



**Oldlands Farm,
Steyping Road,
Bognor Regis,
West Sussex**

**Phase 1 Drainage
Condition Report**

for

Bericote Properties Limited

Sept 2014

Hydrock Ref: R/14443/009



DOCUMENT CONTROL SHEET

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CONTENTS

1.0	Introduction	3
2.0	Planning Conditions	3
3.0	Drainage Strategy (Taken from Approved FRA).....	4
3.1	Surface Water Drainage Strategy	4
3.2	Pollution Control.....	5
4.0	Discharge of Conditions	5
Appendix A – HYDROCK DRAWINGS		6
Appendix B – SOAKAWAY TESTS		7
Appendix C – HYDROCK HYDRAULIC CALCULATIONS		8



1.0 INTRODUCTION

This report has been prepared by Hydrock Consultants Limited (Hydrock) on behalf of our client Bericote Properties Ltd to discharge the drainage related planning conditions for the Distribution Centre scheme at Oldlands Farm, Bognor Regis.

2.0 PLANNING CONDITIONS

The planning conditions below (5) are related to drainage sign off for Planning Approval Notice BE/73/14/PL from Arun District Council:

Condition 5

Prior to Commencement of Development or phase of development details of the proposed surface water drainage scheme have been submitted to and approved in writing by the Local Planning Authority.

The design should follow the hierarchy of preference for different types of surface water drainage disposal systems as set out in Approved Document H of the Building Regulations, the recommendations of the SUDS Manual produced by CIRIA.

Winter groundwater monitoring to establish highest annual ground water levels and Percolation testing to BRE 365, or similar approved, will be required to support the design of any Infiltration drainage. No building shall be occupied until the complete surface water drainage system serving the property has been implemented in accordance with the agreed details.

Reason: To ensure that the proposed development is satisfactorily drained in accordance with policies GEN7 and GEN9 of the Arun District Council Local Plan.

Condition 10

The Development shall be carried out in accordance with the surface water drainage strategy as set out in the approved Flood Risk Assessment prepared (R/14443/001) which is based on sustainable drainage principles and provides an assessment of the hydrological and hydrogeological context of the development. In accordance with the details within the FRA, the development must ensure that surface water run-off generated up to and including the 1 in 30 year and 1 in 100 year for climate change critical storm will not exceed the run-off from the undeveloped site following the corresponding rainfall event (as stated within the approved FRA (R/14443/001)); and pollution prevention measures as set out in the approved FRA are implemented.

Prior to First Occupation the complete surface water drainage system serving the phase within which that Building is situated has been implemented in accordance with the agreed details (which may be revised from time to time with the written approval of the Planning Authority).

Prior to First Occupation provision shall been made within the site in accordance with plans and details to be submitted to and approved by the Local Planning Authority to prevent surface water draining onto the public highway.

Reason: To prevent an increased risk of flooding, both on and off site and to prevent development from contributing to or being put at unacceptable risk from, or being adversely affected by unacceptable levels water pollution in accordance with the NPPF.



3.0 DRAINAGE STRATEGY (TAKEN FROM APPROVED FRA)

3.1 Surface Water Drainage Strategy

- 3.1.1 Surface water runoff from the roof areas will be directed to the below ground gravity network via syphonic drainage systems. This water is considered to be clean and without contamination, and may be discharged directly to the new drainage infrastructure and SuDS Facilities.
- 3.1.2 External hard standing areas will be directed via gullies and channel drains to the underground network where it will then pass through appropriately sized and specified petrol separators in line with current guidance. All separators shall be fitted with high oil-level alarms, flashing beacons and be vented. Silt is to be prevented from entering the drainage system by the use of trapped gullies, channels with silt traps, infiltration trenches with silt traps or by the use of Sustainable Drainage techniques.
- 3.1.3 It is not anticipated that any new plot drainage will be put up for adoption by the local sewage authority, in this case United Utilities as it is serving the new development only. The proposed private drainage layout for the new development site will be designed in accordance with BS EN 752: 2008 and Building Regulations part H guidance.
- 3.1.4 A hydraulic model of the site has been created to determine the peak flows generated from the development, and the resulting attenuation volumes required. The discharge rates from the large attenuation pond at the south east of the site will be limited to mimic the pre development Qbar discharge rates.
- 3.1.5 It is a requirement of building regulation guidance that the drainage systems be designed not to flood any part of the site in a 1 in 30 year return period design storm (3.33% annual probability of occurrence). The below ground surface water design may require that some areas of car park or the hard standing areas experience minor flooding in extreme conditions beyond the 30 year design criteria. This is classed as Exceedance flooding or Secondary Storage and is common for this type of development. Any such flood water will be directed away from door thresholds to the periphery of the site, where it will discharge into the drainage infrastructure as water levels recede. All exceedance flood water will be retained on site up to the 100 year return period to prevent flood impact to the adjoining neighbours. All drainage designs will include the appropriate climate change allowance, in this case a 20% increase in rainfall.



3.2 Pollution Control

- 3.2.1 Silt is to be prevented from entering the drainage system by the use of trapped gullies, channels with silt traps, french drains with silt traps or by the use of Sustainable Drainage techniques such as the attenuation pond. The main element though will be the inclusion of appropriately sized oil separators in line with Pollution Prevention Guidance.
- .

4.0 DISCHARGE OF CONDITIONS

Detailed below is the formal response to the drainage condition.

Condition 5

1. The drainage layout drawing in Appendix A and supporting hydraulic calculations using the Windes Microdrainage design software in Appendix C define the overall surface water drainage strategy for the scheme.
2. Prevention and Source Control methods as the first stage of the SuDS management train process of controlling the runoff have been considered. This will take the form of rainwater harvesting. However, the Hydrock site investigation (R/14459/003) has been reviewed for the whole Oldlands Farm scheme with the outcome being that due to the cohesive ground and high water table, infiltration options would not be feasible. The soakaway tests in line with BRE 365 guidance and taken from the investigation can be found in Appendix B.
3. In light of the above the hierarchal approach within the Approved Document H has been considered the second step to discharge to a local watercourse. This will be carried out with flows to mimic the pre development Qbar discharge rates.
4. The fact that soakaway tests have found the ground to be unsuitable for infiltration would indicate that further groundwater monitoring is unnecessary.

