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CIVIL AND STRUCTURAL ENGINEERING CONSULTANTS

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Job No: 2442E

23rd January 2024

Silver Birches, Tile Kiln Lane, Harefield
Proposed Re-Development of the above site with 1 new residential house

Surface Water Drainage

Impermeable Areas
Existing

The existing house and its garage and driveway, all drain to the combined sewer in the rear garden of the plot.

A*p* = 0.022 hectares (existing site)

Therefore existing 1 in 1 year site discharge approximates to:

Q = 2.78 x 55 x 0.022 = 3.4 litres per second (based on Tc = 5 mins, R = 55mm/hr)

Proposed (1 house development)

A*p* = 0.030 hectares (post re-development)

It has been established that there are no ditches, watercourses or surface water sewers in the vicinity of the site and that the sub-soil is predominantly clay and not suitable for a soakaway system of drainage.

It is therefore proposed to discharge surface water run-off from the developed site to the existing combined sewer within the rear garden of the site, with a flow restriction in keeping the existing 1 in 1 year discharge rate. The flow will be restricted using a flow control manhole incorporating an orifice plate to restrict the flows. The flow restriction will be set to 3.4 litres per second.

The existing combined outlet manhole is quite shallow making a lower flow restriction impractical, as this would require additional storage capacity and we do not have the depth to provide a tank to achieve this.

From the attached hydraulic modelling it can be seen that the system of over-sized pipes and inspection chambers, including the flow control chamber provides sufficient storage to accommodate a 1 in 30 year storm event, restricted to an outflow of 3.4 litres per second.

Maintenance Management Plan

The maintenance requirements for each proposed SuDS component is given below, based on the CIRIA report C753 "The SuDS Manual".

The maintenance of the drainage system will be the responsibility of the property owner.

Drainage Pipes and Inspection Chambers

Maintenance Schedule	Required Action	Typical Frequency
Regular Maintenance	Remove sediment and debris from inspection chambers, channel drainage and hydro-brake flow control manhole.	Annually
	Cleaning of gutters and any filters on downpipes.	Annually
	Remove any root ingress	As required
Occasional Maintenance	CCTV Survey of drains to check for cracking, misalignment, blockage.	10 year interval

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	2	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	0.400	Preferred Cover Depth (m)	1.200
CV	0.750	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)	Width (mm)	Easting (m)	Northing (m)	Depth (m)
F1	0.000		44.300	900	600	507802.228	187598.155	1.100
S1	0.000		44.280	600		507804.918	187599.217	0.780
S2	0.004	4.00	44.300	600		507820.610	187605.150	0.662
S3	0.010	4.00	44.300			507814.788	187620.597	0.524
S4	0.016	4.00	44.300			507797.714	187619.180	0.632

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)
2.000	S4	S1	21.000	0.600	43.668	43.500	0.168	125.0	150	4.39	50.0
1.002	S1	F1	3.000	0.600	43.500	43.200	0.300	10.0	100	4.62	50.0
1.000	S3	S2	16.500	0.600	43.776	43.638	0.138	119.6	150	4.30	50.0
1.001	S2	S1	16.500	0.600	43.638	43.500	0.138	119.6	150	4.60	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)
2.000	0.897	15.9	2.2	0.482	0.630	0.016	0.0
1.002	2.458	19.3	4.1	0.680	1.000	0.030	0.0
1.000	0.918	16.2	1.4	0.374	0.512	0.010	0.0
1.001	0.918	16.2	1.9	0.512	0.630	0.014	0.0

Simulation Settings

Rainfall Methodology	FSR	Analysis Speed	Normal
FSR Region	England and Wales	Skip Steady State	x
M5-60 (mm)	20.000	Drain Down Time (mins)	240
Ratio-R	0.400	Additional Storage (m³/ha)	20.0
Summer CV	0.750	Check Discharge Rate(s)	x
Winter CV	0.840	Check Discharge Volume	x

Storm Durations

15	30	60	120	180	240	360	480	600	720	960	1440

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
2	0	0	0
10	0	0	0
30	0	0	0

Node S1 Online Orifice Control

Flap Valve	x	Design Depth (m)	0.676	Discharge Coefficient	0.600
Replaces Downstream Link	✓	Design Flow (l/s)	3.4		
Invert Level (m)	43.500	Diameter (m)	0.044		

