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Residential Development:
Hayfield Road,
New Mills

SURFACE WATER DRAINAGE CALCULATIONS

LJ/C18756

May 2016



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Design Brief

The following calculations provide designs for the proposed storm water drainage for the above new development.

Percolation testing was carried out across the site, in the form of 3No. test pits, SA1, SA2 & SA3. Satisfactory infiltration rates were established for SA1 & SA3.

The soakaway has therefore been designed using the infiltration rate for SA1 (3.77×10^{-4} m/s i.e. 1.357m/hr and a F.O.S. of 3.0 for the 100 year event incorporating a 30% increase for climate change), which is located in closest proximity.

Soakaway design is in accordance with BRE Digest 365 – `Soakway Design` and CIRIA Report 156 Infiltration Drainage – `Manual of good practice`.

As outlined in the storm water summary (pages 9-10), there is no flooding for the 100 year event (including 30% climate change).

Specification Notes

These calculations are to be read in conjunction with the latest revision of Atkinson Peck Ltd drawing number C18756/101.

References

BS EN 12056:2000 – Gravity Drainage
BS EN 752:1996 – Drain & Sewer Systems
Tables for the Hydraulic Design of Pipes – Hydraulic Research Station
BRE Digest 365 – Soakway Design
CIRIA Report 156 Infiltration Drainage – Manual of good practice

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Existing Network Details for Storm

* - Indicates pipe has been modified outside of System 1

	PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	k (mm)	HYD SECT	DIA (mm)
*	1.000	6.800	0.070	97.1	0.017	5.00	0.600	o	150
*	1.001	25.000	0.250	100.0	0.011	0.00	0.600	o	150
*	2.000	23.150	0.230	100.7	0.023	5.00	0.600	o	150
*	3.000	12.000	0.155	77.4	0.020	5.00	0.600	o	150
*	2.001	10.900	0.250	43.6	0.000	0.00	0.600	o	150
*	4.000	15.700	0.480	32.7	0.008	5.00	0.600	o	150
*	1.002	5.400	1.745	3.1	0.000	0.00	0.600	o	150
*	1.003	3.900	0.040	97.5	0.000	0.00	0.600	o	150
*	1.004	5.000	0.050	100.0	0.000	0.00	0.600	o	150

	PN	US/MH Name	US/CL (m)	US/IL (m)	US C.Depth (m)	DS/CL (m)	DS/IL (m)	DS C.Depth (m)	Ctrl	US/MH (mm)
*	1.000	S01	100.000	99.165	0.685	100.000	99.095	0.755		475
*	1.001	S02	100.000	99.095	0.755	100.000	98.845	1.005		475
*	2.000	S03	100.000	99.400	0.450	100.000	99.170	0.680		300
*	3.000	S04	100.000	99.400	0.450	100.000	99.245	0.605		300
*	2.001	S05	100.000	99.170	0.680	100.000	98.920	0.930		475
*	4.000	S06	100.000	99.400	0.450	100.000	98.920	0.930		300
*	1.002	S07	100.000	98.845	1.005	100.000	97.100	2.750		475
*	1.003	CP1	100.000	97.100	2.750	100.000	97.060	2.790		2400
*	1.004	SA1	100.000	96.700	3.150	100.000	96.650	3.200	Weir	1

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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)
S01	100.000	0.835	Open Manhole	475	1.000	99.165	150				
S02	100.000	0.905	Open Manhole	475	1.001	99.095	150	1.000	99.095	150	
S03	100.000	0.600	Open Manhole	300	2.000	99.400	150				
S04	100.000	0.600	Open Manhole	300	3.000	99.400	150				
S05	100.000	0.830	Open Manhole	475	2.001	99.170	150	2.000	99.170	150	
								3.000	99.245	150	75
S06	100.000	0.600	Open Manhole	300	4.000	99.400	150				
S07	100.000	1.155	Open Manhole	475	1.002	98.845	150	1.001	98.845	150	
								2.001	98.920	150	75
								4.000	98.920	150	75
CP1	100.000	2.900	Open Manhole	2400	1.003	97.100	150	1.002	97.100	150	
SA1	100.000	3.300	Open Manhole	1	1.004	96.700	150	1.003	97.060	150	360
Dummy	100.000	3.350	Open Manhole	1		OUTFALL		1.004	96.650	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	S01	100.000	99.165	0.685	Open Manhole		475
1.001	o	150	S02	100.000	99.095	0.755	Open Manhole		475
2.000	o	150	S03	100.000	99.400	0.450	Open Manhole		300
3.000	o	150	S04	100.000	99.400	0.450	Open Manhole		300
2.001	o	150	S05	100.000	99.170	0.680	Open Manhole		475
4.000	o	150	S06	100.000	99.400	0.450	Open Manhole		300
1.002	o	150	S07	100.000	98.845	1.005	Open Manhole		475
1.003	o	150	CP1	100.000	97.100	2.750	Open Manhole		2400
1.004	o	150	SA1	100.000	96.700	3.150	Open Manhole		1

