



CIVIL +
STRUCTURAL
ENGINEERS

JP Structural Design Ltd
Regus House
Chester Business Park
CH4 9QR

File: RUABON.PFD
Network: Storm Network 1
Russell Hardy
18/03/2021

Page 1
Wynnstay Park
Residential Development
Ruabon

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	100	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	40	Minimum Velocity (m/s)	1.00
FSR Region	England and Wales	Connection Type	Level Soffits
M5-60 (mm)	17.000	Minimum Backdrop Height (m)	0.200
Ratio-R	0.300	Preferred Cover Depth (m)	1.200
CV	0.500	Include Intermediate Ground	✓
Time of Entry (mins)	4.00	Enforce best practice design rules	✓

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
1	0.035	4.00	125.388	1200	329146.210	343607.899	1.288
2	0.035	4.00	125.386	1200	329154.824	343611.465	1.414
3			125.377	1200	329169.585	343615.560	1.533
4	0.023	4.00	125.670	1200	329209.341	343618.821	0.970
5	0.040	4.00	125.466	1200	329192.452	343617.182	0.986
6			125.300	1200	329181.914	343616.409	1.634
7	0.035	4.00	124.846	1200	329184.838	343595.248	1.306
8	0.036	4.00	124.531	1200	329189.356	343575.227	1.112
9	0.029	4.00	124.861	1200	329221.079	343573.393	1.111
10	0.049	4.00	124.327	1200	329196.078	343566.567	0.836
11	0.029	4.00	124.384	1350	329191.812	343565.373	1.502
12	0.024	4.00	123.917	1350	329197.529	343537.621	1.389
13	0.048	4.00	125.940	1200	329218.507	343627.681	1.040
14	0.024	4.00	125.794	1200	329219.848	343622.273	0.950
15	0.029	4.00	125.653	1200	329223.322	343610.311	0.934
16	0.025	4.00	125.344	1200	329228.289	343590.031	0.909
17	0.032	4.00	125.133	1200	329231.506	343576.020	0.938
18			124.700	1200	329239.307	343550.085	0.956
19	0.029	4.00	124.000		329211.497	343527.531	2.000
20	0.030	4.00	124.516	1200	329258.396	343541.062	1.016
21	0.040	4.00	124.382	1200	329261.382	343530.669	1.040
22			123.493	1350	329213.839	343518.843	1.520
23		4.00	123.585	1200	329178.246	343533.013	1.300
24	0.041	4.00	123.500	1350	329183.745	343511.036	1.991
25			122.609	1350	329189.457	343486.953	1.348
25_OUT			121.490	1350	329170.771	343483.199	0.991

