	-	-	100	0.018	0.018	0.018
2.000	-	-	100	0.022	0.022	0.022
1.002	-	-	100	0.000	0.000	0.000
1.003	-	-	100	0.088	0.088	0.088
3.000	-	-	100	0.039	0.039	0.039
1.004	-	-	100	0.049	0.049	0.049
1.005	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				0.280	0.280	0.280

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)
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1.005		42.330	40.330	0.000	1200	0
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Simulation Criteria for Storm

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m ³ /ha Storage	2.000
Hot Start (mins)	0	Inlet Coefficient	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	2
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	1	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.000	Storm Duration (mins)	30
Ratio R	0.406		

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Online Controls for Storm

Hydro-Brake Optimum® Manhole: 8, DS/PN: 1.005, Volume (m³): 2.9

Unit Reference	MD-SHE-0254-3680-1300-3680
Design Head (m)	1.300
Design Flow (l/s)	36.8
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Diameter (mm)	254
Invert Level (m)	40.500
Minimum Outlet Pipe Diameter (mm)	300
Suggested Manhole Diameter (mm)	1800

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.300	36.6
Flush-Flo™	0.441	36.6
Kick-Flo®	0.931	31.2
Mean Flow over Head Range	-	30.9

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	8.2	1.200	35.2	3.000	54.8	7.000	82.6
0.200	26.1	1.400	37.9	3.500	59.0	7.500	85.5
0.300	35.7	1.600	40.4	4.000	63.0	8.000	88.2
0.400	36.6	1.800	42.8	4.500	66.7	8.500	90.8
0.500	36.5	2.000	45.0	5.000	70.2	9.000	93.4
0.600	36.1	2.200	47.2	5.500	73.5	9.500	95.9
0.800	34.3	2.400	49.2	6.000	76.7		
1.000	32.3	2.600	51.1	6.500	79.7		

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Micro Drainage Network 2014.1.1		

Storage Structures for Storm

Cellular Storage Manhole: 3, DS/PN: 2.000

Invert Level (m) 41.400 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)
0.000	80.0	80.0	0.500	0.0	99.2
0.400	80.0	99.2			

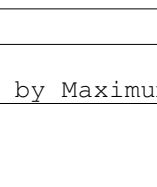
Cellular Storage Manhole: 6, DS/PN: 3.000

Invert Level (m) 41.400 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)
0.000	36.0	36.0	0.500	0.0	48.0
0.400	36.0	48.0			

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Sycamore House Woodside Road Amersham HP6 6AA							
Date 19/05/2014 14:14 File SYSTEM 1.MDX	Designed by Anthony.Mcnevin Checked by						
Micro Drainage Network 2014.1.1							
<u>1 year Return Period Summary of Critical Results by Maximum Level (Rank 1)</u> <u>for Storm</u>							
Simulation Criteria							
Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000							
Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000							
Hot Start Level (mm) 0 Inlet Coefficient 0.800							
Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000							
Foul Sewage per hectare (l/s) 0.000							
Number of Input Hydrographs 0 Number of Storage Structures 2							
Number of Online Controls 1 Number of Time/Area Diagrams 0							
Number of Offline Controls 0 Number of Real Time Controls 0							
Synthetic Rainfall Details							
Rainfall Model FSR Ratio R 0.406							
Region England and Wales Cv (Summer) 0.750							
M5-60 (mm) 20.000 Cv (Winter) 0.840							
Margin for Flood Risk Warning (mm) 300.0							
Analysis Timestep 2.5 Second Increment (Extended)							
DTS Status ON							
DVD Status OFF							
Inertia Status OFF							
Profile(s) Summer and Winter							
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360							
Return Period(s) (years) 1, 30, 100							
Climate Change (%) 0, 0, 30							
PN	Storm	Return Climate Period Change	First X Surcharge	First Y Flood	First Z Overflow	O/F Act.	Lvl Exc.
1.000	15 Winter	1 0%	30/15 Summer				
1.001	15 Winter	1 0%	30/15 Summer				
2.000	15 Winter	1 0%	100/15 Summer				
1.002	15 Winter	1 0%	30/15 Summer				
1.003	15 Winter	1 0%	30/15 Summer				
3.000	15 Winter	1 0%	30/15 Summer				
1.004	15 Winter	1 0%	30/15 Summer				
1.005	15 Winter	1 0%	30/15 Summer				
					</		

