

Surface Water Drainage Calculations

Haywards Heath RFC

Whitemans Green, Cuckfield

Prepared For

Mitchell Design and Construction Ltd

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Document Revisions

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Appendices

Appendix A Hydraulic Calculations

1. Introduction

- 1.1. This surface water calculation pack is the property of H J Consulting Engineers (HJCE) and is produced for the exclusive use of the client, Mitchell Design and Construction Ltd (MDCL). The contents may not be made use of by any third party without the express written consent of HJCE. Without such consent HJCE can accept no responsibility to any third party. By receiving these calculations and acting on it, the client, or any third party relying on it, accepts that no individual is personally liable in contract, tort, or breach of statutory duty (including negligence).
- 1.2. These calculations support the drainage design and has been prepared in accordance with the requirements set out in the National Planning Policy Framework (NPPF) 2021 and the associated Planning Practice Guidance.

2. Drainage Strategy

2.1. Surface Water Disposal

- 2.1.1. Flows generated by the development are collected via permeable paving within the parking areas, linear drains within the terrace area and rainwater pipes on the on-site buildings. Treatment of the parking areas is undertaken by the permeable strata.
- 2.1.2. An attenuation asset is provided in the form of a geocellular tank adjacent the parking to the south.
- 2.1.3. Discharge from the development is restricted to 3.7 l/s into the ditch to the south of the site. An overflow to the nearby 'copse' is provided, with infiltration disposing of these flows at a calculated rate of 0.02333 m/hr.
- 2.1.4. The simulation accounts for a surcharged outfall of 430mm, based on the highest possible top water level in the existing ditch.

2.2. Drainage Calculation Results

- 2.2.1. Causeway Flow has been utilised for the modelling of the proposed surface water drainage infrastructure. The results identify the levels and rates achieved within the system for the 1 in 1, 1 in 30 and the 1 in 100 year + 45% climate change.
- 2.2.2. The 1.2m³ of flooding that occurs in during the exceedance event will be accommodated on site within the landscaped depressions.

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	100	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00
FSR Region	England and Wales	Connection Type	Level Soffits
M5-60 (mm)	20.000	Minimum Backdrop Height (m)	0.200
Ratio-R	0.342	Preferred Cover Depth (m)	1.200
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	5.00	Enforce best practice design rules	x

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
SW02	0.323	5.00	122.405	1200	529853.205	125609.014	1.275
SW12	0.096	5.00	122.358	1200	529874.444	125556.531	1.862
RE05	0.135	5.00	122.275	600	529858.826	125599.517	1.200
SW09	0.010	5.00	122.338	1200	529847.940	125565.262	2.708
SW10	0.080	5.00	122.300	1200	529839.712	125567.960	2.525
SW11FC	0.085	5.00	122.300	1200	529837.214	125547.096	2.775
HW03			119.000	1200	529806.771	125417.119	0.900
POND		5.00	122.660				0.843
COPSE			119.830				0.630

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	POND	SW02	9.000	0.600	121.817	121.280	0.537	16.8	225	5.05	50.0
1.001	SW02	SW10	43.214	0.600	121.130	119.775	1.355	31.9	375	5.27	50.0
3.001	SW12	SW11FC	14.900	0.600	120.496	119.750	0.746	20.0	225	5.08	50.0
4.000	RE05	SW09	35.943	0.600	121.075	119.780	1.295	27.8	300	5.20	50.0
3.002	SW10	SW09	8.659	0.600	119.775	119.705	0.070	123.7	375	5.36	50.0
1.002	SW09	SW11FC	31.000	0.600	119.630	119.525	0.105	295.2	450	5.80	50.0
1.003	SW11FC	HW03	133.495	0.600	119.525	118.100	1.425	93.7	150	7.94	50.0
OVERFLOW	SW11FC	COPSE	34.000	0.600	121.650	119.200	2.450	13.9	150	5.21	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)
1.000	3.211	127.7	0.0	0.618	0.900	0.000	0.0
1.001	3.218	355.4	43.8	0.900	2.150	0.323	0.0
3.001	2.941	116.9	13.0	1.637	2.325	0.096	0.0
4.000	2.995	211.7	18.3	0.900	2.258	0.135	0.0
3.002	1.628	179.8	54.6	2.150	2.258	0.403	0.0
1.002	1.178	187.3	74.3	2.258	2.325	0.548	0.0
1.003	1.038	18.3	98.8	2.625	0.750	0.729	0.0
OVERFLOW	2.718	48.0	0.0	0.500	0.480	0.000	0.0