Condition 10

1. The drainage layout drawing in Appendix A and supporting hydraulic calculations using the Windes Microdrainage design software in Appendix C define the overall surface water drainage strategy for the scheme and take into account the return periods outlined in the approved FRA.



APPENDIX A – HYDROCK DRAWINGS

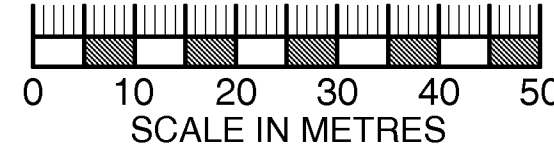
CONTENTS	
Identifier	Name
Hydrock	Drawing No. C14443/215

Notes:

- This drawing is to be read in conjunction with all relevant drawings, specifications and documentation.
- The position, size and levels of all drains are to be confirmed on site prior to the commencement of the works and any discrepancies reported immediately to the Engineer.
- Do not scale from this drawing, work to dimensions or co-ordinates provided. All levels are in metres and all dimensions are in millimetres, unless otherwise noted.
- The contractor shall allow for the protection, temporary and permanent support and diversion works as necessary, to all existing services to the satisfaction of the public utilities.
- The contractor shall allow for dealing with surface water run-off into excavations and from groundwater by means of pumps, pumping and de-watering as appropriate, in order to keep the excavation as reasonably dry as possible during the construction of the works.
- All private drainage within the site is to comply with the requirements of BSEN752 and Building Regulations Part H.
- Concrete protection to pipework is to be provided as follows:
 - All pipework within pedestrian/soft areas with less than 600mm cover.
 - All pipework subject to vehicular overrun with less than 1.2m cover.
 - All pipework within manholes are to be laid soffit to soffit (U.N.O.). All chamber invert levels are for the outgoing pipe levels. Backdrop pipework shall be connected at soffit to soffit with the rodding access level specified.
- Any gradients of drains indicated are indicative only and the Contractor shall install the drains to the specified levels shown for each manhole (U.N.O.). Catchpit invert levels are for the outgoing pipe with the sump level specified separately.
- Co-ordinate setting out information for manholes is to the intersection the drains and not the centre of the manhole.
- Cover levels of the manholes are provisional and subject to adjustment on site to suit the finished ground levels. All external works construction areas to be as located by the architect.
- Manhole covers and frames are to be in accordance with BSEN124 and the following:
 - Vehicular Areas: Class D400 (€600 in service yard locations), double triangular, 150mm deep ductile iron cover and frame with three point cover seating, badged RW or SW for Foul or Surface Water drainage.
 - Pedestrian Areas: Class B125, 100mm deep, badged FW or SW for Foul or Surface Water drainage.
 - Double seal manhole covers and frames are to be used on internal foul water drainage chambers. Finish to be confirmed by Architect.
- Heavy duty cover data are to be used within vehicular trafficked areas.
- Gully gratings and steel channel covers are to be in accordance with BSEN124 as follows:
 - Areas subject to vehicular overrun: Class D400 minimum, €600 in service yard locations.
 - Areas not subject to regular vehicle overrun (adjacent to kerbs etc): Class C250.
- Gully gratings adjacent to kerbs shall be hinged on the side of the traffic direction (left hand side).
- Positions and sizes of above ground foul and surface water drainage connections are to be confirmed prior to construction with the Architect and M&E Engineer.

- Drainage channels are to be ACO Omix, ACO Multidrain as specified or similar approved.
- Type and size of channel is to be approved by the Engineer in writing prior to ordering.
- All brickwork in connection with drainage is to be solid Class B Engineering Brick to BS3921.
- All precast concrete pipes, chamber products and road gullies shall be to BS5911 and be kilnmarked.
- Design chemical class for all insitu and precast concrete products shall be as stated in geotechnical report.
- All separators shall be in accordance with the Environment Agency document PP33.
- All below ground plastic tanks shall be installed in accordance with the manufacturers instructions. They shall be provided with sufficient concrete surround to counter floatation and shall have a wall thickness adequate to resist the highest ground water level which could be encountered at their location.
- All existing drainage structures to be abandoned shall be broken out and removed from site, the excavation shall be backfilled with a suitable granular material to the required level.
- Alternatively, deep drains may be cleaned and grouted with a 1:10 cementitious grout, with structures broken down 1m below finished ground level and backfilled with a suitable granular material.
- Where utility/land drainage trenches etc cross over drainage trenches, the contractor shall construct an impermeable barrier to prevent groundwater infiltrating into the drainage trench.
- Upon completion of the works the contractor shall clean all drainage by jetting, removing all debris from site, no debris shall be permitted to enter the existing drainage system.
- All works are assumed to be within public highway or within land owners lands & no works are required on third party land owners property.
- All RWP, gully and channel connections to be 150mm dia U.N.O. and WPC to be 100mm dia.
- Design assumes that no water authority sewers or other drainage systems require modification, diversion or abandoning.
- Backfill to all drainage trenches to be Class F1 material.
- All works within the public highway to be reinstated to highway authority requirements.
- Unless otherwise agreed all outfalls to ponds and watercourses to be proprietary PCC Units.
- Headwall details to be approved by local Internal Drainage Board where applicable.
- Pensobes where indicated shall be electronically operated complete with power supply and connection (refer to service engineers drawings for cable and ducting etc.)
- Synphonic break chambers (i.e. with SRWP entering) to be constructed with vented manhole covers, (waterway 2000 or similar approved)
- No deep rooting trees/vegetation should be planted within 5.0m of any drainage works.
- All WPC's, SRWP's and RWP's are shown indicatively. Locations shall be confirmed by others.
- All manholes less than 1.5m deep are considered as none man entry and shall be maintained from ground level.
- All sprinkler drain locations and flow rates to be confirmed by specialist. Potential local storage manholes for sprinkler discharge are to be confirmed following definition of system requirements.

SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION
IN ADDITION TO THE HAZARDOUS RISKS NORMALLY ASSOCIATED WITH THE TYPES OF WORKS OR TASKS ON THIS DRAWING, NOTE THE FOLLOWING:
CONSTRUCTION
MAINTENANCE / CLEANING
DECOMMISSIONING / DEMOLITION
IT IS REMINDED THAT ALL WORKS WILL BE CARRIED OUT BY A COMPETENT CONTRACTOR WORKING, WHERE APPROPRIATE, TO AN APPROVED METHOD STATEMENT



Notes:

- All dimensions are to be checked on site before the commencement of works. Any discrepancies are to be reported to the Architect & Engineer for verification. Figure dimensions only are to be taken from this drawing.
- This drawing is to be read in conjunction with all relevant Engineer and Service Engineer drawings and specifications.

SURFACE WATER DRAINAGE STRATEGY

Surface water generated from the development site shall be discharge to the surrounding ditch network with an overall peak rate of 32l/s, which correlates with the respective Qbar Greenfield Runoff Rate as agreed with the EA and the Lead Local Flood Authority.

Unit 1
FFL = 3.00m

Unit 2
FFL = 3.00m

FUTURE DEVELOPABLE
AREA NOT INCLUDED IN
HYDRAULIC CALCULATIONS.

FUTURE DEVELOPABLE
AREA NOT INCLUDED IN
HYDRAULIC CALCULATIONS
(SEPERATE NETWORK
REQUIRED FOR EXTENSIONS).

FUTURE DEVELOPABLE
AREA NOT INCLUDED IN
HYDRAULIC CALCULATIONS.

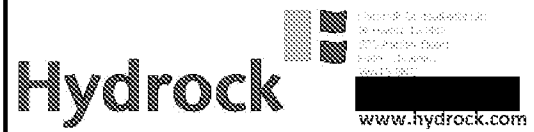
Attenuation Pond 1:
Top of bank = 2.40m AOD
Bed Level = 0.20m AOD
Retained Water Level = 0.30m AOD
30 year Peak Flood Level = 1.73m AOD
100 year plus Climate Change Peak
Flood Level = 2.35m AOD

For attenuation pond
drainage see drawing
C14443/02

KEY:	
	Proposed syphonic pipe (designed by specialist)
	300mmØ
	Proposed SW Drainage
	300mmØ
	Proposed Highway Drainage
	ACO Omix
	Proposed channel Drain
	150mmØ
	Proposed Foul Drainage
	Site Boundary
	Proprietary sumped catchpit

T2	18.09.14	General amendments to layout	PG	ME
T1	22.08.14	ISSUED FOR TENDER	RB	JH
Rev	Date	Description	By	Ctd

MICHAEL SPARKS ASSOCIATES



MICHAEL SPARKS ASSOCIATES

OLDLANDS FARM,
BOGNOR REGIS.

PROPOSED DRAINAGE
LAYOUT

TENDER

C14443

RMB	PMA	1:500	04.08.14	22.08.14
215				T2



APPENDIX B – SOAKAWAY TESTS

CONTENTS	
Identifier	Name
Hydrock	Soakaway Location Plan and Test Results (from main SI)



- Notes:
1. All dimensions are to be checked on site before the commencement of works. Any discrepancies are to be reported to the Architect & Engineer for verification. Figured dimensions only are to be taken from this drawing.
 2. This drawing is to be read in conjunction with all relevant Engineers' and Service Engineers' drawings and specifications.



- TP TRIAL PIT
- TP TRIAL PIT SOAKAWAY
- BH BOREHOLE
- CPT STATIC CONE PENETRATION TEST
- BH MONITORING WELL
- EXTENT OF RAISED MARINE DEPOSITS
- BACKFILLED FORMER PONDS
- PROPOSED BUILDINGS
- EXISTING GAS MAIN
- LOCATION OF WELL

Rev	Date	Description	By	Ckd
Architect				
<div><div>Hydrock</div><div>Hydrock Consultants Ltd 11 Haverhill Park Huddersley Road Barnsley, West Yorkshire S10 2NP www.hydrock.com</div></div>				
Client				
<div><div>BERICOTE</div><div>PROPERTIES</div></div>				
Project Title				
OLDLANDS FARM BOGNOR REGIS				
Drawing Title				
Site Zonation Plan				
Drawing Status				
INFORMATION				
Hydrock Job No				
C/14459				
Drawn	Checked	Scale @ A1	Date	Issue Date
AB	CV	1:1500	23/05/14	23/05/14
Drawing Number				Revisions
14459/D006				-

BRE BR365 - Trial Pit Soakaway Data Sheet

Site: C14459- Oldlands Farm

Client: Bericote

Test Location	TP40	Date of start of testing	04/06/2014	Date at end of testing	04/06/2014
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[illegible]

Note: Groundwater table taken as base of pit for infiltration rate calculation.

BRE BR365 - Trial Pit Soakaway Data Sheet

Site: C14459- Oldlands Farm

Client: Bericote

Test Location

TP34

Date of start of testing

04/06/2014

Date at end of testing

04/06/2014

[illegible]

Note: Groundwater table taken as base of pit for infiltration rate calculation.

BRE BR365 - Trial Pit Soakaway Data Sheet

Site: C14459- Oldlands Farm

Client: Bericote

Test Location	TP26A	Date of start of testing	04/06/2014	Date at end of testing	04/06/2014
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[illegible]

Note: Groundwater table taken as base of pit for infiltration rate calculation.