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Date 19/05/2014 14:14 File SYSTEM 1.MDX	Designed by Anthony.Mcnevin Checked by							
Micro Drainage Network 2014.1.1								
30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm								
Simulation Criteria								
Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000								
Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000								
Hot Start Level (mm) 0 Inlet Coeffiecient 0.800								
Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000								
Foul Sewage per hectare (l/s) 0.000								
Number of Input Hydrographs 0 Number of Storage Structures 2								
Number of Online Controls 1 Number of Time/Area Diagrams 0								
Number of Offline Controls 0 Number of Real Time Controls 0								
Synthetic Rainfall Details								
Rainfall Model FSR Ratio R 0.406								
Region England and Wales Cv (Summer) 0.750								
M5-60 (mm) 20.000 Cv (Winter) 0.840								
Margin for Flood Risk Warning (mm) 300.0								
Analysis Timestep 2.5 Second Increment (Extended)								
DTS Status ON								
DVD Status OFF								
Inertia Status OFF								
Profile(s) Summer and Winter								
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360								
Return Period(s) (years) 1, 30, 100								
Climate Change (%) 0, 0, 30								
PN	Storm	Return Climate Period Change	First X Surcharge	First Y Flood	First Z Overflow	O/F Act.	Lvl Exc.	
1.000	15 Winter	30 0%	30/15 Summer					
1.001	15 Winter	30 0%	30/15 Summer					
2.000	15 Winter	30 0%	100/15 Summer					
1.002	15 Winter	30 0%	30/15 Summer					
1.003	15 Winter	30 0%	30/15 Summer					
3.000	15 Winter	30 0%	30/15 Summer					
1.004	15 Winter	30 0%	30/15 Summer					
1.005	15 Winter	30 0%	30/15 Summer					
PN	US/MH Name	Water Level (m)	Surch'ed Depth (m)	Flooded Volume (m³)	Flow / Cap.	O'flow (l/s)	Pipe Flow (l/s)	Status
1.000	1	41.576	0.131	0.000	0.60	0.0	20.6	SURCHARGED
1.001	2	41.531	0.261	0.000	0.75	0.0	21.5	SURCHARGED
2.000	3	41.447	-0.041	0.000	0.41	0.0	27.3	OK
1.002	4	41.511	0.276	0.000	0.50	0.0	35.0	SURCHARGED
1.003	5	41.502	0.390	0.000	0.20	0.0	38.0	SURCHARGED
3.000	6	41.484	0.259	0.000	0.27	0.0	15.7	SURCHARGED
1.004	6	41.491	0.491	0.000	0.25	0.0	41.4	SURCHARGED
1.005	8	41.487	0.687	0.000	0.36	0.0	36.5	SURCHARGED
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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coefficient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs	0	Number of Storage Structures	2
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.406
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	20.000	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	ON
DVD Status	OFF
Inertia Status	OFF

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 0, 30

PN	Storm	Return Period	Climate Change	First X Surge	First Y Flood	First Z Overflow	O/F Act.	Lvl Exc.
1.000	15 Winter	100	+30%	30/15 Summer				
1.001	15 Winter	100	+30%	30/15 Summer				
2.000	30 Winter	100	+30%	100/15 Summer				
1.002	15 Winter	100	+30%	30/15 Summer				
1.003	15 Winter	100	+30%	30/15 Summer				
3.000	15 Winter	100	+30%	30/15 Summer				
1.004	15 Winter	100	+30%	30/15 Summer				
1.005	15 Winter	100	+30%	30/15 Summer				

PN	US/MH Name	Water		Flooded		Pipe		Status
		Level (m)	Surch'd Depth (m)	Volume (m³)	Flow / Cap. (l/s)	O'flow (l/s)	Flow (l/s)	
1.000	1	41.954	0.509	0.000	0.97	0.0	33.5	SURCHARGED
1.001	2	41.790	0.520	0.000	1.47	0.0	42.1	SURCHARGED
2.000	3	41.683	0.195	0.000	0.47	0.0	31.7	SURCHARGED
1.002	4	41.717	0.482	0.000	0.48	0.0	33.2	SURCHARGED
1.003	5	41.734	0.622	0.000	0.22	0.0	41.6	SURCHARGED
3.000	6	41.720	0.495	0.000	0.30	0.0	17.2	SURCHARGED
1.004	6	41.723	0.723	0.000	0.26	0.0	44.3	SURCHARGED
1.005	8	41.718	0.918	0.000	0.36	0.0	36.5	SURCHARGED