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)	Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
2 year 15 minute summer	141.566	40.058	10 year 360 minute summer	24.632	6.339
2 year 15 minute winter	99.345	40.058	10 year 360 minute winter	16.012	6.339
2 year 30 minute summer	91.753	25.963	10 year 480 minute summer	19.260	5.090
2 year 30 minute winter	64.388	25.963	10 year 480 minute winter	12.796	5.090
2 year 60 minute summer	61.301	16.200	10 year 600 minute summer	15.690	4.291
2 year 60 minute winter	40.727	16.200	10 year 600 minute winter	10.720	4.291
2 year 120 minute summer	37.449	9.897	10 year 720 minute summer	13.925	3.732
2 year 120 minute winter	24.880	9.897	10 year 720 minute winter	9.358	3.732
2 year 180 minute summer	28.672	7.378	10 year 960 minute summer	11.365	2.993
2 year 180 minute winter	18.637	7.378	10 year 960 minute winter	7.528	2.993
2 year 240 minute summer	22.636	5.982	10 year 1440 minute summer	8.174	2.191
2 year 240 minute winter	15.039	5.982	10 year 1440 minute winter	5.493	2.191
2 year 360 minute summer	17.235	4.435	30 year 15 minute summer	268.706	76.035
2 year 360 minute winter	11.203	4.435	30 year 15 minute winter	188.566	76.035
2 year 480 minute summer	13.550	3.581	30 year 30 minute summer	174.929	49.499
2 year 480 minute winter	9.003	3.581	30 year 30 minute winter	122.757	49.499
2 year 600 minute summer	11.088	3.033	30 year 60 minute summer	116.589	30.811
2 year 600 minute winter	7.576	3.033	30 year 60 minute winter	77.459	30.811
2 year 720 minute summer	9.878	2.647	30 year 120 minute summer	70.438	18.615
2 year 720 minute winter	6.639	2.647	30 year 120 minute winter	46.797	18.615
2 year 960 minute summer	8.113	2.136	30 year 180 minute summer	53.298	13.715
2 year 960 minute winter	5.374	2.136	30 year 180 minute winter	34.645	13.715
2 year 1440 minute summer	5.891	1.579	30 year 240 minute summer	41.604	10.995
2 year 1440 minute winter	3.959	1.579	30 year 240 minute winter	27.641	10.995
10 year 15 minute summer	211.819	59.937	30 year 360 minute summer	31.221	8.034
10 year 15 minute winter	148.645	59.937	30 year 360 minute winter	20.295	8.034
10 year 30 minute summer	136.831	38.718	30 year 480 minute summer	24.324	6.428
10 year 30 minute winter	96.022	38.718	30 year 480 minute winter	16.160	6.428
10 year 60 minute summer	90.826	24.003	30 year 600 minute summer	19.756	5.404
10 year 60 minute winter	60.342	24.003	30 year 600 minute winter	13.498	5.404
10 year 120 minute summer	54.899	14.508	30 year 720 minute summer	17.490	4.687
10 year 120 minute winter	36.474	14.508	30 year 720 minute winter	11.754	4.687
10 year 180 minute summer	41.666	10.722	30 year 960 minute summer	14.215	3.743
10 year 180 minute winter	27.084	10.722	30 year 960 minute winter	9.416	3.743
10 year 240 minute summer	32.645	8.627	30 year 1440 minute summer	10.161	2.723
10 year 240 minute winter	21.689	8.627	30 year 1440 minute winter	6.829	2.723

Results for 2 year Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	F1	1	43.200	0.000	2.0	0.0000	0.0000	OK
15 minute winter	S1	13	43.786	0.286	4.6	0.0809	0.0000	SURCHARGED
15 minute winter	S2	14	43.785	0.147	2.7	0.0593	0.0000	OK
15 minute summer	S3	10	43.811	0.035	1.9	0.0132	0.0000	OK
15 minute winter	S4	13	43.786	0.118	3.1	0.0599	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	S1	Orifice	F1	2.1				2.5
15 minute winter	S2	1.001	S1	2.0	0.302	0.125	0.2897	
15 minute summer	S3	1.000	S2	1.9	0.552	0.117	0.1379	
15 minute winter	S4	2.000	S1	2.9	0.471	0.186	0.3413	

Results for 10 year Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	F1	1	43.200	0.000	2.5	0.0000	0.0000	OK
30 minute winter	S1	23	43.966	0.466	3.7	0.1319	0.0000	SURCHARGED
30 minute winter	S2	23	43.968	0.330	3.0	0.1335	0.0000	SURCHARGED
30 minute winter	S3	23	43.970	0.194	3.0	0.0741	0.0000	SURCHARGED
30 minute winter	S4	23	43.966	0.298	3.4	0.1508	0.0000	SURCHARGED

