Ashley Waitt

St. Georges Terrace, Herne Bay

Drainage Operation & Maintenance Requirements

MLM. Group

Part of Sweco

Notice

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Document History

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Revision	Status	Description	Author	Checked/Approved	Date
00		First Issue	Dan Kent	Toby Crayden	20 December 2019
01		Revised based on updated site layout & CCTV Drainage Survey	Luke Bacon	Toby Crayden	17 January 2020

Contents

1 Drainage Operation

The following sets out the requirements for the operation of the private foul and surface water drainage system for the new development at St. Georges Terrace, Herne Bay.

The private foul and surface water system includes all pipes, flow controls, attenuation etc. that collect, restrict, store and outfall private foul and surface water runoff from the building and external works. It does not include any adoptable surface water drainage, land drainage or surface water run-off from the adjacent areas.

The surface water design incorporates permeable surfacing to drain external hardstanding areas with attenuation provided within the sub-base of the paving. The sub base will be lined with an impermeable membrane to ensure no discharge into the ground. Surface water from the roof areas will be collected by rainwater pipes and discharge directly into the permeable paving sub-base attenuation.

A flow control device will be installed (inside a catchpit chamber) and this will restrict the discharge to ensure that outflow rates from the proposed development are limited to a maximum of 2l/s (the lowest rate that can reasonably achieved without increasing the risk of pipe blockage), this is a significant reduction from the existing discharge rates on the site.

A CCTV survey has been undertaken by Omega Geo and this has indicated that both the existing surface and foul water network discharge into the adopted foul sewer along St. Georges Terrace. The adopted foul sewer is therefore a combined sewer, and subject to approval from Southern Water the controlled surface water outflow will be discharged via carrier pipes into the existing combined sewer network in St. Georges Terrace.

The foul water system is a gravity pipe network that collects foul drain points from within the building and discharges to the existing adopted combined water network in St Georges Terrace.

The drainage system is as indicated on MLM Drawing No. 6101045-MLM-ZZ-XX-DR-C-0001 and can be found in Appendix A.

2 Maintenance Requirements

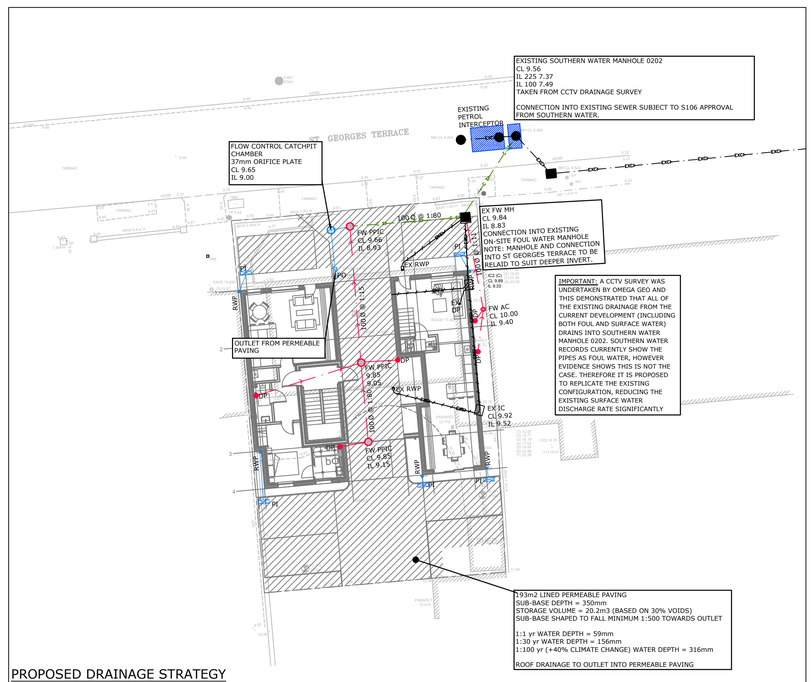
To ensure the long term operation of the drainage system, it is essential that maintenance is carried out. Details for the long-term maintenance arrangements shall be in accordance with the requirements of the CIRIA report C753, the manufacturer's recommendations and as required based on operational needs, as summarised below. The recommended maintenance regime should be seen as the minimum recommended frequency and operational / site needs may dictate a greater frequency of inspection / action.

Item	Description	Frequency
1	Flow control: The orifice plate should be inspected every six months for correct operation, check for no visual damage etc. The sumps should be cleaned of silt and debris.	Every six months
2	Pipework/chambers in general: General foul and surface water pipework and chambers etc should be jetted clean and CCTV'd at 5 year intervals and any recommendations on the CCTV footage / report actioned.	5 years
3	Permeable Paving: Brushing and vacuuming of surfacing Removal of weeds Remedial work to any depressions, rutting and cracking considered to be detrimental to the structural performance or a hazard to users Rehabilitation of surface and upper substructure by remedial sweeping	 Annually As required As required Every 10 to 15 years or as required (if performance is reduced due to significant clogging)

Appendix A - Drainage Drawing

EXISTING IMPERMEABLE AREA PLAN
1:200

PROPOSED IMPERMEABLE AREA PLAN
1:200



PROPOSED DRAINAGE STRATEGY
1:200

DISCHARGE RATES:

EXISTING SITE DISCHARGE RATES
1:1 YEAR = 3.4l/s
1:30 YEAR = 7.6 l/s
1:100 YR = 9.4 l/s

PROPOSED DISCHARGE RATES BASED ON 37mm ORIFICE PLATE FITTED TO DISCHARGE CHAMBER
1:1 YEAR = 1.3l/s
1:30 YEAR = 1.6l/s
1:100 YEAR (+40% CLIMATE CHANGE) = 2.0l/s

DESIGN NOTES:

1. IMPORTANT: A CCTV SURVEY WAS UNDERTAKEN BY OMEGAGEO AND THIS DEMONSTRATED THAT ALL OF THE EXISTING DRAINAGE FROM THE CURRENT DEVELOPMENT (INCLUDING BOTH FOUL AND SURFACE WATER) DRAINS INTO SOUTHERN WATER MANHOLE 0202. SOUTHERN WATER RECORDS CURRENTLY SHOW THE PIPES AS FOUL WATER, HOWEVER EVIDENCE SHOWS THIS IS NOT THE CASE. THEREFORE IT IS PROPOSED TO REPLICATE THE EXISTING CONFIGURATION, REDUCING THE EXISTING SURFACE WATER RUNOFF SIGNIFICANTLY.
2. NOT FOR CONSTRUCTION. SUBJECT TO DETAILED DESIGN.
3. CONNECTION INTO EXISTING SEWERS SUBJECT TO APPROVAL FROM WATER AUTHORITY.
4. DRAINAGE SUBJECT TO DETAILED LEVEL DESIGN.
5. PROPOSED DISCHARGE RATES TO BE RESTRICTED TO BE NO GREATER THAN PRE-DEVELOPED SITE.
6. COVER LEVELS SHOWN INDICATIVELY ONLY SUBJECT TO DETAILED DESIGN.
7. ADDITIONAL CHAMBERS MAY BE REQUIRED TO SUIT CONNECTION LOCATIONS ON SITE.
8. SVP / RWP LOCATIONS SUBJECT TO DETAILED DESIGN.

DRAINAGE KEY:

- EXISTING SURFACE WATER SEWER
- EXISTING FOUL WATER SEWER
- EXISTING COMBINED SEWER
- SEWER TO BE ABANDONED
- PROPOSED SURFACE WATER DRAIN
- PROPOSED FOUL WATER DRAIN
- PROPOSED COMBINED SEWER
- PERMEABLE PAVING STORAGE
- PI — PERMEABLE PAVING INLET
- PO — PERMEABLE PAVING OUTLET
- DP — FOUL DRAINAGE POINT
- RWP — PROPOSED RAINWATER PIPE
- EX RWP — EXISTING RAINWATER PIPE

DRAINAGE NOTES

1. ALL PRIVATE DRAINAGE WORKS SHALL BE IN ACCORDANCE WITH 'THE BUILDING REGULATIONS APPROVED DOCUMENT H' AND BRITISH STANDARD EN 752.
2. PRIOR TO COMMENCEMENT OF THE WORKS THE CONTRACTOR SHALL LIAISE WITH ALL RELEVANT AUTHORITIES TO OBTAIN THEIR REQUIREMENTS AND TO OBTAIN APPROVAL FOR HIS METHOD OF WORKING AND WHERE APPROPRIATE HIS INTENDED CHOICE OF MATERIALS.
3. REFER TO SITE SURVEY FOR DETAILS OF EXISTING SITE CONDITIONS AND BENCH MARKS.
4. PRIOR TO COMMENCEMENT OF THE WORKS THE CONTRACTOR SHALL LIAISE WITH ALL RELEVANT AUTHORITIES TO LOCATE, PROTECT AND WHERE NECESSARY DIVERT ALL EXISTING SERVICES AFFECTED BY THE WORKS.
5. ALL EXCAVATIONS SHALL BE KEPT FREE OF STANDING WATER.
6. THE CONTRACTOR SHALL ENSURE THE STABILITY OF ALL EXCAVATIONS IS MAINTAINED AT ALL TIMES.
7. ALL WORKS IN, OR ADJACENT TO, THE PUBLIC HIGHWAY SHALL BE IN ACCORDANCE WITH THE REQUIREMENTS OF THE HIGHWAY AUTHORITY. THE CONTRACTOR SHALL OBTAIN ALL NECESSARY LICENSES REQUIRED TO CARRY OUT THE WORKS WITHIN THE PUBLIC HIGHWAY.
8. ALL WORKS TO NEW OR EXISTING PUBLIC SEWERS SHALL BE TO THE APPROVAL OF THE WATER AUTHORITY AND IN ACCORDANCE WITH 'SEWERS FOR ADOPTION'-LATEST EDITION.
9. PRIOR TO COMMENCEMENT OF THE WORKS ALL DRAINAGE OUTFALL POINTS, WHETHER EXISTING SEWER, DRAIN OR WATERCOURSE, SHALL BE VERIFIED ON SITE BY THE CONTRACTOR. IF THE OUTFALL POINT IS FOUND TO BE HIGHER OR SIGNIFICANTLY LOWER THAN SHOWN ON THE DRAWINGS THEN THE CONTRACT ADMINISTRATOR SHALL BE NOTIFIED IMMEDIATELY. (SIGNIFICANT REDESIGN OF DRAINAGE AND LEVELS MAY BE NECESSARY). PRIOR TO COMMENCEMENT OF CONSTRUCTION ON-SITE THE CONTRACTOR SHALL INSTALL ALL OFF-SITE DRAINAGE CONNECTIONS, OR SATISFY HIMSELF THAT THERE ARE NO OBSTRUCTIONS OR OTHER REASONS WHY, THE DRAIN CONNECTIONS CAN NOT BE MADE.
10. ALL COVER LEVELS SHOWN ON THIS DRAWING ARE APPROXIMATE. EXACT LEVELS OF NEW COVERS AND FRAMES TO BE DETERMINED ON SITE TO MATCH LEVEL AND PROFILE OF FINISHED SURFACE.
11. THE CONSTRUCTION OF ALL EXISTING CHAMBERS, GULLIES ETC. AND THEIR COVERS, GRATINGS AND FRAMES TO BE IMPROVED, REPAIRED OR REPLACED AS NECESSARY TO SUIT THEIR LOCATION WITHIN THE FINISHED DEVELOPMENT.
12. ALL COVERS, GRATINGS AND FRAMES TO CHAMBERS, GULLIES, CHANNELS ETC. SHALL BE OF THE CORRECT LOAD CLASS TO SUIT THEIR LOCATION.