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	6.800	97.1	S02	100.000	99.095	0.755	Open Manhole		475
1.001	25.000	100.0	S07	100.000	98.845	1.005	Open Manhole		475
2.000	23.150	100.7	S05	100.000	99.170	0.680	Open Manhole		475
3.000	12.000	77.4	S05	100.000	99.245	0.605	Open Manhole		475
2.001	10.900	43.6	S07	100.000	98.920	0.930	Open Manhole		475
4.000	15.700	32.7	S07	100.000	98.920	0.930	Open Manhole		475
1.002	5.400	3.1	CP1	100.000	97.100	2.750	Open Manhole		2400
1.003	3.900	97.5	SA1	100.000	97.060	2.790	Open Manhole		1
1.004	5.000	100.0	Dummy	100.000	96.650	3.200	Open Manhole		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)
1.004	Dummy	100.000	96.650	96.650	1	0

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Micro Drainage		Network 2015.1
<u>Simulation Criteria for Storm</u> Volumetric Runoff Coeff 0.750 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) 200 Foul Sewage per hectare (l/s) 0.000 Output Interval (mins) 3 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 <u>Synthetic Rainfall Details</u> Rainfall Model FSR Profile Type Summer Return Period (years) 100 Cv (Summer) 0.750 Region England and Wales Cv (Winter) 0.840 M5-60 (mm) 18.000 Storm Duration (mins) 100 Ratio R 0.334		
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Online Controls for Storm Weir Manhole: SA1, DS/PN: 1.004, Volume (m³): 0.0 Discharge Coef 0.544 Width (m) 0.001 Invert Level (m) 99.999		
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Storage Structures for Storm

Lined Soakaway Manhole: SA1, DS/PN: 1.004

Infiltration Coefficient Base (m/hr)	0.00000	Ring Diameter (m)	2.40
Infiltration Coefficient Side (m/hr)	1.35700	Pit Multiplier	1.8
Safety Factor	3.0	Number Required	1
Porosity	0.30	Cap Volume Depth (m)	2.500
Invert Level (m)	96.700	Cap Infiltration Depth (m)	1.250

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10 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	0.334
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	18.000	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	OFF

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)	10, 100
Climate Change (%)	30, 30

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	S01	15 Winter	10	+30%					99.224
1.001	S02	15 Winter	10	+30%					99.171
2.000	S03	15 Winter	10	+30%					99.467
3.000	S04	15 Winter	10	+30%					99.459
2.001	S05	15 Winter	10	+30%					99.248
4.000	S06	15 Winter	10	+30%					99.429
1.002	S07	15 Winter	10	+30%	100/60 Winter				98.900
1.003	CP1	120 Winter	10	+30%	10/15 Summer				97.918
1.004	SA1	120 Winter	10	+30%	10/15 Summer				97.913

Surcharged					Flooded		Pipe	
PN	US/MH Name	Depth (m)	Volume (m³)	Flow / Cap.	Overflow (l/s)	Flow (l/s)	Status	Level Exceeded
1.000	S01	-0.091	0.000	0.33		5.0	OK	
1.001	S02	-0.074	0.000	0.49		8.3	OK	