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<u>Time Area Diagram for Storm</u> <table border="1"> <thead> <tr> <th>Time (mins)</th> <th>Area (ha)</th> <th>Time (mins)</th> <th>Area (ha)</th> </tr> </thead> <tbody> <tr> <td>0-4</td> <td>0.090</td> <td>4-8</td> <td>0.031</td> </tr> </tbody> </table> Total Area Contributing (ha) = 0.121 Total Pipe Volume (m³) = 3.565			Time (mins)	Area (ha)	Time (mins)	Area (ha)	0-4	0.090	4-8	0.031
Time (mins)	Area (ha)	Time (mins)	Area (ha)							
0-4	0.090	4-8	0.031							
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Existing Network Details 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)
1.000	13.000	0.150	86.7	0.006	5.00	0.0	0.600	o	150
1.001	6.500	0.100	65.0	0.001	0.00	0.0	0.600	o	150
1.002	16.000	0.200	80.0	0.000	0.00	0.0	0.600	o	150
1.003	3.000	0.200	15.0	0.010	0.00	0.0	0.600	o	150
2.000	24.500	0.250	98.0	0.004	5.00	0.0	0.600	o	150
2.001	4.500	0.350	12.9	0.009	0.00	0.0	0.600	o	150
3.000	7.000	0.385	18.2	0.061	5.00	0.0	0.600	oo	-1
1.004	15.000	0.100	150.0	0.000	0.00	0.0	0.600	o	225
4.000	34.000	0.600	56.7	0.017	5.00	0.0	0.600	o	150
5.000	27.000	0.600	45.0	0.013	5.00	0.0	0.600	o	150
1.005	8.000	0.200	40.0	0.000	0.00	0.0	0.600	o	150

Network Results Table

PN	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Vel (m/s)	Cap (l/s)
1.000	42.525	0.006	0.0	1.08	19.1
1.001	42.375	0.007	0.0	1.25	22.1
1.002	42.275	0.007	0.0	1.12	19.9
1.003	42.075	0.017	0.0	2.61	46.2
2.000	42.475	0.004	0.0	1.02	17.9
2.001	42.225	0.013	0.0	2.82	49.9
3.000	42.185	0.061	0.0	3.08	246.7
1.004	41.800	0.091	0.0	1.07	42.4
4.000	42.300	0.017	0.0	1.34	23.7
5.000	42.300	0.013	0.0	1.50	26.6
1.005	41.700	0.121	0.0	1.60	28.2

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Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam., L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
1	42.975	0.450	Open Manhole	1200	1.000	42.525	150				
2	42.975	0.600	Open Manhole	1200	1.001	42.375	150	1.000	42.375	150	
3	43.000	0.725	Open Manhole	1200	1.002	42.275	150	1.001	42.275	150	
4	43.000	0.925	Open Manhole	1200	1.003	42.075	150	1.002	42.075	150	
5	43.075	0.600	Open Manhole	1200	2.000	42.475	150				
6	43.000	0.775	Open Manhole	1200	2.001	42.225	150	2.000	42.225	150	
7	42.805	0.620	Open Manhole	450	3.000	42.185	-1				
7	43.000	1.200	Open Manhole	1200	1.004	41.800	225	1.003	41.875	150	
								2.001	41.875	150	
								3.000	41.800	-1	
8	43.000	0.700	Open Manhole	1200	4.000	42.300	150				
9	43.000	0.700	Open Manhole	1200	5.000	42.300	150				
10	42.950	1.250	Open Manhole	1200	1.005	41.700	150	1.004	41.700	225	
								4.000	41.700	150	
								5.000	41.700	150	
	43.000	1.500	Open Manhole	0		OUTFALL		1.005	41.500	150	

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PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., (mm)	L*W
1.000	o	150	1	42.975	42.525	0.300	Open Manhole	1200	
1.001	o	150	2	42.975	42.375	0.450	Open Manhole	1200	
1.002	o	150	3	43.000	42.275	0.575	Open Manhole	1200	
1.003	o	150	4	43.000	42.075	0.775	Open Manhole	1200	
2.000	o	150	5	43.075	42.475	0.450	Open Manhole	1200	
2.001	o	150	6	43.000	42.225	0.625	Open Manhole	1200	
3.000	oo	-1	7	42.805	42.185	0.395	Open Manhole		450
1.004	o	225	7	43.000	41.800	0.975	Open Manhole	1200	
4.000	o	150	8	43.000	42.300	0.550	Open Manhole	1200	
5.000	o	150	9	43.000	42.300	0.550	Open Manhole	1200	
1.005	o	150	10	42.950	41.700	1.100	Open Manhole	1200	