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	9.000	16.8	225	1 Default	122.660	121.817	0.618	122.405	121.280	0.900
1.001	43.214	31.9	375	1 Default	122.405	121.130	0.900	122.300	119.775	2.150
3.001	14.900	20.0	225	1 Default	122.358	120.496	1.637	122.300	119.750	2.325
4.000	35.943	27.8	300	1 Default	122.275	121.075	0.900	122.338	119.780	2.258
3.002	8.659	123.7	375	1 Default	122.300	119.775	2.150	122.338	119.705	2.258
1.002	31.000	295.2	450	1 Default	122.338	119.630	2.258	122.300	119.525	2.325
1.003	133.495	93.7	150	1 Default	122.300	119.525	2.625	119.000	118.100	0.750
OVERFLOW	34.000	13.9	150	1 Default	122.300	121.650	0.500	119.830	119.200	0.480

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	POND		Manhole	1 Default	SW02	1200	Manhole	1 Default
1.001	SW02	1200	Manhole	1 Default	SW10	1200	Manhole	1 Default
3.001	SW12	1200	Manhole	1 Default	SW11FC	1200	Manhole	1 Default
4.000	RE05	600	Manhole	1 Default	SW09	1200	Manhole	1 Default
3.002	SW10	1200	Manhole	1 Default	SW09	1200	Manhole	1 Default
1.002	SW09	1200	Manhole	1 Default	SW11FC	1200	Manhole	1 Default
1.003	SW11FC	1200	Manhole	1 Default	HW03	1200	Manhole	1 Default
OVERFLOW	SW11FC	1200	Manhole	1 Default	COPSE		Manhole	1 Default

Simulation Settings

Rainfall Methodology	FSR	Analysis Speed	Detailed
Rainfall Events	Singular	Skip Steady State	x
FSR Region	England and Wales	Drain Down Time (mins)	240
M5-60 (mm)	20.000	Additional Storage (m³/ha)	20.0
Ratio-R	0.342	Starting Level (m)	
Summer CV	0.750	Check Discharge Rate(s)	x
Winter CV	0.840	Check Discharge Volume	x

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 %)
1	0	0	0
30	0	0	0
100	45	0	0

Node HW03 Surcharged Outfall

Overrides Design Area	x	Depression Storage Area (m²)	0	Evapo-transpiration (mm/day)	0
Overrides Design Additional Inflow	x	Depression Storage Depth (mm)	0		
Applies to All storms					

Time (mins)	Depth (m)	Time (mins)	Depth (m)
0	0.430	10080	0.430

Node SW11FC Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	x	Sump Available	✓
Invert Level (m)	119.525	Product Number	CTL-SHE-0073-3700-2700-3700
Design Depth (m)	2.700	Min Outlet Diameter (m)	0.100
Design Flow (l/s)	3.7	Min Node Diameter (mm)	1200

Node SW11FC Online Orifice Control

Flap Valve	x	Invert Level (m)	121.650
Downstream Link	OVERFLOW	Diameter (m)	0.075
Replaces Downstream Link	x	Discharge Coefficient	0.600

Node SW11FC Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	119.600
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	

Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)
0.000	290.0	0.0	1.600	290.0	0.0	1.601	0.0	0.0

Node POND Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	122.360
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	207.3	0.0	0.300	262.1	0.0

Node COPSE Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.02333	Safety Factor	2.0	Invert Level (m)	118.160
Side Inf Coefficient (m/hr)	0.02333	Porosity	1.00	Time to half empty (mins)	1811

Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)
0.000	0.0	0.0	1.670	118.0	240.3

Node SW09 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	121.878	Slope (1:X)	60.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	120	Depth (m)	0.300
Safety Factor	2.0	Width (m)	33.000	Inf Depth (m)	
Porosity	0.30	Length (m)	68.000		