BRE BR365 - Trial Pit Soakaway Data Sheet

Site: C14459- Oldlands Farm

Client: Bericote

Test Location	TP15	Date of start of testing	04/06/2014	Date at end of testing	04/06/2014
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[illegible]

Note: Groundwater table taken as base of pit for infiltration rate calculation.

BRE BR365 - Trial Pit Soakaway Data Sheet

Site: C14459- Oldlands Farm
Client: Bericote

Test Location	TP17	Date of start of testing	04/06/2014	Date at end of testing	04/06/2014
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[illegible]

Note: Groundwater table taken as base of pit for infiltration rate calculation.



APPENDIX C – HYDROCK HYDRAULIC CALCULATIONS

CONTENTS	
Identifier	Name
Hydrock	Micro Drainage Calculations

		Page 1
	Rolls-Royce Motor Cars Li... Oldlands Farm - BR Main SW Network	
Date 9th Sept 2014	Designed by Paul G	
File Main Site 15.09.14.mdx	Checked by	
Micro Drainage	Network 2013.1.1	

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	2	Add Flow / Climate Change (%)	0
M5-60 (mm)	19.000	Minimum Backdrop Height (m)	0.200
Ratio R	0.348	Maximum Backdrop Height (m)	3.000
Maximum Rainfall (mm/hr)	0	Min Design Depth for Optimisation (m)	1.200
Maximum Time of Concentration (mins)	30	Min Vel for Auto Design only (m/s)	1.00
Foul Sewage (l/s/ha)	0.000	Min Slope for Optimisation (1:X)	500
Volumetric Runoff Coeff.	0.750		

Designed with Level Soffits

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	1.776	4-8	3.115	8-12	0.250

Total Area Contributing (ha) = 5.142

Total Pipe Volume (m³) = 107.588

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)
1.000	29.000	0.116	250.0	0.925	6.00	0.0	0.600	o	450
2.000	22.000	0.116	189.7	0.760	4.00	0.0	0.600	o	375
1.001	45.000	0.129	350.0	0.000	0.00	0.0	0.600	o	525
3.000	54.000	0.154	350.6	0.962	4.00	0.0	0.600	o	450
1.002	36.000	0.072	500.0	0.000	0.00	0.0	0.600	o	675

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	E I.Area (ha)	E Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	0.00	6.38	1.450	0.925	0.0	0.0	0.0	1.28	203.8	0.0
2.000	0.00	4.28	1.450	0.760	0.0	0.0	0.0	1.31	144.9	0.0
1.001	0.00	7.01	1.184	1.685	0.0	0.0	0.0	1.19	257.9	0.0
3.000	0.00	4.83	1.100	0.962	0.0	0.0	0.0	1.08	171.8	0.0
1.002	0.00	7.52	0.721	2.647	0.0	0.0	0.0	1.17	417.0	0.0