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., (mm)	L*W
1.000	13.000	86.7	2	42.975	42.375	0.450	Open Manhole	1200	
1.001	6.500	65.0	3	43.000	42.275	0.575	Open Manhole	1200	
1.002	16.000	80.0	4	43.000	42.075	0.775	Open Manhole	1200	
1.003	3.000	15.0	7	43.000	41.875	0.975	Open Manhole	1200	
2.000	24.500	98.0	6	43.000	42.225	0.625	Open Manhole	1200	
2.001	4.500	12.9	7	43.000	41.875	0.975	Open Manhole	1200	
3.000	7.000	18.2	7	43.000	41.800	0.975	Open Manhole	1200	
1.004	15.000	150.0	10	42.950	41.700	1.025	Open Manhole	1200	
4.000	34.000	56.7	10	42.950	41.700	1.100	Open Manhole	1200	
5.000	27.000	45.0	10	42.950	41.700	1.100	Open Manhole	1200	
1.005	8.000	40.0		43.000	41.500	1.350	Open Manhole		0

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Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	-	-	100	0.006	0.006	0.006
1.001	-	-	100	0.001	0.001	0.001
1.002	-	-	100	0.000	0.000	0.000
1.003	-	-	100	0.010	0.010	0.010
2.000	-	-	100	0.004	0.004	0.004
2.001	-	-	100	0.009	0.009	0.009
3.000	-	-	100	0.061	0.061	0.061
1.004	-	-	100	0.000	0.000	0.000
4.000	-	-	100	0.017	0.017	0.017
5.000	-	-	100	0.013	0.013	0.013
1.005	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				0.121	0.121	0.121

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)
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1.005		43.000	41.500	0.000	0	0
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Simulation Criteria for Storm

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m ³ /ha Storage	2.000
Hot Start (mins)	0	Inlet Coefficient	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	1
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	1	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.000	Storm Duration (mins)	30
Ratio R	0.406		

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Online Controls for Storm

Hydro-Brake Optimum® Manhole: 10, DS/PN: 1.005, Volume (m³): 3.0

Unit Reference MD-SHE-0105-5000-1000-5000
Design Head (m) 1.000
Design Flow (l/s) 5.0
Flush-Flo™ Calculated
Objective Minimise upstream storage
Diameter (mm) 105
Invert Level (m) 41.700
Minimum Outlet Pipe Diameter (mm) 150
Suggested Manhole Diameter (mm) 1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	5.0
Flush-Flo™	0.295	4.9
Kick-Flo®	0.636	4.0
Mean Flow over Head Range	-	4.3

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	3.6	1.200	5.4	3.000	8.3	7.000	12.4
0.200	4.8	1.400	5.8	3.500	8.9	7.500	12.8
0.300	4.9	1.600	6.2	4.000	9.5	8.000	13.2
0.400	4.9	1.800	6.5	4.500	10.1	8.500	13.6
0.500	4.7	2.000	6.9	5.000	10.6	9.000	14.0
0.600	4.3	2.200	7.2	5.500	11.1	9.500	14.4
0.800	4.5	2.400	7.5	6.000	11.5		
1.000	5.0	2.600	7.8	6.500	12.0		

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Storage Structures for Storm

Cellular Storage Manhole: 7, DS/PN: 3.000

Invert Level (m) 42.185 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)
0.000	200.0	200.0	0.400	0.0	227.0
0.300	200.0	227.0			

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<u>1 year Return Period Summary of Critical Results by Maximum Level (Rank 1)</u> <u>for Storm</u>							
Simulation Criteria							
Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000							
Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000							
Hot Start Level (mm) 0 Inlet Coeffiecient 0.800							
Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000							
Foul Sewage per hectare (l/s) 0.000							
Number of Input Hydrographs 0 Number of Storage Structures 1							
Number of Online Controls 1 Number of Time/Area Diagrams 0							
Number of Offline Controls 0 Number of Real Time Controls 0							
Synthetic Rainfall Details							
Rainfall Model FSR Ratio R 0.406							
Region England and Wales Cv (Summer) 0.750							
M5-60 (mm) 20.000 Cv (Winter) 0.840							
Margin for Flood Risk Warning (mm) 300.0							
Analysis Timestep 2.5 Second Increment (Extended)							
DTS Status ON							
DVD Status OFF							
Inertia Status OFF							
Profile(s) Summer and Winter							
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360							
Return Period(s) (years) 1, 30, 100							
Climate Change (%) 0, 0, 30							
PN	Storm	Return Climate Period Change	First X Surcharge	First Y Flood	First Z Overflow	O/F Act.	Lvl Exc.
1.000	15 Winter	1	0%				
1.001	15 Winter	1	0%				
1.002	15 Winter	1	0%				
1.003	30 Winter	1	0%	30/15 Summer			
2.000	15 Winter	1	0%				
2.001	15 Winter	1	0%	100/15 Summer			
3.000	30 Winter	1	0%				
1.004	30 Winter	1	0%	1/15 Winter			
4.000	15 Winter	1	0%	100/15 Summer			
5.000	15 Winter	1	0%	100/15 Summer			
1.005	30 Winter	1	0%	1/15 Summer			