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.000	1	2	9.323	0.600	124.100	124.022	0.078	120.0	100	4.22	50.0
1.001	2	3	15.318	0.600	123.972	123.844	0.128	120.0	150	4.50	50.0
1.002	3	6	12.358	0.600	123.844	123.741	0.103	120.0	150	4.73	50.0
2.000	4	5	16.968	0.600	124.700	124.530	0.170	100.0	100	4.37	50.0
2.001	5	6	10.566	0.600	124.480	124.374	0.106	100.0	150	4.54	50.0
1.003	6	7	21.362	0.600	123.666	123.540	0.126	170.0	225	5.08	50.0
1.004	7	8	20.524	0.600	123.540	123.419	0.121	170.0	225	5.42	50.0
1.005	8	11	10.155	0.600	123.419	123.359	0.060	170.0	225	5.59	50.0
3.000	9	10	25.916	0.600	123.750	123.491	0.259	100.0	150	4.43	50.0
3.001	10	11	4.430	0.600	123.491	123.107	0.384	11.5	150	4.45	50.0
1.006	11	12	28.335	0.600	122.882	122.528	0.354	80.0	375	5.83	50.0
1.007	12	19	17.231	0.600	122.528	122.474	0.054	319.1	375	6.11	50.0
4.000	13	14	5.572	0.600	124.900	124.844	0.056	100.0	150	4.09	50.0
4.001	14	15	12.456	0.600	124.844	124.719	0.125	100.0	150	4.30	50.0
4.002	15	16	20.879	0.600	124.719	124.510	0.209	100.0	150	4.65	50.0
4.003	16	17	14.376	0.600	124.435	124.195	0.240	60.0	225	4.79	50.0
4.004	17	18	27.083	0.600	124.195	123.744	0.451	60.0	225	5.05	50.0
4.005	18	19	35.806	0.600	123.744	122.000	1.744	20.5	225	5.26	50.0
1.008	19	22	8.998	0.600	122.000	121.973	0.027	330.0	375	6.26	50.0
5.000	20	21	10.813	0.600	123.500	123.392	0.108	100.0	100	4.23	50.0
5.001	21	22	48.992	0.600	123.342	122.518	0.824	59.5	150	4.86	50.0
1.009	22	24	31.090	0.600	121.973	121.879	0.094	330.0	375	6.78	50.0
6.000	23	24	22.655	0.600	122.285	121.784	0.501	45.2	100	4.33	50.0
1.010	24	25	24.751	0.600	121.509	121.261	0.248	100.0	375	7.01	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.000	0.701	5.5	4.4	1.188	1.264	0.035	0.0	68	0.778
1.001	0.916	16.2	8.9	1.264	1.383	0.070	0.0	79	0.937
1.002	0.916	16.2	8.9	1.383	1.409	0.070	0.0	79	0.937
2.000	0.769	6.0	2.9	0.870	0.836	0.023	0.0	49	0.761
2.001	1.005	17.8	8.0	0.836	0.776	0.063	0.0	71	0.979
1.003	1.000	39.7	16.8	1.409	1.081	0.133	0.0	102	0.960
1.004	1.000	39.7	21.3	1.081	0.887	0.168	0.0	117	1.017
1.005	1.000	39.7	25.8	0.887	0.800	0.204	0.0	132	1.062
3.000	1.005	17.8	3.7	0.961	0.686	0.029	0.0	46	0.791
3.001	2.982	52.7	9.9	0.686	1.127	0.078	0.0	44	2.288
1.006	2.027	223.9	39.3	1.127	1.014	0.311	0.0	106	1.540
1.007	1.009	111.4	42.4	1.014	1.151	0.335	0.0	160	0.942
4.000	1.005	17.8	6.1	0.890	0.800	0.048	0.0	61	0.912
4.001	1.005	17.8	9.1	0.800	0.784	0.072	0.0	76	1.009
4.002	1.005	17.8	12.8	0.784	0.684	0.101	0.0	94	1.091
4.003	1.691	67.2	15.9	0.684	0.713	0.126	0.0	74	1.391
4.004	1.691	67.2	20.0	0.713	0.731	0.158	0.0	84	1.480
4.005	2.900	115.3	20.0	0.731	1.775	0.158	0.0	63	2.183
1.008	0.992	109.5	66.0	1.625	1.145	0.522	0.0	211	1.037
5.000	0.769	6.0	3.8	0.916	0.890	0.030	0.0	57	0.812
5.001	1.307	23.1	8.9	0.890	0.825	0.070	0.0	64	1.219
1.009	0.992	109.5	74.9	1.145	1.246	0.592	0.0	228	1.065
6.000	1.149	9.0	0.0	1.200	1.616	0.000	0.0	0	0.000
1.010	1.812	200.1	80.1	1.616	0.973	0.633	0.0	164	1.713

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.011	25	25_OUT	19.059	0.600	121.261	120.499	0.762	25.0	375	7.10	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.011	3.636	401.6	80.1	0.973	0.616	0.633	0.0	113	2.865