    - LOAD CLASS A15 PEDESTRIAN AREAS (NOT ACCESSIBLE BY VEHICLES)
    - LOAD CLASS B125 PRIVATE DRIVES
    - LOAD CLASS C250 BASEMENTS / PARKING BAYS / LIGHTLY TRAFFICKED ROADS.
    - LOAD CLASS D400 MAIN ROADS

    GRATINGS IN PEDESTRIAN AREAS TO BE DESIGNED FOR PEDESTRIAN USE.
13. ALL EXISTING CHAMBERS, GULLIES CHANNELS, PIPES AND OTHER DRAINAGE APPARATUS SHALL BE PROTECTED FROM DAMAGE DURING THE WORKS. THE CONTRACTOR SHALL TAKE ALL NECESSARY MEASURES TO ENSURE THAT NO MATERIAL ENTERS THE DRAINS (OTHER THAN THAT WHICH THEY ARE DESIGNED TO CARRY).
14. REFER TO SITE INVESTIGATION REPORT FOR EXISTING GROUND CONDITIONS AND ANY SPECIAL REQUIREMENTS FOR BURIED CONCRETE (SPECIAL REQUIREMENTS FOR BURIED CONCRETE SHALL INCLUDE ALL PRE-CAST AND IN-SITU CONCRETE AND MORTARS). WHERE APPROPRIATE REFER TO CONTAMINATION REPORTS FOR DETAILS OF CHEMICALS AFFECTING CHOICE OF MATERIALS AND OTHER ADDITIONAL REQUIREMENTS.
15. ALL PRE-CAST AND IN-SITU CONCRETE AND MORTARS USED IN THE CONSTRUCTION OF FOUL DRAINS AND SEWERS SHALL BE MADE FROM SULPHATE RESISTING CEMENT.
16. UNLESS NOTED OTHERWISE ALL PIPEWORK SHALL BE 100mm DIAMETER LAID TO A FALL OF 1 IN 100 OR STEEPER FOR SURFACE WATER AND 1 IN 40 OR STEEPER FOR FOUL WATER. FOUL DRAINS WITH ONE OR MORE W.C. CONNECTED MAY BE LAID AT 1 IN 80 OR STEEPER. WHERE APPROPRIATE ROAD GULLY CONNECTIONS SHALL BE 150mm DIA AT 1 IN 150 OR STEEPER.
17. UNLESS NOTED OTHERWISE ALL PIPEWORK SHALL BE CONSTRUCTED FROM 'SUPER STRENGTH' VITRIFIED CLAY TO BS 65,BS EN 295 OR UPVC TO BS EN 1201 BEDDED AND BACKFILLED AS PER THE MANUFACTURERS RECOMMENDATIONS AND THE ABOVE LISTED PUBLICATIONS.
18. THE CONTRACTORS ATTENTION IS DRAWN TO DIAGRAMS 7 AND 8 OF 'THE BUILDING REGULATIONS APPROVED DOCUMENT H' SHOWING DETAILS OF DRAINS LAID BELOW AND NEAR TO BUILDINGS. WHERE GROUND BEAMS ARE USED, THEIR LEVEL SHALL BE SET TO AVOID CLASHING WITH DRAIN CONNECTIONS.
19. EXACT LOCATION OF GULLIES TO BE DETERMINED ON SITE TO SUIT LOW POINTS. THE CONTRACTOR SHALL ENSURE THAT ALL FINISHED SURFACE ARE LAID TO FALLS THAT ARE SUFFICIENT FOR ALL SURFACE WATER TO DRAIN WITHOUT SURFACE PONDING.
20. FOR THE EXACT LOCATION OF SOIL PIPES, STUBSTACKS, W.C.'S AND OTHER DRAINAGE CONNECTIONS REFER TO THE LARGE SCALE ARCHITECTURAL BUILDING PLANS.
21. RAINWATER DOWNPIPES THAT DO NOT CONNECT DIRECTLY TO AN ACCESS POINT, SHALL BE FITTED WITH A RODDING ACCESS.
22. ALL DRAINAGE CHANNELS TO BE BY ACO OR SIMILAR AND TO BE OF A TYPE SIZE AND CAPACITY SUITABLE FOR THEIR LOCATION.
23. ACCESS FITTINGS, INSPECTION CHAMBERS AND MANHOLES SHALL BE CONSTRUCTED TO THE DIMENSIONS SHOWN IN TABLES 11 AND 12 OF 'THE BUILDING REGULATIONS APPROVED DOCUMENT H' AND FROM THE MATERIALS LISTED IN TABLE 14. ACCESS POINTS, INSPECTION CHAMBERS AND MANHOLES SHALL BE CONSTRUCTED FROM PRODUCTS DESIGNED/RATED FOR THE LOCATION IN WHICH THEY ARE TO BE USED. THEY SHALL BE INSTALLED IN ACCORDANCE WITH THE MANUFACTURERS/SUPPLIERS RECOMMENDATIONS.
24. PRIOR TO COMMENCEMENT OF ANY WORKS THE EXISTING DRAINAGE MUST BE TRACED TO ENSURE THAT NO 'LIVE' CONNECTIONS REMAIN. ANY SUCH CONNECTIONS MUST BE REPORTED TO THE CONTRACT ADMINISTRATOR, PRIOR TO DIVERSION INTO THE NEW DRAINS.
25. EXISTING PIPES TO BE ABANDONED SHALL BE BROKEN OUT OR FILLED WITH PFA GROUT. MANHOLES SHALL BE BROKEN OUT AND FILLED WITH COMPACTED GRANULAR MATERIAL.