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		Page 2																																																																																																																																																																									
	Rolls-Royce Motor Cars Li... Oldlands Farm - BR Main SW Network																																																																																																																																																																										
Date 9th Sept 2014 File Main Site 15.09.14.mdx	Designed by Paul G Checked by																																																																																																																																																																										
Micro Drainage	Network 2013.1.1																																																																																																																																																																										
<div>Network Design Table for Storm</div> <table><tr><th>PN</th><th>Length (m)</th><th>Fall (m)</th><th>Slope (1:X)</th><th>I.Area (ha)</th><th>T.E. (mins)</th><th>Base Flow (l/s)</th><th>k (mm)</th><th>HYD SECT</th><th>DIA (mm)</th></tr><tr><td>1.003</td><td>62.000</td><td>0.103</td><td>601.9</td><td>0.968</td><td>0.00</td><td>0.0</td><td>0.600</td><td>o</td><td>750</td></tr><tr><td>1.004</td><td>42.000</td><td>0.071</td><td>591.5</td><td>0.000</td><td>0.00</td><td>0.0</td><td>0.600</td><td>o</td><td>750</td></tr><tr><td>4.000</td><td>56.000</td><td>0.187</td><td>299.5</td><td>0.469</td><td>0.00</td><td>0.0</td><td>0.600</td><td>o</td><td>300</td></tr><tr><td>4.001</td><td>59.000</td><td>0.148</td><td>400.0</td><td>0.958</td><td>0.00</td><td>0.0</td><td>0.600</td><td>o</td><td>525</td></tr><tr><td>4.002</td><td>28.000</td><td>0.070</td><td>400.0</td><td>0.000</td><td>0.00</td><td>0.0</td><td>0.600</td><td>o</td><td>525</td></tr><tr><td>1.005</td><td>9.000</td><td>0.045</td><td>200.0</td><td>0.100</td><td>0.00</td><td>0.0</td><td>0.600</td><td>o</td><td>225</td></tr><tr><td>1.006</td><td>6.000</td><td>0.030</td><td>200.0</td><td>0.000</td><td>0.00</td><td>0.0</td><td>0.600</td><td>o</td><td>225</td></tr></table> <div>Network Results Table</div> <table><tr><th>PN</th><th>Rain (mm/hr)</th><th>T.C. (mins)</th><th>US/IL (m)</th><th>Σ I.Area (ha)</th><th>Σ Base Flow (l/s)</th><th>Foul (l/s)</th><th>Add Flow (l/s)</th><th>Vel (m/s)</th><th>Cap (l/s)</th><th>Flow (l/s)</th></tr><tr><td>1.003</td><td>0.00</td><td>8.43</td><td>0.574</td><td>3.615</td><td>0.0</td><td>0.0</td><td>0.0</td><td>1.13</td><td>500.7</td><td>0.0</td></tr><tr><td>1.004</td><td>0.00</td><td>9.05</td><td>0.471</td><td>3.615</td><td>0.0</td><td>0.0</td><td>0.0</td><td>1.14</td><td>505.1</td><td>0.0</td></tr><tr><td>4.000</td><td>0.00</td><td>7.03</td><td>1.350</td><td>0.469</td><td>0.0</td><td>0.0</td><td>0.0</td><td>0.90</td><td>63.9</td><td>0.0</td></tr><tr><td>4.001</td><td>0.00</td><td>7.92</td><td>0.938</td><td>1.427</td><td>0.0</td><td>0.0</td><td>0.0</td><td>1.11</td><td>241.1</td><td>0.0</td></tr><tr><td>4.002</td><td>0.00</td><td>8.34</td><td>0.791</td><td>1.427</td><td>0.0</td><td>0.0</td><td>0.0</td><td>1.11</td><td>241.1</td><td>0.0</td></tr><tr><td>1.005</td><td>0.00</td><td>9.21</td><td>0.300</td><td>5.142</td><td>0.0</td><td>0.0</td><td>0.0</td><td>0.92</td><td>36.6</td><td>0.0</td></tr><tr><td>1.006</td><td>0.00</td><td>9.32</td><td>0.255</td><td>5.142</td><td>0.0</td><td>0.0</td><td>0.0</td><td>0.92</td><td>36.6</td><td>0.0</td></tr></table>				PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	1.003	62.000	0.103	601.9	0.968	0.00	0.0	0.600	o	750	1.004	42.000	0.071	591.5	0.000	0.00	0.0	0.600	o	750	4.000	56.000	0.187	299.5	0.469	0.00	0.0	0.600	o	300	4.001	59.000	0.148	400.0	0.958	0.00	0.0	0.600	o	525	4.002	28.000	0.070	400.0	0.000	0.00	0.0	0.600	o	525	1.005	9.000	0.045	200.0	0.100	0.00	0.0	0.600	o	225	1.006	6.000	0.030	200.0	0.000	0.00	0.0	0.600	o	225	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)	1.003	0.00	8.43	0.574	3.615	0.0	0.0	0.0	1.13	500.7	0.0	1.004	0.00	9.05	0.471	3.615	0.0	0.0	0.0	1.14	505.1	0.0	4.000	0.00	7.03	1.350	0.469	0.0	0.0	0.0	0.90	63.9	0.0	4.001	0.00	7.92	0.938	1.427	0.0	0.0	0.0	1.11	241.1	0.0	4.002	0.00	8.34	0.791	1.427	0.0	0.0	0.0	1.11	241.1	0.0	1.005	0.00	9.21	0.300	5.142	0.0	0.0	0.0	0.92	36.6	0.0	1.006	0.00	9.32	0.255	5.142	0.0	0.0	0.0	0.92	36.6	0.0
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		Page 3						
	Rolls-Royce Motor Cars Li...							
	Oldlands Farm - BR							
	Main SW Network							
Date 9th Sept 2014	Designed by Paul G							
File Main Site 15.09.14.mdx	Checked by							
Micro Drainage	Network 2013.1.1							
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	450	Channel	2.550	1.450	0.650	Open Manhole	400
2.000	o	375	Channel	2.550	1.450	0.725	Open Manhole	400
1.001	o	525	S1	3.240	1.184	1.531	Open Manhole	1500
3.000	o	450	S2	2.900	1.100	1.350	Open Manhole	1500
1.002	o	675	S3	3.240	0.721	1.844	Open Manhole	1800
1.003	o	750	S4	2.820	0.574	1.496	Open Manhole	1800
1.004	o	750	S5	2.780	0.471	1.559	Open Manhole	1800
4.000	o	300	S6	2.850	1.350	1.200	Open Manhole	1500
4.001	o	525	S7	2.900	0.938	1.437	Open Manhole	1500
4.002	o	525	S8	2.800	0.791	1.485	Open Manhole	1500
1.005	o	225	Pond	2.400	0.300	1.875	Open Manhole	300
1.006	o	225	S9 Hydro	2.400	0.255	1.920	Open Manhole	1500
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	29.000	250.0	S1	3.240	1.334	1.456	Open Manhole	1500
2.000	22.000	189.7	S1	3.240	1.334	1.531	Open Manhole	1500
1.001	45.000	350.0	S3	3.240	1.055	1.660	Open Manhole	1800
3.000	54.000	350.6	S3	3.240	0.946	1.844	Open Manhole	1800
1.002	36.000	500.0	S4	2.820	0.649	1.496	Open Manhole	1800
1.003	62.000	601.9	S5	2.780	0.471	1.559	Open Manhole	1800
1.004	42.000	591.5	Pond	2.400	0.400	1.250	Open Manhole	300
4.000	56.000	299.5	S7	2.900	1.163	1.437	Open Manhole	1500
4.001	59.000	400.0	S8	2.800	0.791	1.485	Open Manhole	1500
4.002	28.000	400.0	Pond	2.400	0.721	1.155	Open Manhole	300
1.005	9.000	200.0	S9 Hydro	2.400	0.255	1.920	Open Manhole	1500
1.006	6.000	200.0		2.400	0.225	1.950	Open Manhole	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)		
1.006		2.400	0.225	0.300	0	0		
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		Page 4
	Rolls-Royce Motor Cars Li... Oldlands Farm - BR Main SW Network	
Date 9th Sept 2014	Designed by Paul G	
File Main Site 15.09.14.mdx	Checked by	
Micro Drainage	Network 2013.1.1	
<p align="center"><u>Simulation Criteria for Storm</u></p> <p> Volumetric Runoff Coeff 0.840 Additional Flow - % of Total Flow 0.000 Areal Reduction Factor 1.000 MADD Factor * 10m³/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) 360 Foul Sewage per hectare (l/s) 0.000 Output Interval (mins) 3 </p> <p> Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0 Number of Online Controls 1 Number of Storage Structures 1 Number of Real Time Controls 0 </p> <p align="center"><u>Synthetic Rainfall Details</u></p> <p> Rainfall Model FSR Profile Type Winter Return Period (years) 30 Cv (Summer) 0.750 Region England and Wales Cv (Winter) 0.840 M5-60 (mm) 19.000 Storm Duration (mins) 180 Ratio R 0.348 </p>		
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Online Controls for Storm							
Hydro-Brake® Manhole: S9 Hydro, DS/PN: 1.006, Volume (m³): 4.1							
Design Head (m) 2.000				Hydro-Brake® Type Md4			
Design Flow (l/s) 27.0				Invert Level (m) 0.255			
				Diameter (mm) 156			
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	20.8	3.000	32.8	7.000	50.2
0.200	13.3	1.400	22.4	3.500	35.5	7.500	51.9
0.300	18.9	1.600	24.0	4.000	37.9	8.000	53.6
0.400	18.2	1.800	25.4	4.500	40.2	8.500	55.3
0.500	16.3	2.000	26.8	5.000	42.4	9.000	56.9
0.600	15.8	2.200	28.1	5.500	44.5	9.500	58.5
0.800	17.1	2.400	29.4	6.000	46.5		
1.000	19.0	2.600	30.6	6.500	48.3		