Results for 1 year Critical Storm Duration. Lowest mass balance: 98.27%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	SW02	10	121.217	0.087	43.2	0.5377	0.0000	OK
15 minute winter	SW12	10	120.546	0.050	12.9	0.1084	0.0000	OK
15 minute winter	RE05	10	121.134	0.058	18.1	0.1481	0.0000	OK
600 minute winter	SW09	495	119.953	0.323	28.3	0.3892	0.0000	OK
480 minute winter	SW10	424	119.952	0.177	16.3	0.3131	0.0000	OK
600 minute winter	SW11FC	480	119.949	0.424	11.7	97.0276	0.0000	SURCHARGED
15 minute summer	HW03	1	118.530	0.430	2.2	0.0000	0.0000	OK
15 minute summer	POND	1	121.817	0.000	0.0	0.0000	0.0000	OK
15 minute summer	COPSE	1	118.160	-1.040	0.0	0.0000	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	SW02	1.001	SW10	42.6	1.546	0.120	1.2037	
15 minute winter	SW12	3.001	SW11FC	12.8	1.946	0.109	0.0978	
15 minute winter	RE05	4.000	SW09	17.8	1.845	0.084	0.3461	
600 minute winter	SW09	1.002	SW11FC	8.9	0.212	0.048	4.2867	
480 minute winter	SW10	3.002	SW09	15.2	0.807	0.084	0.5446	
600 minute winter	SW11FC	1.003	HW03	2.4	0.191	0.131	1.3965	103.0
600 minute winter	SW11FC	OVERFLOW	COPSE	0.0	0.000	0.000	0.0000	
15 minute summer	POND	1.000	SW02	0.0	0.000	0.000	0.0000	
15 minute summer	COPSE	Infiltration		0.0				

Results for 30 year Critical Storm Duration. Lowest mass balance: 98.27%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	SW02	10	121.268	0.138	105.9	0.8546	0.0000	OK
720 minute winter	SW12	690	120.586	0.090	2.9	0.1943	0.0000	OK
15 minute winter	RE05	10	121.167	0.092	44.3	0.2332	0.0000	OK
720 minute winter	SW09	705	120.584	0.954	46.0	1.1498	0.0000	SURCHARGED
720 minute winter	SW10	705	120.584	0.809	18.1	1.4283	0.0000	SURCHARGED
720 minute winter	SW11FC	705	120.584	1.059	24.9	273.1221	0.0000	SURCHARGED
15 minute summer	HW03	1	118.530	0.430	2.4	0.0000	0.0000	OK
15 minute summer	POND	1	121.817	0.000	0.0	0.0000	0.0000	OK
15 minute summer	COPSE	1	118.160	-1.040	0.0	0.0000	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	SW02	1.001	SW10	105.0	1.941	0.295	2.3386	
720 minute winter	SW12	3.001	SW11FC	2.9	1.022	0.025	0.4064	
15 minute winter	RE05	4.000	SW09	43.9	1.985	0.208	0.9858	
720 minute winter	SW09	1.002	SW11FC	20.0	0.203	0.107	4.9117	
720 minute winter	SW10	3.002	SW09	41.8	0.737	0.232	0.9551	
720 minute winter	SW11FC	1.003	HW03	2.4	0.191	0.131	1.3964	121.0
720 minute winter	SW11FC	OVERFLOW	COPSE	0.0	0.000	0.000	0.0000	
15 minute summer	POND	1.000	SW02	0.0	0.000	0.000	0.0000	
15 minute summer	COPSE	Infiltration		0.0				

Results for 100 year +45% CC Critical Storm Duration. Lowest mass balance: 98.27%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
720 minute winter	SW02	510	122.277	1.147	17.9	7.1106	0.0000	FLOOD RISK
720 minute winter	SW12	510	122.276	1.780	5.3	3.8491	0.0000	FLOOD RISK
720 minute winter	RE05	510	122.275	1.200	7.5	3.0396	1.2145	FLOOD
720 minute winter	SW09	510	122.276	2.646	46.3	15.6986	0.0000	FLOOD RISK
720 minute winter	SW10	510	122.277	2.502	22.3	4.4153	0.0000	FLOOD RISK
720 minute winter	SW11FC	510	122.276	2.751	38.7	445.8736	0.0000	FLOOD RISK
15 minute summer	HW03	1	118.530	0.430	2.3	0.0000	0.0000	OK
720 minute winter	POND	510	122.276	0.459	0.8	0.0000	0.0000	SURCHARGED
960 minute winter	COPSE	930	119.811	0.611	8.9	96.3618	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)
720 minute winter	SW02	1.001	SW10	17.9	0.859	0.050	4.7664	
720 minute winter	SW12	3.001	SW11FC	5.1	0.953	0.044	0.5926	
720 minute winter	RE05	4.000	SW09	7.5	0.952	0.035	2.5311	
720 minute winter	SW09	1.002	SW11FC	29.2	0.281	0.156	4.9117	
720 minute winter	SW10	3.002	SW09	41.6	0.707	0.232	0.9551	
720 minute winter	SW11FC	1.003	HW03	3.7	0.280	0.202	1.4771	156.0
720 minute winter	SW11FC	OVERFLOW	COPSE	9.0	2.086	0.186	0.3659	
720 minute winter	POND	1.000	SW02	-0.8	-0.025	-0.006	0.3579	
960 minute winter	COPSE	Infiltration		0.8				