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1 year Return Period Summary of Critical Results by Maximum Level (Rank 1)
for Storm

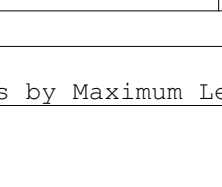
PN	US/MH Name	Water		Flooded		Pipe		Status
		Level (m)	Surch'd Depth (m)	Volume (m ³)	Flow / Cap.	O'flow (1/s)	Flow (1/s)	
2.001	6	42.245	-0.130	0.000	0.04	0.0	1.6	OK
3.000	7	42.199	-0.211	0.000	0.02	0.0	3.2	OK
1.004	7	42.120	0.095	0.000	0.12	0.0	4.5	SURCHARGED
4.000	8	42.332	-0.118	0.000	0.10	0.0	2.3	OK
5.000	9	42.326	-0.124	0.000	0.07	0.0	1.8	OK
1.005	10	42.114	0.264	0.000	0.20	0.0	4.9	SURCHARGED

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<u>30 year Return Period Summary of Critical Results by Maximum Level (Rank 1)</u> <u>for Storm</u>							
Simulation Criteria							
Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000							
Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000							
Hot Start Level (mm) 0 Inlet Coeffiecient 0.800							
Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000							
Foul Sewage per hectare (l/s) 0.000							
Number of Input Hydrographs 0 Number of Storage Structures 1							
Number of Online Controls 1 Number of Time/Area Diagrams 0							
Number of Offline Controls 0 Number of Real Time Controls 0							
Synthetic Rainfall Details							
Rainfall Model FSR Ratio R 0.406							
Region England and Wales Cv (Summer) 0.750							
M5-60 (mm) 20.000 Cv (Winter) 0.840							
Margin for Flood Risk Warning (mm) 300.0							
Analysis Timestep 2.5 Second Increment (Extended)							
DTS Status ON							
DVD Status OFF							
Inertia Status OFF							
Profile(s) Summer and Winter							
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360							
Return Period(s) (years) 1, 30, 100							
Climate Change (%) 0, 0, 30							
PN	Storm	Return Climate Period Change	First X Surcharge	First Y Flood	First Z Overflow	O/F Act.	Lvl Exc.
1.000	15 Winter	30 0%					
1.001	15 Winter	30 0%					
1.002	15 Winter	30 0%					
1.003	15 Winter	30 0%	30/15 Summer				
2.000	15 Winter	30 0%					
2.001	15 Winter	30 0%	100/15 Summer				
3.000	60 Winter	30 0%					
1.004	15 Winter	30 0%	1/15 Winter				
4.000	15 Winter	30 0%	100/15 Summer				
5.000	15 Winter	30 0%	100/15 Summer				
1.005	15 Winter	30 0%	1/15 Summer				
					</		

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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1)
for Storm

PN	US/MH Name	Water		Flooded		Pipe		Status
		Level (m)	Surch'd Depth (m)	Volume (m³)	Flow / Cap.	O'flow (l/s)	Flow (l/s)	
2.001	6	42.324	-0.051	0.000	0.12	0.0	4.3	OK
3.000	7	42.262	-0.148	0.000	0.03	0.0	4.7	OK
1.004	7	42.317	0.292	0.000	0.16	0.0	5.8	SURCHARGED
4.000	8	42.367	-0.083	0.000	0.25	0.0	5.7	OK
5.000	9	42.355	-0.095	0.000	0.17	0.0	4.4	OK
1.005	10	42.333	0.483	0.000	0.20	0.0	4.9	SURCHARGED

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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coefficient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs	0	Number of Storage Structures	1
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.406
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	20.000	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	ON
DVD Status	OFF
Inertia Status	OFF

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 0, 30

PN	Storm	Return Period	Climate Change	First X Surchage	First Y Flood	First Z Overflow	O/F Act.	Lvl Exc.
1.000	15 Winter	100	+30%					
1.001	15 Winter	100	+30%					
1.002	15 Winter	100	+30%					
1.003	15 Winter	100	+30%	30/15 Summer				
2.000	15 Winter	100	+30%					
2.001	15 Winter	100	+30%	100/15 Summer				
3.000	60 Winter	100	+30%					
1.004	15 Winter	100	+30%	1/15 Winter				
4.000	15 Winter	100	+30%	100/15 Summer				
5.000	15 Winter	100	+30%	100/15 Summer				
1.005	15 Winter	100	+30%	1/15 Summer				