PRINT ACCURACY INDICATOR 50mm 100mm

N S E W

THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT ENGINEERS', ARCHITECTS' AND SPECIALISTS' DRAWINGS AND THE SPECIFICATION.

DESIGN INFORMATION FROM OTHER DISCIPLINES SHOWN ON THIS DRAWING IS FOR COORDINATION PURPOSES ONLY

DO NOT SCALE FROM THIS DRAWING MANUALLY OR ELECTRONICALLY. WRITTEN PERMISSION MUST BE OBTAINED FROM MLM PRIOR TO SCALING ELECTRONICALLY OR USING THIS ELECTRONIC FILE.

NOTES

CONSTRUCTION (DESIGN AND MANAGEMENT) REGULATIONS 2015 DESIGNERS RISK INFORMATION

IN ACCORDANCE WITH THE CONSTRUCTION (DESIGN AND MANAGEMENT) REGULATIONS THE HAZARDS AND RISKS ASSOCIATED WITH CONSTRUCTING MAINTAINING AND CLEANING THE STRUCTURE HAVE BEEN ASSESSED.

THE DESIGN SOLUTION HAS MITIGATED THESE WHERE POSSIBLE, HOWEVER, RESIDUAL/ UNUSUAL HAZARDS OR RISKS IDENTIFIED HAVE BEEN RECORDED IN THE DESIGNERS RISK INFORMATION SPECIFIC TO THE PROJECT.

ASSUMPTIONS MADE ABOUT THE METHOD OF CONSTRUCTION, MAINTENANCE AND DEMOLITION HAVE BEEN STATED WHERE THESE FORM AN INTEGRAL PART OF MANAGING THE RISKS AND HAZARDS, HOWEVER, THIS DOES NOT RESTRICT THE CONTRACTOR TO THESE METHODS ALONE.

IT IS UNDERSTOOD THAT A COMPETENT CONTRACTOR WILL CARRY OUT CONSTRUCTION, MAINTENANCE AND DEMOLITION WORK IN ACCORDANCE WITH RECOGNISED GOOD INDUSTRY PRACTICE.

1. ASBESTOS: THE CONTRACTOR SHOULD ENSURE THAT AN APPROPRIATE ASBESTOS SURVEY IS UNDERTAKEN PRIOR TO ANY DEMOLITION AND ANY REMEDIAL ACTIONS COMPLETED.

2. BURIED SERVICES: THE CONTRACTOR SHOULD REFER TO ALL CURRENT SERVICES INFORMATION COLLATED BY THE PRINCIPAL DESIGNER AND IS ADVISED TO UNDERTAKE HIS OWN ON-SITE SEARCHES/SURVEYS TO CHECK LOCATIONS OF THESE AND FOR ANY FURTHER SERVICES. ALL SERVICES IDENTIFIED SHOULD BE RECORDED AND MARKED OUT ON SITE.

THE ABOVE NOTES REFER SPECIFICALLY TO THE INFORMATION SHOWN ON THIS DRAWING AS DESIGNERS.

PLEASE REFER TO THE DESIGNERS RISK INFORMATION FOR FURTHER CLARIFICATION AND THOSE RELEVANT TO OTHER DISCIPLINES.