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	9.323	120.0	100	Circular_Default Sewer Type	125.388	124.100	1.188	125.386	124.022	1.264
1.001	15.318	120.0	150	Circular_Default Sewer Type	125.386	123.972	1.264	125.377	123.844	1.383
1.002	12.358	120.0	150	Circular_Default Sewer Type	125.377	123.844	1.383	125.300	123.741	1.409
2.000	16.968	100.0	100	Circular_Default Sewer Type	125.670	124.700	0.870	125.466	124.530	0.836
2.001	10.566	100.0	150	Circular_Default Sewer Type	125.466	124.480	0.836	125.300	124.374	0.776
1.003	21.362	170.0	225	Circular_Default Sewer Type	125.300	123.666	1.409	124.846	123.540	1.081
1.004	20.524	170.0	225	Circular_Default Sewer Type	124.846	123.540	1.081	124.531	123.419	0.887
1.005	10.155	170.0	225	Circular_Default Sewer Type	124.531	123.419	0.887	124.384	123.359	0.800
3.000	25.916	100.0	150	Circular_Default Sewer Type	124.861	123.750	0.961	124.327	123.491	0.686
3.001	4.430	11.5	150	Circular_Default Sewer Type	124.327	123.491	0.686	124.384	123.107	1.127
1.006	28.335	80.0	375	Circular_Default Sewer Type	124.384	122.882	1.127	123.917	122.528	1.014
1.007	17.231	319.1	375	Circular_Default Sewer Type	123.917	122.528	1.014	124.000	122.474	1.151
4.000	5.572	100.0	150	Circular_Default Sewer Type	125.940	124.900	0.890	125.794	124.844	0.800
4.001	12.456	100.0	150	Circular_Default Sewer Type	125.794	124.844	0.800	125.653	124.719	0.784
4.002	20.879	100.0	150	Circular_Default Sewer Type	125.653	124.719	0.784	125.344	124.510	0.684
4.003	14.376	60.0	225	Circular_Default Sewer Type	125.344	124.435	0.684	125.133	124.195	0.713
4.004	27.083	60.0	225	Circular_Default Sewer Type	125.133	124.195	0.713	124.700	123.744	0.731
4.005	35.806	20.5	225	Circular_Default Sewer Type	124.700	123.744	0.731	124.000	122.000	1.775
1.008	8.998	330.0	375	Circular_Default Sewer Type	124.000	122.000	1.625	123.493	121.973	1.145

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	1	1200	Manhole	Adoptable	2	1200	Manhole	Adoptable
1.001	2	1200	Manhole	Adoptable	3	1200	Manhole	Adoptable
1.002	3	1200	Manhole	Adoptable	6	1200	Manhole	Adoptable
2.000	4	1200	Manhole	Adoptable	5	1200	Manhole	Adoptable
2.001	5	1200	Manhole	Adoptable	6	1200	Manhole	Adoptable
1.003	6	1200	Manhole	Adoptable	7	1200	Manhole	Adoptable
1.004	7	1200	Manhole	Adoptable	8	1200	Manhole	Adoptable
1.005	8	1200	Manhole	Adoptable	11	1350	Manhole	Adoptable
3.000	9	1200	Manhole	Adoptable	10	1200	Manhole	Adoptable
3.001	10	1200	Manhole	Adoptable	11	1350	Manhole	Adoptable
1.006	11	1350	Manhole	Adoptable	12	1350	Manhole	Adoptable
1.007	12	1350	Manhole	Adoptable	19		Junction	
4.000	13	1200	Manhole	Adoptable	14	1200	Manhole	Adoptable
4.001	14	1200	Manhole	Adoptable	15	1200	Manhole	Adoptable
4.002	15	1200	Manhole	Adoptable	16	1200	Manhole	Adoptable
4.003	16	1200	Manhole	Adoptable	17	1200	Manhole	Adoptable
4.004	17	1200	Manhole	Adoptable	18	1200	Manhole	Adoptable
4.005	18	1200	Manhole	Adoptable	19		Junction	
1.008	19		Junction		22	1350	Manhole	Adoptable