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

PN	US/MH Name	Surcharged Flooded		Flow / Overflow Cap. (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
		Depth (m)	Volume (m ³)				
2.000	S03	-0.083	0.000	0.40	6.7	OK	
3.000	S04	-0.091	0.000	0.32	5.9	OK	
2.001	S05	-0.072	0.000	0.52	12.5	OK	
4.000	S06	-0.121	0.000	0.08	2.4	OK	
1.002	S07	-0.095	0.000	0.28	23.2	OK	
1.003	CP1	0.668	0.000	0.47	5.9	SURCHARGED	
1.004	SA1	1.063	0.000	0.00	0.0	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 * 10m ³ /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	0.334
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	18.000	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	OFF

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)	10, 100
Climate Change (%)	30, 30

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	S01	15 Winter	100	+30%					99.244
1.001	S02	120 Winter	100	+30%					99.202
2.000	S03	15 Winter	100	+30%					99.490
3.000	S04	15 Winter	100	+30%					99.478
2.001	S05	15 Winter	100	+30%					99.278
4.000	S06	15 Winter	100	+30%					99.436
1.002	S07	120 Winter	100	+30%	100/60 Winter				99.197
1.003	CP1	120 Winter	100	+30%	10/15 Summer				99.191
1.004	SA1	120 Winter	100	+30%	10/15 Summer				99.187

Surcharged Flooded					Pipe			
PN	US/MH Name	Depth (m)	Volume (m ³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	S01	-0.071	0.000	0.54		8.2	OK	
1.001	S02	-0.043	0.000	0.29		4.8	OK	

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

PN	US/MH Name	Surcharged Flooded		Flow / Overflow		Pipe Flow	Status	Level Exceeded
		Depth (m)	Volume (m ³)	Cap.	(l/s)	(l/s)		
2.000	S03	-0.060	0.000	0.65		10.9	OK	
3.000	S04	-0.072	0.000	0.53		9.6	OK	
2.001	S05	-0.042	0.000	0.84		20.4	OK	
4.000	S06	-0.114	0.000	0.13		3.9	OK	
1.002	S07	0.202	0.000	0.17		13.7	SURCHARGED	
1.003	CP1	1.941	0.000	0.78		9.7	SURCHARGED	
1.004	SA1	2.337	0.000	0.00		0.0	SURCHARGED	

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Summary of Results for 10 year Return Period (+30%)

Half Drain Time : 53 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Overflow (l/s)	Max Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	97.427	0.727	1.6	0.0	0.0	1.6	6.4	O K
30 min Summer	97.669	0.969	2.1	0.0	0.0	2.1	8.5	O K
60 min Summer	97.871	1.171	2.5	0.0	0.0	2.5	10.3	O K
120 min Summer	97.979	1.279	2.7	0.0	0.0	2.7	11.1	O K
180 min Summer	98.001	1.301	2.7	0.0	0.0	2.7	11.2	O K
240 min Summer	97.953	1.253	2.7	0.0	0.0	2.7	11.0	O K
360 min Summer	97.875	1.175	2.6	0.0	0.0	2.6	10.3	O K
480 min Summer	97.795	1.095	2.4	0.0	0.0	2.4	9.6	O K
600 min Summer	97.725	1.025	2.2	0.0	0.0	2.2	9.0	O K
720 min Summer	97.660	0.960	2.1	0.0	0.0	2.1	8.4	O K
960 min Summer	97.556	0.856	1.9	0.0	0.0	1.9	7.5	O K
1440 min Summer	97.409	0.709	1.5	0.0	0.0	1.5	6.2	O K
2160 min Summer	97.270	0.570	1.2	0.0	0.0	1.2	5.0	O K
2880 min Summer	97.182	0.482	1.0	0.0	0.0	1.0	4.2	O K
4320 min Summer	97.074	0.374	0.8	0.0	0.0	0.8	3.3	O K
5760 min Summer	97.010	0.310	0.7	0.0	0.0	0.7	2.7	O K
7200 min Summer	96.967	0.267	0.6	0.0	0.0	0.6	2.3	O K
8640 min Summer	96.935	0.235	0.5	0.0	0.0	0.5	2.1	O K
10080 min Summer	96.911	0.211	0.5	0.0	0.0	0.5	1.9	O K
15 min Winter	97.521	0.821	1.8	0.0	0.0	1.8	7.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
15 min Summer	65.936	0.0	9.8	0.0	38
30 min Summer	43.837	0.0	13.0	0.0	46
60 min Summer	28.050	0.0	16.6	0.0	66
120 min Summer	17.525	0.0	20.8	0.0	98
180 min Summer	13.206	0.0	23.5	0.0	130
240 min Summer	10.772	0.0	25.5	0.0	162
360 min Summer	8.059	0.0	28.6	0.0	226
480 min Summer	6.556	0.0	31.1	0.0	290
600 min Summer	5.584	0.0	33.1	0.0	352
720 min Summer	4.896	0.0	34.8	0.0	414
960 min Summer	3.977	0.0	37.7	0.0	538
1440 min Summer	2.965	0.0	42.1	0.0	780
2160 min Summer	2.208	0.0	47.1	0.0	1148
2880 min Summer	1.791	0.0	50.9	0.0	1500
4320 min Summer	1.332	0.0	56.8	0.0	2232
5760 min Summer	1.079	0.0	61.4	0.0	2952
7200 min Summer	0.917	0.0	65.2	0.0	3680
8640 min Summer	0.802	0.0	68.4	0.0	4432
10080 min Summer	0.717	0.0	71.3	0.0	5144
15 min Winter	65.936	0.0	10.9	0.0	37