REV	DATE	REVISION	MADE	CHK	APP
P02	17.01.2020	REVISED TO SUIT DRAINAGE SURVEY	LB	TC	TC
P01	20.12.2019	FIRST ISSUE	DK	TC	TC

PURPOSE OF ISSUE
PLANNING

STATUS S2 — SUITABLE FOR INFORMATION

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CLIENT
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PROJECT
ST. GEORGES TERRACE
HERNE BAY

DRAWING TITLE
PROPOSED DRAINAGE STRATEGY

SCALE	DRAWN/DESIGN	MLM REF	REVISION
1:200 @A1	DK	6101045	P02

PROJECT	ORIGINATOR	VOLUME/ SYSTEM	LEVELS & LOCATIONS	TYPE	ROLE	NUMBER
6101045	MLM	ZZ	XX	DR	C	0001

AUTOCAD 2017

Appendix B - Drainage Calculations

North Kiln Felaw Maltings 46 Felaw Street Ipswich IP2 8PN	Existing Brownfield Rates St Georges Terrace Herne Bay
Date 19/12/19 File 6101045-MLM-ZZ-XX-CA-	Designed by DKent Checked by
XP Solutions	Network 2017.1.2

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)	1	PIMP (%)	100
M5-60 (mm)	26.250	Add Flow / Climate Change (%)	0
Ratio R	0.400	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.022	4-8	0.001

Total Area Contributing (ha) = 0.023

Total Pipe Volume (m³) = 0.079

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)	Section Type	Auto Design
S1.000	5.000	0.063	80.0	0.023	4.00	0.0	0.600	o	100	Pipe/Conduit	
S1.001	5.000	0.063	80.0	0.000	0.00	0.0	0.600	o	100	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.000	50.00	4.10	9.000	0.023	0.0	0.0	0.0	0.86	6.8	3.1
S1.001	50.00	4.19	8.938	0.023	0.0	0.0	0.0	0.86	6.8	3.1

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S1.001	S	10.000	8.875	0.000	0	0

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

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.400
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	19.800	Cv (Winter)	0.840

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

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 0, 0

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S1.000	S1	15 Summer	1	+0%	30/15 Summer				9.055
S1.001	S2	15 Summer	1	+0%	30/15 Summer				8.992

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S1	-0.045	0.000	0.57		3.4	OK	
S1.001	S2	-0.046	0.000	0.57		3.4	OK	

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	0
Number of Online Controls	0	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.400
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	19.800	Cv (Winter)	0.840

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

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 0, 0

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S1.000	S1	15 Winter	30	+0%	30/15 Summer				9.181
S1.001	S2	15 Winter	30	+0%	30/15 Summer				9.072

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S1	0.081	0.000	1.28		7.6	SURCHARGED	
S1.001	S2	0.034	0.000	1.28		7.6	SURCHARGED	

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 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	0	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	0.400
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	19.800	Cv (Winter)	0.840

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

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 0, 0

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S1.000	S1	15 Winter	100	+0%	30/15 Summer				9.295
S1.001	S2	15 Winter	100	+0%	30/15 Summer				9.130

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S1	0.195	0.000	1.61		9.5	SURCHARGED	
S1.001	S2	0.093	0.000	1.59		9.4	SURCHARGED	

Summary of Results for 1 year Return Period

Half Drain Time : 13 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	9.216	0.046	0.0	1.3	1.3	1.2	O K
30 min Summer	9.222	0.052	0.0	1.3	1.3	1.6	O K
60 min Summer	9.225	0.055	0.0	1.3	1.3	1.8	O K
120 min Summer	9.220	0.050	0.0	1.3	1.3	1.5	O K
180 min Summer	9.212	0.042	0.0	1.3	1.3	1.1	O K
240 min Summer	9.204	0.034	0.0	1.2	1.2	0.7	O K
360 min Summer	9.190	0.020	0.0	1.2	1.2	0.3	O K
480 min Summer	9.178	0.008	0.0	1.1	1.1	0.0	O K
600 min Summer	9.170	0.000	0.0	1.0	1.0	0.0	O K
720 min Summer	9.170	0.000	0.0	0.9	0.9	0.0	O K
960 min Summer	9.170	0.000	0.0	0.7	0.7	0.0	O K
1440 min Summer	9.170	0.000	0.0	0.5	0.5	0.0	O K
2160 min Summer	9.170	0.000	0.0	0.4	0.4	0.0	O K
2880 min Summer	9.170	0.000	0.0	0.3	0.3	0.0	O K
4320 min Summer	9.170	0.000	0.0	0.2	0.2	0.0	O K
5760 min Summer	9.170	0.000	0.0	0.2	0.2	0.0	O K
7200 min Summer	9.170	0.000	0.0	0.2	0.2	0.0	O K
8640 min Summer	9.170	0.000	0.0	0.1	0.1	0.0	O K
10080 min Summer	9.170	0.000	0.0	0.1	0.1	0.0	O K
15 min Winter	9.221	0.051	0.0	1.3	1.3	1.5	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	41.398	0.0	1.9	15
30 min Summer	27.391	0.0	2.8	24
60 min Summer	17.456	0.0	3.8	42
120 min Summer	10.848	0.0	5.0	74
180 min Summer	8.118	0.0	5.7	106
240 min Summer	6.600	0.0	6.3	136
360 min Summer	4.925	0.0	7.1	192
480 min Summer	4.000	0.0	7.7	248
600 min Summer	3.404	0.0	8.2	0
720 min Summer	2.984	0.0	8.7	0
960 min Summer	2.419	0.0	9.4	0
1440 min Summer	1.801	0.0	10.5	0
2160 min Summer	1.341	0.0	11.6	0
2880 min Summer	1.089	0.0	12.4	0
4320 min Summer	0.811	0.0	13.5	0
5760 min Summer	0.655	0.0	14.2	0
7200 min Summer	0.556	0.0	14.7	0
8640 min Summer	0.486	0.0	15.0	0
10080 min Summer	0.434	0.0	15.2	0
15 min Winter	41.398	0.0	2.2	15