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		Page 6																																																																
	Rolls-Royce Motor Cars Li... Oldlands Farm - BR Main SW Network																																																																	
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File Main Site 15.09.14.mdx	Checked by																																																																	
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<p style="text-align: center;"><u>Storage Structures for Storm</u></p> <p style="text-align: center;"><u>Tank or Pond Manhole: Pond, DS/PN: 1.005</u></p> <p style="text-align: center;">Invert Level (m) 0.300</p> <table border="1"> <thead> <tr> <th>Depth (m)</th> <th>Area (m²)</th> <th>Depth (m)</th> <th>Area (m²)</th> <th>Depth (m)</th> <th>Area (m²)</th> <th>Depth (m)</th> <th>Area (m²)</th> </tr> </thead> <tbody> <tr> <td>0.000</td> <td>675.0</td> <td>2.800</td> <td>0.9</td> <td>5.600</td> <td>0.9</td> <td>8.400</td> <td>0.9</td> </tr> <tr> <td>0.400</td> <td>904.0</td> <td>3.200</td> <td>0.9</td> <td>6.000</td> <td>0.9</td> <td>8.800</td> <td>0.9</td> </tr> <tr> <td>0.800</td> <td>1162.0</td> <td>3.600</td> <td>0.9</td> <td>6.400</td> <td>0.9</td> <td>9.200</td> <td>0.9</td> </tr> <tr> <td>1.200</td> <td>1444.0</td> <td>4.000</td> <td>0.9</td> <td>6.800</td> <td>0.9</td> <td>9.600</td> <td>0.9</td> </tr> <tr> <td>1.600</td> <td>1742.0</td> <td>4.400</td> <td>0.9</td> <td>7.200</td> <td>0.9</td> <td>10.000</td> <td>0.9</td> </tr> <tr> <td>2.000</td> <td>2049.0</td> <td>4.800</td> <td>0.9</td> <td>7.600</td> <td>0.9</td> <td></td> <td></td> </tr> <tr> <td>2.400</td> <td>0.0</td> <td>5.200</td> <td>0.9</td> <td>8.000</td> <td>0.9</td> <td></td> <td></td> </tr> </tbody> </table>			Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	0.000	675.0	2.800	0.9	5.600	0.9	8.400	0.9	0.400	904.0	3.200	0.9	6.000	0.9	8.800	0.9	0.800	1162.0	3.600	0.9	6.400	0.9	9.200	0.9	1.200	1444.0	4.000	0.9	6.800	0.9	9.600	0.9	1.600	1742.0	4.400	0.9	7.200	0.9	10.000	0.9	2.000	2049.0	4.800	0.9	7.600	0.9			2.400	0.0	5.200	0.9	8.000	0.9		
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		Page 7
	Rolls-Royce Motor Cars Li... Oldlands Farm - BR Main SW Network	
Date 9th Sept 2014	Designed by Paul G	
File Main Site 15.09.14.mdx	Checked by	
Micro Drainage	Network 2013.1.1	

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

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.350
Region England and Wales Cv (Summer)	0.750		
M5-60 (mm)	19.000	Cv (Winter)	0.840

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

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 0, 20

PN	Storm	Return Period	Climate Change	First X Surchage	First Y Flood	First Z Overflow	O/F Act.	Lvl Exc.
1.000	15 Winter	1	0%	30/15 Summer	100/15 Summer			6
2.000	15 Winter	1	0%	30/15 Summer	100/15 Summer			6
1.001	15 Winter	1	0%	30/15 Summer				
3.000	15 Winter	1	0%	30/15 Summer	100/15 Summer			4
1.002	15 Winter	1	0%	30/15 Summer				
1.003	15 Winter	1	0%	30/15 Summer				
1.004	480 Winter	1	0%	30/15 Summer				
4.000	15 Winter	1	0%	30/15 Summer	100/15 Summer			5
4.001	15 Winter	1	0%	30/15 Summer				
4.002	15 Winter	1	0%	30/15 Summer				
1.005	480 Winter	1	0%	1/15 Summer				
1.006	600 Winter	1	0%	1/15 Summer				

PN	US/MH Name	Water		Flooded		Pipe		Status
		Level (m)	Surch'ed Depth (m)	Volume (m³)	Flow / Cap. (l/s)	O'flow (l/s)	Flow (l/s)	
1.000	Channel	1.706	-0.194	0.000	0.60	0.0	105.3	OK
2.000	Channel	1.712	-0.113	0.000	0.81	0.0	100.1	OK
1.001	S1	1.568	-0.141	0.000	0.87	0.0	197.3	OK
3.000	S2	1.413	-0.137	0.000	0.78	0.0	123.1	OK
1.002	S3	1.229	-0.167	0.000	0.87	0.0	296.2	OK
1.003	S4	1.139	-0.185	0.000	0.83	0.0	362.7	OK
1.004	S5	1.050	-0.171	0.000	0.15	0.0	61.0	OK
4.000	S6	1.572	-0.078	0.000	0.87	0.0	52.5	OK
4.001	S7	1.255	-0.208	0.000	0.66	0.0	144.3	OK