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Summary of Results for 10 year Return Period (+30%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Overflow (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
30 min Winter	97.795	1.095	2.4	0.0	0.0	2.4	9.6	O K
60 min Winter	98.094	1.394	2.7	0.0	0.0	2.7	11.6	O K
120 min Winter	98.281	1.581	2.7	0.0	0.0	2.7	12.5	O K
180 min Winter	98.226	1.526	2.7	0.0	0.0	2.7	12.2	O K
240 min Winter	98.085	1.385	2.7	0.0	0.0	2.7	11.6	O K
360 min Winter	97.876	1.176	2.6	0.0	0.0	2.6	10.3	O K
480 min Winter	97.759	1.059	2.3	0.0	0.0	2.3	9.3	O K
600 min Winter	97.661	0.961	2.1	0.0	0.0	2.1	8.4	O K
720 min Winter	97.580	0.880	1.9	0.0	0.0	1.9	7.7	O K
960 min Winter	97.455	0.755	1.6	0.0	0.0	1.6	6.6	O K
1440 min Winter	97.294	0.594	1.3	0.0	0.0	1.3	5.2	O K
2160 min Winter	97.156	0.456	1.0	0.0	0.0	1.0	4.0	O K
2880 min Winter	97.075	0.375	0.8	0.0	0.0	0.8	3.3	O K
4320 min Winter	96.983	0.283	0.6	0.0	0.0	0.6	2.5	O K
5760 min Winter	96.931	0.231	0.5	0.0	0.0	0.5	2.0	O K
7200 min Winter	96.896	0.196	0.4	0.0	0.0	0.4	1.7	O K
8640 min Winter	96.872	0.172	0.4	0.0	0.0	0.4	1.5	O K
10080 min Winter	96.854	0.154	0.3	0.0	0.0	0.3	1.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Overflow Volume (m³)	Time-Peak (mins)
30 min Winter	43.837	0.0	14.5	0.0	46
60 min Winter	28.050	0.0	18.6	0.0	66
120 min Winter	17.525	0.0	23.3	0.0	102
180 min Winter	13.206	0.0	26.3	0.0	138
240 min Winter	10.772	0.0	28.6	0.0	172
360 min Winter	8.059	0.0	32.1	0.0	236
480 min Winter	6.556	0.0	34.8	0.0	302
600 min Winter	5.584	0.0	37.0	0.0	366
720 min Winter	4.896	0.0	39.0	0.0	426
960 min Winter	3.977	0.0	42.2	0.0	554
1440 min Winter	2.965	0.0	47.2	0.0	800
2160 min Winter	2.208	0.0	52.7	0.0	1172
2880 min Winter	1.791	0.0	57.0	0.0	1544
4320 min Winter	1.332	0.0	63.6	0.0	2272
5760 min Winter	1.079	0.0	68.7	0.0	2952
7200 min Winter	0.917	0.0	73.0	0.0	3656
8640 min Winter	0.802	0.0	76.7	0.0	4384
10080 min Winter	0.717	0.0	79.9	0.0	5152