Summary of Results for 1 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
30 min Winter	9.227	0.057	0.0	1.3	1.3	1.9	O K
60 min Winter	9.229	0.059	0.0	1.3	1.3	2.0	O K
120 min Winter	9.219	0.049	0.0	1.3	1.3	1.4	O K
180 min Winter	9.207	0.037	0.0	1.2	1.2	0.8	O K
240 min Winter	9.194	0.024	0.0	1.2	1.2	0.3	O K
360 min Winter	9.170	0.000	0.0	1.1	1.1	0.0	O K
480 min Winter	9.170	0.000	0.0	0.9	0.9	0.0	O K
600 min Winter	9.170	0.000	0.0	0.7	0.7	0.0	O K
720 min Winter	9.170	0.000	0.0	0.6	0.6	0.0	O K
960 min Winter	9.170	0.000	0.0	0.5	0.5	0.0	O K
1440 min Winter	9.170	0.000	0.0	0.4	0.4	0.0	O K
2160 min Winter	9.170	0.000	0.0	0.3	0.3	0.0	O K
2880 min Winter	9.170	0.000	0.0	0.2	0.2	0.0	O K
4320 min Winter	9.170	0.000	0.0	0.2	0.2	0.0	O K
5760 min Winter	9.170	0.000	0.0	0.1	0.1	0.0	O K
7200 min Winter	9.170	0.000	0.0	0.1	0.1	0.0	O K
8640 min Winter	9.170	0.000	0.0	0.1	0.1	0.0	O K
10080 min Winter	9.170	0.000	0.0	0.1	0.1	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
30 min Winter	27.391	0.0	3.2	26
60 min Winter	17.456	0.0	4.5	44
120 min Winter	10.848	0.0	5.8	80
180 min Winter	8.118	0.0	6.6	110
240 min Winter	6.600	0.0	7.2	138
360 min Winter	4.925	0.0	8.1	0
480 min Winter	4.000	0.0	8.8	0
600 min Winter	3.404	0.0	9.4	0
720 min Winter	2.984	0.0	9.9	0
960 min Winter	2.419	0.0	10.7	0
1440 min Winter	1.801	0.0	11.9	0
2160 min Winter	1.341	0.0	13.2	0
2880 min Winter	1.089	0.0	14.1	0
4320 min Winter	0.811	0.0	15.5	0
5760 min Winter	0.655	0.0	16.3	0
7200 min Winter	0.556	0.0	16.9	0
8640 min Winter	0.486	0.0	17.4	0
10080 min Winter	0.434	0.0	17.7	0

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	1	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	26.250	Shortest Storm (mins)	15
Ratio R	0.400	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 0.037

Time (mins) From:	To:	Area (ha)
0	4	0.037

Model Details

Storage is Online Cover Level (m) 9.650

Porous Car Park Structure

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	8.0
Membrane Percolation (mm/hr)	1000	Length (m)	24.0
Max Percolation (l/s)	53.3	Slope (1:X)	500.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	9.170	Membrane Depth (m)	0

Orifice Outflow Control

Diameter (m) 0.037 Discharge Coefficient 0.600 Invert Level (m) 9.000

Summary of Results for 30 year Return Period

Half Drain Time : 51 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	9.282	0.112	0.0	1.5	1.5	5.1	O K
30 min Summer	9.301	0.131	0.0	1.5	1.5	6.2	O K
60 min Summer	9.306	0.136	0.0	1.5	1.5	6.5	O K
120 min Summer	9.298	0.128	0.0	1.5	1.5	6.0	O K
180 min Summer	9.287	0.117	0.0	1.5	1.5	5.4	O K
240 min Summer	9.276	0.106	0.0	1.5	1.5	4.7	O K
360 min Summer	9.257	0.087	0.0	1.4	1.4	3.6	O K
480 min Summer	9.240	0.070	0.0	1.3	1.3	2.7	O K
600 min Summer	9.227	0.057	0.0	1.3	1.3	1.9	O K
720 min Summer	9.216	0.046	0.0	1.3	1.3	1.3	O K
960 min Summer	9.198	0.028	0.0	1.2	1.2	0.5	O K
1440 min Summer	9.170	0.000	0.0	1.0	1.0	0.0	O K
2160 min Summer	9.170	0.000	0.0	0.7	0.7	0.0	O K
2880 min Summer	9.170	0.000	0.0	0.6	0.6	0.0	O K
4320 min Summer	9.170	0.000	0.0	0.4	0.4	0.0	O K
5760 min Summer	9.170	0.000	0.0	0.3	0.3	0.0	O K
7200 min Summer	9.170	0.000	0.0	0.3	0.3	0.0	O K
8640 min Summer	9.170	0.000	0.0	0.2	0.2	0.0	O K
10080 min Summer	9.170	0.000	0.0	0.2	0.2	0.0	O K
15 min Winter	9.296	0.126	0.0	1.5	1.5	5.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	101.239	0.0	6.1	17
30 min Summer	65.473	0.0	8.1	31
60 min Summer	40.257	0.0	10.2	48
120 min Summer	23.937	0.0	12.3	82
180 min Summer	17.563	0.0	13.6	116
240 min Summer	14.070	0.0	14.6	150
360 min Summer	10.271	0.0	16.0	214
480 min Summer	8.204	0.0	17.1	276
600 min Summer	6.888	0.0	17.9	336
720 min Summer	5.969	0.0	18.6	392
960 min Summer	4.758	0.0	19.8	504
1440 min Summer	3.453	0.0	21.5	0
2160 min Summer	2.503	0.0	23.2	0
2880 min Summer	1.990	0.0	24.4	0
4320 min Summer	1.441	0.0	26.1	0
5760 min Summer	1.146	0.0	27.3	0
7200 min Summer	0.960	0.0	28.1	0
8640 min Summer	0.830	0.0	28.8	0
10080 min Summer	0.735	0.0	29.3	0
15 min Winter	101.239	0.0	6.9	17