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 Oldlands Farm - BR
 Main SW Network



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

		Water		Flooded		Pipe		
PN	US/MH Name	Level (m)	Surch'd Depth (m)	Volume (m ³)	Flow / Cap.	O'flow (l/s)	Flow (l/s)	Status
4.002	S8	1.118	-0.197	0.000	0.71	0.0	141.6	OK
1.005	Pond	1.021	0.496	0.000	0.64	0.0	19.1	SURCHARGED
1.006	S9 Hydro	1.007	0.527	0.000	0.68	0.0	18.8	SURCHARGED

		Page 9																																																																																																																																																																																																																					
	Rolls-Royce Motor Cars Li... Oldlands Farm - BR Main SW Network																																																																																																																																																																																																																						
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<p align="center"><u>Simulation Criteria</u></p> <p> 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 </p> <p> Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0 Number of Online Controls 1 Number of Storage Structures 1 Number of Real Time Controls 0 </p> <p align="center"><u>Synthetic Rainfall Details</u></p> <p> Rainfall Model FSR Ratio R 0.350 Region England and Wales Cv (Summer) 0.750 M5-60 (mm) 19.000 Cv (Winter) 0.840 </p> <p> Margin for Flood Risk Warning (mm) 300.0 Analysis Timestep 2.5 Second Increment (Extended) DTS Status ON DVD Status ON Inertia Status ON </p> <p> Profile(s) Summer and Winter Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440 Return Period(s) (years) 1, 30, 100 Climate Change (%) 0, 0, 20 </p> <table border="1"> <thead> <tr> <th>PN</th> <th>Storm</th> <th>Return Period</th> <th>Climate Change</th> <th>First X Surchage</th> <th>First Y Flood</th> <th>First Z Overflow</th> <th>O/F Act.</th> <th>Lvl Exc.</th> </tr> </thead> <tbody> <tr><td>1.000</td><td>15 Winter</td><td>30</td><td>0%</td><td>30/15 Summer</td><td>100/15 Summer</td><td></td><td></td><td>6</td></tr> <tr><td>2.000</td><td>15 Winter</td><td>30</td><td>0%</td><td>30/15 Summer</td><td>100/15 Summer</td><td></td><td></td><td>6</td></tr> <tr><td>1.001</td><td>15 Winter</td><td>30</td><td>0%</td><td>30/15 Summer</td><td></td><td></td><td></td><td></td></tr> <tr><td>3.000</td><td>15 Winter</td><td>30</td><td>0%</td><td>30/15 Summer</td><td>100/15 Summer</td><td></td><td></td><td>4</td></tr> <tr><td>1.002</td><td>15 Winter</td><td>30</td><td>0%</td><td>30/15 Summer</td><td></td><td></td><td></td><td></td></tr> <tr><td>1.003</td><td>600 Winter</td><td>30</td><td>0%</td><td>30/15 Summer</td><td></td><td></td><td></td><td></td></tr> <tr><td>1.004</td><td>600 Winter</td><td>30</td><td>0%</td><td>30/15 Summer</td><td></td><td></td><td></td><td></td></tr> <tr><td>4.000</td><td>15 Winter</td><td>30</td><td>0%</td><td>30/15 Summer</td><td>100/15 Summer</td><td></td><td></td><td>5</td></tr> <tr><td>4.001</td><td>600 Winter</td><td>30</td><td>0%</td><td>30/15 Summer</td><td></td><td></td><td></td><td></td></tr> <tr><td>4.002</td><td>600 Winter</td><td>30</td><td>0%</td><td>30/15 Summer</td><td></td><td></td><td></td><td></td></tr> <tr><td>1.005</td><td>600 Winter</td><td>30</td><td>0%</td><td>1/15 Summer</td><td></td><td></td><td></td><td></td></tr> <tr><td>1.006</td><td>480 Winter</td><td>30</td><td>0%</td><td>1/15 Summer</td><td></td><td></td><td></td><td></td></tr> </tbody> </table> <table border="1"> <thead> <tr> <th rowspan="2">PN</th> <th rowspan="2">US/MH Name</th> <th colspan="2">Water</th> <th colspan="2">Flooded</th> <th colspan="2">Pipe</th> <th rowspan="2">Status</th> </tr> <tr> <th>Level (m)</th> <th>Surch'd Depth (m)</th> <th>Volume (m³)</th> <th>Flow / Cap. (l/s)</th> <th>O'flow (l/s)</th> <th>Flow</th> </tr> </thead> <tbody> <tr><td>1.000</td><td>Channel</td><td>2.514</td><td>0.614</td><td>0.000</td><td>1.29</td><td>0.0</td><td>225.3</td><td>FLOOD RISK</td></tr> <tr><td>2.000</td><td>Channel</td><td>2.516</td><td>0.631</td><td>0.000</td><td>1.61</td><td>0.0</td><td>138.2</td><td>FLOOD RISK</td></tr> <tr><td>1.001</td><td>S1</td><td>2.315</td><td>0.606</td><td>0.000</td><td>1.65</td><td>0.0</td><td>374.4</td><td>SURCHARGED</td></tr> <tr><td>3.000</td><td>S2</td><td>2.291</td><td>0.741</td><td>0.000</td><td>1.62</td><td>0.0</td><td>255.2</td><td>SURCHARGED</td></tr> <tr><td>1.002</td><td>S3</td><td>1.962</td><td>0.566</td><td>0.000</td><td>1.78</td><td>0.0</td><td>609.8</td><td>SURCHARGED</td></tr> <tr><td>1.003</td><td>S4</td><td>1.750</td><td>0.426</td><td>0.000</td><td>0.27</td><td>0.0</td><td>118.1</td><td>SURCHARGED</td></tr> <tr><td>1.004</td><td>S5</td><td>1.747</td><td>0.526</td><td>0.000</td><td>0.28</td><td>0.0</td><td>118.0</td><td>SURCHARGED</td></tr> <tr><td>4.000</td><td>S6</td><td>2.431</td><td>0.781</td><td>0.000</td><td>1.86</td><td>0.0</td><td>112.6</td><td>SURCHARGED</td></tr> <tr><td>4.001</td><td>S7</td><td>1.749</td><td>0.286</td><td>0.000</td><td>0.21</td><td>0.0</td><td>45.6</td><td>SURCHARGED</td></tr> </tbody> </table>			PN	Storm	Return Period	Climate Change	First X Surchage	First Y Flood	First Z Overflow	O/F Act.	Lvl Exc.	1.000	15 Winter	30	0%	30/15 Summer	100/15 Summer			6	2.000	15 Winter	30	0%	30/15 Summer	100/15 Summer			6	1.001	15 Winter	30	0%	30/15 Summer					3.000	15 Winter	30	0%	30/15 Summer	100/15 Summer			4	1.002	15 Winter	30	0%	30/15 Summer					1.003	600 Winter	30	0%	30/15 Summer					1.004	600 Winter	30	0%	30/15 Summer					4.000	15 Winter	30	0%	30/15 Summer	100/15 Summer			5	4.001	600 Winter	30	0%	30/15 Summer					4.002	600 Winter	30	0%	30/15 Summer					1.005	600 Winter	30	0%	1/15 Summer					1.006	480 Winter	30	0%	1/15 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	1.000	Channel	2.514	0.614	0.000	1.29	0.0	225.3	FLOOD RISK	2.000	Channel	2.516	0.631	0.000	1.61	0.0	138.2	FLOOD RISK	1.001	S1	2.315	0.606	0.000	1.65	0.0	374.4	SURCHARGED	3.000	S2	2.291	0.741	0.000	1.62	0.0	255.2	SURCHARGED	1.002	S3	1.962	0.566	0.000	1.78	0.0	609.8	SURCHARGED	1.003	S4	1.750	0.426	0.000	0.27	0.0	118.1	SURCHARGED	1.004	S5	1.747	0.526	0.000	0.28	0.0	118.0	SURCHARGED	4.000	S6	2.431	0.781	0.000	1.86	0.0	112.6	SURCHARGED	4.001	S7	1.749	0.286	0.000	0.21	0.0	45.6	SURCHARGED
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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 (m ³)	Flow / Cap.	O'flow (l/s)	Flow (l/s)	
4.002	S8	1.747	0.431	0.000	0.23	0.0	45.6	SURCHARGED
1.005	Pond	1.745	1.220	0.000	0.78	0.0	23.2	SURCHARGED
1.006	S9 Hydro	1.707	1.227	0.000	0.82	0.0	22.8	SURCHARGED