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
5.000	10.813	100.0	100	Circular_Default Sewer Type	124.516	123.500	0.916	124.382	123.392	0.890
5.001	48.992	59.5	150	Circular_Default Sewer Type	124.382	123.342	0.890	123.493	122.518	0.825
1.009	31.090	330.0	375	Circular_Default Sewer Type	123.493	121.973	1.145	123.500	121.879	1.246
6.000	22.655	45.2	100	Circular_Default Sewer Type	123.585	122.285	1.200	123.500	121.784	1.616
1.010	24.751	100.0	375	Circular_Default Sewer Type	123.500	121.509	1.616	122.609	121.261	0.973
1.011	19.059	25.0	375	Circular_Default Sewer Type	122.609	121.261	0.973	121.490	120.499	0.616

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
5.000	20	1200	Manhole	Adoptable	21	1200	Manhole	Adoptable
5.001	21	1200	Manhole	Adoptable	22	1350	Manhole	Adoptable
1.009	22	1350	Manhole	Adoptable	24	1350	Manhole	Adoptable
6.000	23	1200	Manhole	Adoptable	24	1350	Manhole	Adoptable
1.010	24	1350	Manhole	Adoptable	25	1350	Manhole	Adoptable
1.011	25	1350	Manhole	Adoptable	25_OUT	1350	Manhole	Adoptable

Simulation Settings

Rainfall Methodology	FSR	Skip Steady State	✓
FSR Region	England and Wales	Drain Down Time (mins)	240
M5-60 (mm)	17.000	Additional Storage (m³/ha)	20.0
Ratio-R	0.300	Check Discharge Rate(s)	✓
Summer CV	0.750	100 year (l/s)	0.0
Winter CV	0.840	Check Discharge Volume	✓
Analysis Speed	Normal	100 year 360 minute (m³)	

Storm Durations

15	60	180	360	600	960	2160	4320	7200	10080
30	120	240	480	720	1440	2880	5760	8640	

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
1000	0	0	0

Pre-development Discharge Rate

Site Makeup	Greenfield	Growth Factor 30 year	1.95
Greenfield Method	IH124	Growth Factor 100 year	2.48
Positively Drained Area (ha)		Betterment (%)	0
SAAR (mm)		QBar	
Soil Index	1	Q 1 year (l/s)	
SPR	0.10	Q 30 year (l/s)	
Region	1	Q 100 year (l/s)	
Growth Factor 1 year	0.85		

Pre-development Discharge Volume

Site Makeup	Greenfield	Return Period (years)	100
Greenfield Method	FSR/FEH	Climate Change (%)	0
Positively Drained Area (ha)		Storm Duration (mins)	360
Soil Index	1	Betterment (%)	0
SPR	0.10	PR	
CWI		Runoff Volume (m³)	

Node 24 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Downstream Link	1.010	Sump Available	✓
Replaces Downstream Link	✓	Product Number	CTL-SHE-0094-5000-1800-5000
Invert Level (m)	121.509	Min Outlet Diameter (m)	0.150
Design Depth (m)	1.800	Min Node Diameter (mm)	1200
Design Flow (l/s)	5.0		

Node 19 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	122.000
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	

Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)
0.000	222.0	0.0	2.000	457.0	0.0