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
30 minute winter	S1	Orifice	F1	2.7				4.9
30 minute winter	S2	1.001	S1	1.6	0.234	0.099	0.2905	
30 minute winter	S3	1.000	S2	2.1	0.510	0.129	0.2905	
30 minute winter	S4	2.000	S1	3.3	0.467	0.206	0.3697	

Results for 30 year Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	F1	1	43.200	0.000	3.0	0.0000	0.0000	OK
30 minute winter	S1	23	44.176	0.676	4.1	0.1914	0.0000	FLOOD RISK
30 minute winter	S2	23	44.178	0.540	3.3	0.2180	0.0000	FLOOD RISK
30 minute winter	S3	23	44.178	0.402	2.7	0.1537	0.0000	FLOOD RISK
30 minute winter	S4	23	44.178	0.510	4.4	0.2582	0.0000	FLOOD RISK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
30 minute winter	S1	Orifice	F1	3.3				6.2
30 minute winter	S2	1.001	S1	1.7	0.294	0.102	0.2905	
30 minute winter	S3	1.000	S2	2.3	0.503	0.143	0.2905	
30 minute winter	S4	2.000	S1	3.4	0.457	0.217	0.3697	

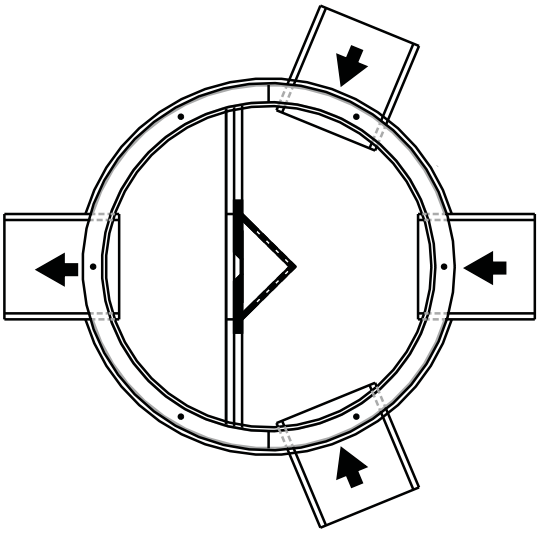
Controflow 500 Series Universal Level Invert

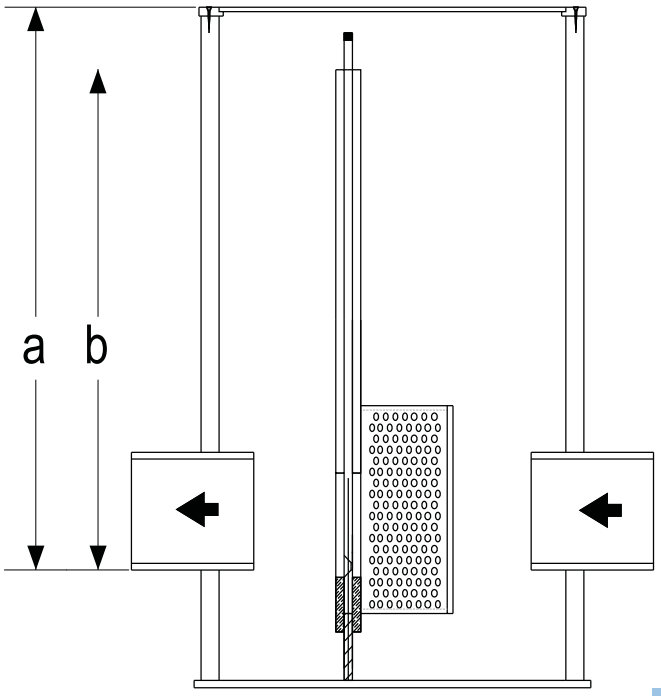
SUDS02005

Applications *– all SuDS elements, particularly where an internal overflow is required, and at the end of the management train.*

A flexible, universal flow control chamber suitable for any SuDS technique, with level inverts. The slide-out centre plate contains a circular orifice (to specified diameter), protected by an upstream guard, and acts as an overflow weir. Additional orifices can be added to order.

Three 160mm diameter inlet pipe connection stubs offer layout flexibility. Supplied with a temporary protective site cover (permanent cover and frame not included). Suitable for depths ranging from 537mm to 1.2m (finished cover to base). An optional foul air trap is available for use when connected to combined sewers. The chamber is fully compatible with 'Cloud Water Control' wireless SuDS monitoring systems to remotely monitor live and historical stormwater performance.





Please specify:

- orifice diameter
- type/depth of cover/frame to be used
- any additional orifice positions & diameters
- if foul air trap is required
- cover to inlet invert depth 'a'
- weir to inlet depth 'b'