PN	US/MH Name	Water		Flooded		Pipe		Status
		Level (m)	Surch'd Depth (m)	Volume (m³)	Flow / Cap.	O'flow (l/s)	Flow (l/s)	
1.000	1	42.571	-0.104	0.000	0.20	0.0	3.5	OK
1.001	2	42.425	-0.100	0.000	0.22	0.0	4.0	OK
1.002	3	42.409	-0.016	0.000	0.21	0.0	3.9	OK
1.003	4	42.394	0.169	0.000	0.32	0.0	8.9	SURCHARGED
2.000	5	42.512	-0.113	0.000	0.13	0.0	2.3	OK

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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Water		Flooded		Pipe		Status
		Level (m)	Surch'd Depth (m)	Volume (m³)	Flow / Cap.	O'flow (l/s)	Flow (l/s)	
2.001	6	42.392	0.017	0.000	0.18	0.0	6.8	SURCHARGED
3.000	7	42.365	-0.045	0.000	0.02	0.0	4.3	OK
1.004	7	42.380	0.355	0.000	0.15	0.0	5.7	SURCHARGED
4.000	8	42.516	0.066	0.000	0.39	0.0	8.8	SURCHARGED
5.000	9	42.465	0.015	0.000	0.27	0.0	6.8	SURCHARGED
1.005	10	42.421	0.571	0.000	0.20	0.0	4.9	SURCHARGED

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Sycamore House Woodside Road Amersham HP6 6AA										
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<u>Time Area Diagram for Storm</u> <table border="1"> <thead> <tr> <th>Time (mins)</th> <th>Area (ha)</th> <th>Time (mins)</th> <th>Area (ha)</th> </tr> </thead> <tbody> <tr> <td>0-4</td> <td>0.017</td> <td>4-8</td> <td>0.003</td> </tr> </tbody> </table> Total Area Contributing (ha) = 0.020 Total Pipe Volume (m³) = 1.136			Time (mins)	Area (ha)	Time (mins)	Area (ha)	0-4	0.017	4-8	0.003
Time (mins)	Area (ha)	Time (mins)	Area (ha)							
0-4	0.017	4-8	0.003							
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Existing Network Details 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)
1.000	14.000	0.100	140.0	0.005	5.00	0.0	0.600	o	150
1.001	7.000	0.100	70.0	0.000	0.00	0.0	0.600	o	150
2.000	15.000	0.100	150.0	0.005	5.00	0.0	0.600	o	150
2.001	6.800	0.100	68.0	0.000	0.00	0.0	0.600	o	150
2.002	5.000	0.100	50.0	0.010	0.00	0.0	0.600	o	150
1.002	6.000	0.200	30.0	0.000	0.00	0.0	0.600	o	225
1.003	3.000	0.500	6.0	0.000	0.00	0.0	0.600	o	150

Network Results Table

PN	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Vel (m/s)	Cap (l/s)
1.000	42.400	0.005	0.0	0.85	15.0
1.001	42.300	0.005	0.0	1.20	21.3
2.000	42.500	0.005	0.0	0.82	14.5
2.001	42.400	0.005	0.0	1.22	21.6
2.002	42.300	0.015	0.0	1.43	25.2
1.002	42.200	0.020	0.0	2.40	95.3
1.003	42.000	0.020	0.0	4.14	73.2

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Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam., L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
1	43.000	0.600	Open Manhole	1200	1.000	42.400	150				
2	43.000	0.700	Open Manhole	1200	1.001	42.300	150	1.000	42.300	150	
3	43.000	0.500	Open Manhole	1200	2.000	42.500	150				
4	43.000	0.600	Open Manhole	1200	2.001	42.400	150	2.000	42.400	150	
5	43.000	0.700	Open Manhole	1200	2.002	42.300	150	2.001	42.300	150	
6	43.000	0.800	Open Manhole	1200	1.002	42.200	225	1.001	42.200	150	
								2.002	42.200	150	
7	43.000	1.000	Open Manhole	1200	1.003	42.000	150	1.002	42.000	225	
	43.000	1.500	Open Manhole	0		OUTFALL		1.003	41.500	150	