Summary of Results for 30 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Outflow (l/s)	Max Volume (m³)	Status
30 min Winter	9.319	0.149	0.0	1.6	1.6	7.2	O K
60 min Winter	9.326	0.156	0.0	1.6	1.6	7.6	O K
120 min Winter	9.313	0.143	0.0	1.6	1.6	6.9	O K
180 min Winter	9.297	0.127	0.0	1.5	1.5	5.9	O K
240 min Winter	9.281	0.111	0.0	1.5	1.5	5.0	O K
360 min Winter	9.252	0.082	0.0	1.4	1.4	3.3	O K
480 min Winter	9.228	0.058	0.0	1.3	1.3	2.0	O K
600 min Winter	9.211	0.041	0.0	1.3	1.3	1.0	O K
720 min Winter	9.194	0.024	0.0	1.2	1.2	0.3	O K
960 min Winter	9.170	0.000	0.0	1.0	1.0	0.0	O K
1440 min Winter	9.170	0.000	0.0	0.7	0.7	0.0	O K
2160 min Winter	9.170	0.000	0.0	0.5	0.5	0.0	O K
2880 min Winter	9.170	0.000	0.0	0.4	0.4	0.0	O K
4320 min Winter	9.170	0.000	0.0	0.3	0.3	0.0	O K
5760 min Winter	9.170	0.000	0.0	0.2	0.2	0.0	O K
7200 min Winter	9.170	0.000	0.0	0.2	0.2	0.0	O K
8640 min Winter	9.170	0.000	0.0	0.2	0.2	0.0	O K
10080 min Winter	9.170	0.000	0.0	0.2	0.2	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
30 min Winter	65.473	0.0	9.2	31
60 min Winter	40.257	0.0	11.5	52
120 min Winter	23.937	0.0	13.8	90
180 min Winter	17.563	0.0	15.3	126
240 min Winter	14.070	0.0	16.5	162
360 min Winter	10.271	0.0	18.0	228
480 min Winter	8.204	0.0	19.3	288
600 min Winter	6.888	0.0	20.2	344
720 min Winter	5.969	0.0	21.0	392
960 min Winter	4.758	0.0	22.3	0
1440 min Winter	3.453	0.0	24.2	0
2160 min Winter	2.503	0.0	26.2	0
2880 min Winter	1.990	0.0	27.6	0
4320 min Winter	1.441	0.0	29.6	0
5760 min Winter	1.146	0.0	31.0	0
7200 min Winter	0.960	0.0	32.0	0
8640 min Winter	0.830	0.0	32.8	0
10080 min Winter	0.735	0.0	33.4	0

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	30	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	26.250	Shortest Storm (mins)	15
Ratio R	0.400	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 0.037

Time (mins) From:	To:	Area (ha)
0	4	0.037

Model Details

Storage is Online Cover Level (m) 9.650

Porous Car Park Structure

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	8.0
Membrane Percolation (mm/hr)	1000	Length (m)	24.0
Max Percolation (l/s)	53.3	Slope (1:X)	500.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	9.170	Membrane Depth (m)	0

Orifice Outflow Control

Diameter (m) 0.037 Discharge Coefficient 0.600 Invert Level (m) 9.000

North Kiln Felaw Maltings 46 Felaw Street Ipswich IP2 8PN	Permeable Paving St Georges Terrace
Date 19/12/19 File 6101045-MLM-ZZ-XX-CA-	Designed by DKent Checked by
XP Solutions	Source Control 2017.1.2