Results for 1000 year Critical Storm Duration. Lowest mass balance: 99.12%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	1	11	125.388	1.288	20.3	2.1561	0.7901	FLOOD
15 minute winter	2	12	125.170	1.197	30.6	1.9471	0.0000	FLOOD RISK
15 minute winter	3	12	124.867	1.023	23.3	1.1569	0.0000	SURCHARGED
15 minute winter	4	12	125.459	0.759	13.3	1.2187	0.0000	FLOOD RISK
15 minute winter	5	11	124.957	0.477	32.0	0.9257	0.0000	SURCHARGED
15 minute winter	6	11	124.602	0.936	50.3	1.0584	0.0000	SURCHARGED
15 minute winter	7	11	124.363	0.823	66.1	1.3719	0.0000	SURCHARGED
15 minute winter	8	11	123.951	0.532	83.3	0.9456	0.0000	SURCHARGED
15 minute winter	9	10	123.874	0.124	16.8	0.2050	0.0000	OK
15 minute winter	10	10	123.684	0.193	44.5	0.4447	0.0000	SURCHARGED
600 minute winter	11	585	123.398	0.516	20.4	0.9373	0.0000	SURCHARGED
600 minute winter	12	585	123.398	0.870	22.0	1.5451	0.0000	SURCHARGED
15 minute winter	13	10	125.940	1.040	27.8	2.1362	0.3129	FLOOD
15 minute winter	14	10	125.794	0.950	37.0	1.5542	2.2310	FLOOD
15 minute winter	15	11	125.589	0.869	37.8	1.5233	0.0000	FLOOD RISK
15 minute winter	16	10	124.599	0.164	49.4	0.2761	0.0000	OK
15 minute winter	17	11	124.443	0.248	67.7	0.4488	0.0000	SURCHARGED
15 minute summer	18	11	123.864	0.120	64.9	0.1361	0.0000	OK
600 minute winter	19	585	123.398	1.397	35.8	425.3781	0.0000	SURCHARGED
15 minute winter	20	12	124.513	1.013	17.4	1.7450	0.0000	FLOOD RISK
15 minute winter	21	11	124.033	0.691	33.5	1.3126	0.0000	SURCHARGED
600 minute winter	22	585	123.397	1.424	5.5	2.0383	0.0000	FLOOD RISK
600 minute winter	23	585	123.397	1.112	0.1	1.2579	0.0000	FLOOD RISK
600 minute winter	24	585	123.397	1.888	5.2	3.4799	0.0000	FLOOD RISK
600 minute winter	25	585	121.291	0.030	5.1	0.0430	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	1	1.000	2	10.6	1.355	1.927	0.0729	
15 minute winter	2	1.001	3	23.3	1.325	1.440	0.2697	
15 minute winter	3	1.002	6	24.7	1.404	1.527	0.2176	
15 minute winter	4	2.000	5	10.1	1.292	1.674	0.1328	
15 minute winter	5	2.001	6	30.3	1.721	1.707	0.1860	
15 minute winter	6	1.003	7	51.7	1.301	1.301	0.8496	
15 minute winter	7	1.004	8	65.9	1.656	1.657	0.8163	
15 minute winter	8	1.005	11	83.3	2.094	2.095	0.3998	
15 minute winter	9	3.000	10	16.1	1.002	0.907	0.4299	
15 minute winter	10	3.001	11	42.9	2.766	0.814	0.0675	
600 minute winter	11	1.006	12	20.4	0.903	0.091	3.1253	
600 minute winter	12	1.007	19	21.1	0.789	0.190	1.9005	
15 minute winter	13	4.000	14	23.2	1.316	1.305	0.0981	
15 minute winter	14	4.001	15	23.7	1.346	1.334	0.2193	
15 minute winter	15	4.002	16	35.2	1.998	1.981	0.3639	
15 minute winter	16	4.003	17	49.2	1.455	0.731	0.5043	
15 minute winter	17	4.004	18	65.4	2.153	0.972	0.8251	
15 minute summer	18	4.005	19	65.2	3.177	0.565	1.0986	
600 minute winter	19	1.008	22	5.0	0.431	0.046	0.9925	
15 minute winter	20	5.000	21	12.0	1.540	1.995	0.0846	
15 minute winter	21	5.001	22	28.7	1.633	1.245	0.8538	
600 minute winter	22	1.009	24	5.1	0.525	0.047	3.4291	
600 minute winter	23	6.000	24	-0.1	-0.028	-0.016	0.1773	
600 minute winter	24	Hydro-Brake®	25	5.1				
600 minute winter	25	1.011	25_OUT	5.1	1.262	0.013	0.0773	223.1

**Results for 1000 year Critical Storm Duration. Lowest mass balance: 99.12%**

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m ³)	Flood (m ³)	Status
600 minute winter	25_OUT	585	120.529	0.030	5.1	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m ³)	Discharge Vol (m ³)
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