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PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	o	150	1	43.000	42.400	0.450	Open Manhole	1200
1.001	o	150	2	43.000	42.300	0.550	Open Manhole	1200
2.000	o	150	3	43.000	42.500	0.350	Open Manhole	1200
2.001	o	150	4	43.000	42.400	0.450	Open Manhole	1200
2.002	o	150	5	43.000	42.300	0.550	Open Manhole	1200
1.002	o	225	6	43.000	42.200	0.575	Open Manhole	1200
1.003	o	150	7	43.000	42.000	0.850	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	14.000	140.0	2	43.000	42.300	0.550	Open Manhole	1200
1.001	7.000	70.0	6	43.000	42.200	0.650	Open Manhole	1200
2.000	15.000	150.0	4	43.000	42.400	0.450	Open Manhole	1200
2.001	6.800	68.0	5	43.000	42.300	0.550	Open Manhole	1200
2.002	5.000	50.0	6	43.000	42.200	0.650	Open Manhole	1200
1.002	6.000	30.0	7	43.000	42.000	0.775	Open Manhole	1200
1.003	3.000	6.0		43.000	41.500	1.350	Open Manhole	0

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Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	-	-	100	0.005	0.005	0.005
1.001	-	-	100	0.000	0.000	0.000
2.000	-	-	100	0.005	0.005	0.005
2.001	-	-	100	0.000	0.000	0.000
2.002	-	-	100	0.010	0.010	0.010
1.002	-	-	100	0.000	0.000	0.000
1.003	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				0.020	0.020	0.020

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)
---------------------	--------------	--------------	--------------	------------------	----------	--------

1.003		43.000	41.500	0.000	0	0
-------	--	--------	--------	-------	---	---

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m ³ /ha Storage	2.000
Hot Start (mins)	0	Inlet Coefficient	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	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	1	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.000	Storm Duration (mins)	30
Ratio R	0.406		

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Online Controls for Storm

Hydro-Brake Optimum® Manhole: 7, DS/PN: 1.003, Volume (m³): 1.3

Unit Reference MD-SHE-0112-5000-0500-5000
Design Head (m) 0.500
Design Flow (l/s) 5.0
Flush-Flo™ Calculated
Objective Minimise upstream storage
Diameter (mm) 112
Invert Level (m) 42.000
Minimum Outlet Pipe Diameter (mm) 150
Suggested Manhole Diameter (mm) 1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.500	5.0
Flush-Flo™	0.178	4.9
Kick-Flo®	0.370	4.3
Mean Flow over Head Range	-	4.1

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	3.9	1.200	7.4	3.000	11.5	7.000	17.3
0.200	4.9	1.400	8.0	3.500	12.4	7.500	17.9
0.300	4.7	1.600	8.5	4.000	13.2	8.000	18.5
0.400	4.5	1.800	9.0	4.500	13.9	8.500	19.0
0.500	5.0	2.000	9.5	5.000	14.7	9.000	19.6
0.600	5.4	2.200	9.9	5.500	15.3	9.500	20.1
0.800	6.2	2.400	10.3	6.000	16.0		
1.000	6.8	2.600	10.7	6.500	16.6		

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1 year Return Period Summary of Critical Results by Maximum Level (Rank 1)
for Storm

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coefficient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs	0	Number of Storage Structures	0
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.406
Region England and Wales	Cv (Summer)		0.750
M5-60 (mm)	20.000	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	ON
DVD Status	OFF
Inertia Status	OFF

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 0, 30

PN	Storm	Return Climate Period Change	First X Surcharge	First Y Flood	First Z Overflow	O/F Act.	Lvl Exc.
1.000	15 Winter	1	0%				
1.001	15 Winter	1	0% 100/15 Summer				
2.000	15 Winter	1	0%				
2.001	15 Winter	1	0%				
2.002	15 Winter	1	0% 100/15 Summer				
1.002	15 Winter	1	0% 100/15 Summer				
1.003	15 Winter	1	0% 30/15 Summer				

PN	US/MH Name	Water		Flooded		Pipe		Status
		Level (m)	Surch'd Depth (m)	Volume (m³)	Flow / Cap.	O'flow (l/s)	Flow (l/s)	
1.000	1	42.422	-0.128	0.000	0.05	0.0	0.7	OK
1.001	2	42.319	-0.131	0.000	0.04	0.0	0.7	OK
2.000	3	42.522	-0.128	0.000	0.05	0.0	0.7	OK
2.001	4	42.419	-0.131	0.000	0.04	0.0	0.7	OK
2.002	5	42.331	-0.119	0.000	0.09	0.0	1.9	OK
1.002	6	42.229	-0.196	0.000	0.04	0.0	2.5	OK
1.003	7	42.074	-0.076	0.000	0.06	0.0	2.5	OK