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

Half Drain Time : 93 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	9.379	0.209	0.0	1.7	1.7	10.6	Flood Risk
30 min Summer	9.424	0.254	0.0	1.8	1.8	13.3	Flood Risk
60 min Summer	9.445	0.275	0.0	1.9	1.9	14.5	Flood Risk
120 min Summer	9.437	0.267	0.0	1.8	1.8	14.0	Flood Risk
180 min Summer	9.422	0.252	0.0	1.8	1.8	13.1	Flood Risk
240 min Summer	9.407	0.237	0.0	1.8	1.8	12.3	Flood Risk
360 min Summer	9.381	0.211	0.0	1.7	1.7	10.8	Flood Risk
480 min Summer	9.356	0.186	0.0	1.7	1.7	9.4	Flood Risk
600 min Summer	9.334	0.164	0.0	1.6	1.6	8.1	O K
720 min Summer	9.314	0.144	0.0	1.6	1.6	6.9	O K
960 min Summer	9.281	0.111	0.0	1.5	1.5	5.0	O K
1440 min Summer	9.235	0.065	0.0	1.3	1.3	2.3	O K
2160 min Summer	9.194	0.024	0.0	1.2	1.2	0.4	O K
2880 min Summer	9.170	0.000	0.0	1.0	1.0	0.0	O K
4320 min Summer	9.170	0.000	0.0	0.7	0.7	0.0	O K
5760 min Summer	9.170	0.000	0.0	0.6	0.6	0.0	O K
7200 min Summer	9.170	0.000	0.0	0.5	0.5	0.0	O K
8640 min Summer	9.170	0.000	0.0	0.4	0.4	0.0	O K
10080 min Summer	9.170	0.000	0.0	0.4	0.4	0.0	O K
15 min Winter	9.405	0.235	0.0	1.8	1.8	12.2	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	185.630	0.0	11.9	18
30 min Summer	120.567	0.0	15.7	32
60 min Summer	73.889	0.0	19.5	60
120 min Summer	43.472	0.0	23.1	90
180 min Summer	31.706	0.0	25.4	124
240 min Summer	25.287	0.0	27.0	158
360 min Summer	18.336	0.0	29.4	228
480 min Summer	14.573	0.0	31.2	294
600 min Summer	12.186	0.0	32.6	358
720 min Summer	10.523	0.0	33.8	420
960 min Summer	8.342	0.0	35.7	542
1440 min Summer	6.003	0.0	38.5	780
2160 min Summer	4.312	0.0	41.2	1108
2880 min Summer	3.407	0.0	43.3	0
4320 min Summer	2.442	0.0	46.1	0
5760 min Summer	1.930	0.0	48.2	0
7200 min Summer	1.609	0.0	49.7	0
8640 min Summer	1.386	0.0	51.0	0
10080 min Summer	1.222	0.0	52.0	0
15 min Winter	185.630	0.0	13.4	18

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

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
30 min Winter	9.458	0.288	0.0	1.9	1.9	15.2	Flood Risk
60 min Winter	9.486	0.316	0.0	2.0	2.0	16.8	Flood Risk
120 min Winter	9.477	0.307	0.0	1.9	1.9	16.3	Flood Risk
180 min Winter	9.458	0.288	0.0	1.9	1.9	15.2	Flood Risk
240 min Winter	9.437	0.267	0.0	1.8	1.8	14.0	Flood Risk
360 min Winter	9.397	0.227	0.0	1.8	1.8	11.7	Flood Risk
480 min Winter	9.361	0.191	0.0	1.7	1.7	9.6	Flood Risk
600 min Winter	9.329	0.159	0.0	1.6	1.6	7.8	O K
720 min Winter	9.302	0.132	0.0	1.5	1.5	6.2	O K
960 min Winter	9.257	0.087	0.0	1.4	1.4	3.6	O K
1440 min Winter	9.201	0.031	0.0	1.2	1.2	0.6	O K
2160 min Winter	9.170	0.000	0.0	0.9	0.9	0.0	O K
2880 min Winter	9.170	0.000	0.0	0.7	0.7	0.0	O K
4320 min Winter	9.170	0.000	0.0	0.5	0.5	0.0	O K
5760 min Winter	9.170	0.000	0.0	0.4	0.4	0.0	O K
7200 min Winter	9.170	0.000	0.0	0.3	0.3	0.0	O K
8640 min Winter	9.170	0.000	0.0	0.3	0.3	0.0	O K
10080 min Winter	9.170	0.000	0.0	0.3	0.3	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
30 min Winter	120.567	0.0	17.7	31
60 min Winter	73.889	0.0	21.9	60
120 min Winter	43.472	0.0	26.0	96
180 min Winter	31.706	0.0	28.5	134
240 min Winter	25.287	0.0	30.4	172
360 min Winter	18.336	0.0	33.1	246
480 min Winter	14.573	0.0	35.1	314
600 min Winter	12.186	0.0	36.7	380
720 min Winter	10.523	0.0	38.0	444
960 min Winter	8.342	0.0	40.1	568
1440 min Winter	6.003	0.0	43.3	778
2160 min Winter	4.312	0.0	46.4	0
2880 min Winter	3.407	0.0	48.7	0
4320 min Winter	2.442	0.0	52.0	0
5760 min Winter	1.930	0.0	54.3	0
7200 min Winter	1.609	0.0	56.2	0
8640 min Winter	1.386	0.0	57.7	0
10080 min Winter	1.222	0.0	58.9	0

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	26.250	Shortest Storm (mins)	15
Ratio R	0.400	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.037

Time (mins) From:	To:	Area (ha)
0	4	0.037

Model Details

Storage is Online Cover Level (m) 9.650

Porous Car Park Structure

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	8.0
Membrane Percolation (mm/hr)	1000	Length (m)	24.0
Max Percolation (l/s)	53.3	Slope (1:X)	500.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	9.170	Membrane Depth (m)	0

Orifice Outflow Control

Diameter (m) 0.037 Discharge Coefficient 0.600 Invert Level (m) 9.000

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