		Page 11						
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	Oldlands Farm - BR							
	Main SW Network							
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<u>100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm</u>								
<u>Simulation Criteria</u>								
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 Offline Controls 0						
Number of Online Controls 1		Number of Storage Structures 1						
		Number of Time/Area Diagrams 0						
		Number of Real Time Controls 0						
<u>Synthetic Rainfall Details</u>								
Rainfall Model		FSR Ratio R 0.350						
Region England and Wales Cv (Summer)		0.750						
M5-60 (mm)		19.000 Cv (Winter) 0.840						
Margin for Flood Risk Warning (mm)		300.0						
Analysis Timestep 2.5 Second Increment (Extended)								
DTS Status		ON						
DVD Status		ON						
Inertia Status		ON						
Profile(s)		Summer and Winter						
Duration(s) (mins)		15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440						
Return Period(s) (years)		1, 30, 100						
Climate Change (%)		0, 0, 20						
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	+20%	30/15 Summer	100/15 Summer			6
2.000	15 Winter	100	+20%	30/15 Summer	100/15 Summer			6
1.001	15 Winter	100	+20%	30/15 Summer				
3.000	15 Winter	100	+20%	30/15 Summer	100/15 Summer			4
1.002	720 Winter	100	+20%	30/15 Summer				
1.003	720 Winter	100	+20%	30/15 Summer				
1.004	720 Winter	100	+20%	30/15 Summer				
4.000	15 Winter	100	+20%	30/15 Summer	100/15 Summer			5
4.001	720 Winter	100	+20%	30/15 Summer				
4.002	720 Winter	100	+20%	30/15 Summer				
1.005	720 Winter	100	+20%	1/15 Summer				
1.006	720 Winter	100	+20%	1/15 Summer				
		Water		Flooded		Pipe		
	US/MH	Level	Surch'ed	Volume	Flow /	O'flow	Flow	
PN	Name	(m)	Depth (m)	(m³)	Cap.	(l/s)	(l/s)	Status
1.000	Channel	2.605	0.705	54.963	1.23	0.0	214.2	FLOOD
2.000	Channel	2.599	0.774	49.400	1.68	0.0	266.5	FLOOD
1.001	S1	2.486	0.777	0.000	1.68	0.0	381.4	SURCHARGED
3.000	S2	2.916	1.366	16.526	2.12	0.0	332.7	FLOOD
1.002	S3	2.380	0.984	0.000	0.33	0.0	113.6	SURCHARGED
1.003	S4	2.378	1.054	0.000	0.35	0.0	154.2	SURCHARGED
1.004	S5	2.375	1.154	0.000	0.37	0.0	153.8	SURCHARGED
4.000	S6	2.868	1.218	17.929	2.27	0.0	137.6	FLOOD
4.001	S7	2.377	0.914	0.000	0.27	0.0	59.8	SURCHARGED
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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 (m ³)	Flow / Cap.	O'flow (l/s)	Flow (l/s)	
4.002	S8	2.374	1.058	0.000	0.30	0.0	59.6	SURCHARGED
1.005	Pond	2.372	1.847	0.000	0.93	0.0	27.7	FLOOD RISK
1.006	S9 Hydro	2.327	1.847	0.000	0.96	0.0	26.7	FLOOD RISK