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<u>30 year Return Period Summary of Critical Results by Maximum Level (Rank 1)</u> <u>for Storm</u>							
Simulation Criteria							
Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000							
Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000							
Hot Start Level (mm) 0 Inlet Coeffiecient 0.800							
Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000							
Foul Sewage per hectare (l/s) 0.000							
Number of Input Hydrographs 0 Number of Storage Structures 0							
Number of Online Controls 1 Number of Time/Area Diagrams 0							
Number of Offline Controls 0 Number of Real Time Controls 0							
Synthetic Rainfall Details							
Rainfall Model FSR Ratio R 0.406							
Region England and Wales Cv (Summer) 0.750							
M5-60 (mm) 20.000 Cv (Winter) 0.840							
Margin for Flood Risk Warning (mm) 300.0							
Analysis Timestep 2.5 Second Increment (Extended)							
DTS Status ON							
DVD Status OFF							
Inertia Status OFF							
Profile(s) Summer and Winter							
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360							
Return Period(s) (years) 1, 30, 100							
Climate Change (%) 0, 0, 30							
PN	Storm	Return Climate Period Change	First X Surcharge	First Y Flood	First Z Overflow	O/F Act.	Lvl Exc.
1.000	15 Winter	30	0%				
1.001	15 Winter	30	0%	100/15 Summer			
2.000	15 Winter	30	0%				
2.001	15 Winter	30	0%				
2.002	15 Winter	30	0%	100/15 Summer			
1.002	15 Winter	30	0%	100/15 Summer			
1.003	15 Winter	30	0%	30/15 Summer			

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Sycamore House Woodside Road Amersham HP6 6AA		
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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coefficient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs	0	Number of Storage Structures	0
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.406
Region England and Wales	Cv (Summer)		0.750
M5-60 (mm)	20.000	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	ON
DVD Status	OFF
Inertia Status	OFF

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 0, 30

PN	Storm	Return Period	Climate Change	First X Surcharge	First Y Flood	First Z Overflow	O/F Act.	Lvl Exc.
1.000	15 Winter	100	+30%					
1.001	15 Winter	100	+30%	100/15 Summer				
2.000	15 Winter	100	+30%					
2.001	15 Winter	100	+30%					
2.002	15 Winter	100	+30%	100/15 Summer				
1.002	15 Winter	100	+30%	100/15 Summer				
1.003	15 Winter	100	+30%	30/15 Summer				

PN	US/MH Name	Water		Flooded		Pipe		Status
		Level (m)	Surch'd Depth (m)	Volume (m³)	Flow / Cap.	O'flow (l/s)	Pipe Flow (l/s)	
1.000	1	42.498	-0.052	0.000	0.21	0.0	2.9	OK
1.001	2	42.492	0.042	0.000	0.13	0.0	2.3	SURCHARGED
2.000	3	42.547	-0.103	0.000	0.21	0.0	2.8	OK
2.001	4	42.501	-0.049	0.000	0.15	0.0	2.7	OK
2.002	5	42.497	0.047	0.000	0.41	0.0	8.1	SURCHARGED
1.002	6	42.489	0.064	0.000	0.13	0.0	8.3	SURCHARGED
1.003	7	42.485	0.335	0.000	0.11	0.0	4.9	SURCHARGED

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Appendix D

RECEIVED
18 OCT 2012



RSK Land & Development Engineering
Limited

Developer Services

18 Frogmore Road
Hemel Hempstead
Herts
HP3 9RT

Your ref
Our ref 5 35512
Name Tim Dale
Phone 0118 373 8782

Attention: Mr C Ball
16th October 2012

Dear Colin,

**Pre Development Enquiry – Royal Quay Coppermill Lock Park Lane
Harefield**

I refer to your pre-development enquiry application dated 25th September 2012
for the above site.

I apologise for the delay in responding but due to the scale of the development
I had to consult with our catchment planners before replying to you.

I have now heard back from the Catchment Planning team and they are satisfied
that the foul water flows that will be generated by the proposed development of
30 units can be accommodated within the existing sewerage network.

Should the development proposals increase then we will need to be further
consulted regarding capacity in the network.

I trust this information is sufficient for your current requirements.

Yours sincerely

Tim Dale
Development Engineer

Thames Water Utilities Ltd
Developer Services
3rd Floor West
Clearwater Court
Vastern Road
Reading
RG1 8DB

Tel: 0845 850 2777

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No. 2366661,
Registered office: Clearwater Court,
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