Hayes Park

Drainage Assessment and Strategy Report

May 2023

Whitby Wood

Hayes Park

Drainage Assessment and Strategy Report

Client: Shall Do Hayes Developments Limited

Date: June 2023

P450887-WW-XX-XX-RP-C-0002

Appendix E – Greenfield Storage Calculations

Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	Tom Tosetti
Site name:	Hayes Park
Site location:	Hayes, London

This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance "Rainfall runoff management for developments", SC030219 (2013) , the SuDS Manual C753 (Ciria, 2015) and the non-statutory standards for SuDS (Defra, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Site Details

Latitude:	51.52927° N
Longitude:	0.43147° W
Reference:	3650241954
Date:	Mar 23 2023 17:34

Runoff estimation approach IH124

Site characteristics

Total site area (ha): 0.517

Methodology

Q_{BAR} estimation method:	Calculate from SPR and SAAR
SPR estimation method:	Calculate from SOIL type

Soil characteristics	Default	Edited
SOIL type:	4	4
HOST class:	N/A	N/A
SPR/SPRHOST:	0.47	0.47

Hydrological characteristics	Default	Edited
SAAR (mm):	623	623
Hydrological region:	6	6
Growth curve factor 1 year:	0.85	0.85
Growth curve factor 30 years:	2.3	2.3
Growth curve factor 100 years:	3.19	3.19
Growth curve factor 200 years:	3.74	3.74

Notes

(1) Is Q_{BAR} < 2.0 l/s/ha?

When Q_{BAR} is < 2.0 l/s/ha then limiting discharge rates are set at 2.0 l/s/ha.

(2) Are flow rates < 5.0 l/s?

Where flow rates are less than 5.0 l/s consent for discharge is usually set at 5.0 l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set where the blockage risk is addressed by using appropriate drainage elements.

(3) Is SPR/SPRHOST ≤ 0.3?

Where groundwater levels are low enough the use of soakaways to avoid discharge offsite would normally be preferred for disposal of surface water runoff.

Greenfield runoff rates	Default	Edited
Q_{BAR} (l/s):	2.18	2.18
1 in 1 year (l/s):	1.85	1.85
1 in 30 years (l/s):	5.01	5.01
1 in 100 year (l/s):	6.95	6.95
1 in 200 years (l/s):	8.15	8.15

Pre-development discharge

Site Makeup	Brownfield
Brownfield Method	MRM
Contributing Area (ha)	0.517
PIMP (%)	100
CV	1.000
Time of Concentration (mins)	5.00
Betterment (%)	0

Calc

Return Period (years)	Q (l/s)
1	102.2
30	241.6
100	306.3

EXISITING DISCHARGE RATES - 0% BETTERMENT

Pre-development discharge

Site Makeup	Brownfield
Brownfield Method	MRM
Contributing Area (ha)	0.517
PIMP (%)	100
CV	1.000
Time of Concentration (mins)	5.00
Betterment (%)	50

Calc

Return Period (years)	Q (l/s)
1	51.1
30	120.8
100	153.1

DISCHARGE RATES - 50% BETTERMENT

Pre-development discharge

Site Makeup	Brownfield
Brownfield Method	MRM
Contributing Area (ha)	0.517
PIMP (%)	100
CV	1.000
Time of Concentration (mins)	5.00
Betterment (%)	90

Calc

Return Period (years)	Q (l/s)
1	10.2
30	24.2
100	30.6

DISCHARGE RATES - 90% BETTERMENT

Pre-development discharge

Site Makeup	Brownfield
Brownfield Method	MRM
Contributing Area (ha)	0.517
PIMP (%)	100
CV	1.000
Time of Concentration (mins)	5.00
Betterment (%)	95

Calc

Return Period (years)	Q (l/s)
1	5.1
30	12.1
100	15.3

DISCHARGE RATES - 95% BETTERMENT

HAYES PARK
PRE-DEVELOPMENT EXISTING DISCHARGE RATES
P450887
23.03.2023

whitby wood

Appendix F - Volume Storage Calculations

Print Close Report

Surface water storage requirements for sites

www.uksuds.com | Storage estimation tool

Calculated by:	Tom Tosetti
Site name:	Hayes Park
Site location:	Hayes, London

This is an estimation of the storage volume requirements that are needed to meet normal
best practice criteria in line with Environment Agency guidance "Rainfall runoff management
for developments", SC030219 (2013), the SuDS Manual C753 (Ciria, 2015) and
the non-statutory standards for SuDS (Defra, 2015). It is not to be used for detailed design
of drainage systems. It is recommended that hydraulic modelling software is used to calculate
volume requirements and design details before finalising the design of the drainage scheme.

Site Details

Latitude:	51.53018° N
Longitude:	0.4317° W
Reference:	4214355286
Date:	May 09 2023 18:27

Site characteristics

Total site area (ha):	0.535
Significant public open space (ha):	0
Area positively drained (ha):	0.535
Impermeable area (ha):	0.535
Percentage of drained area that is impermeable (%):	100
Impervious area drained via infiltration (ha):	0
Return period for infiltration system design (year):	10
Impervious area drained to rainwater harvesting (ha):	0
Return period for rainwater harvesting system (year):	10
Compliance factor for rainwater harvesting system (%):	66
Net site area for storage volume design (ha):	0.54
Net impermable area for storage volume design (ha):	0.54
Pervious area contribution to runoff (%):	30

* where rainwater harvesting or infiltration has been used for managing surface water runoff such that the effective impermeable area is less than 50% of the 'area positively drained', the 'net site area' and the estimates of Q_{BAR} and other flow rates will have been reduced accordingly.

Design criteria

Climate change allowance factor:	1.4
Urban creep allowance factor:	1.1
Volume control approach	Use long term storage
Interception rainfall depth (mm):	5
Minimum flow rate (l/s):	51.1

Methodology

esti	IH124
Q_{BAR} estimation method:	Calculate from SPR and SAAR
SPR estimation method:	Calculate from SOIL type

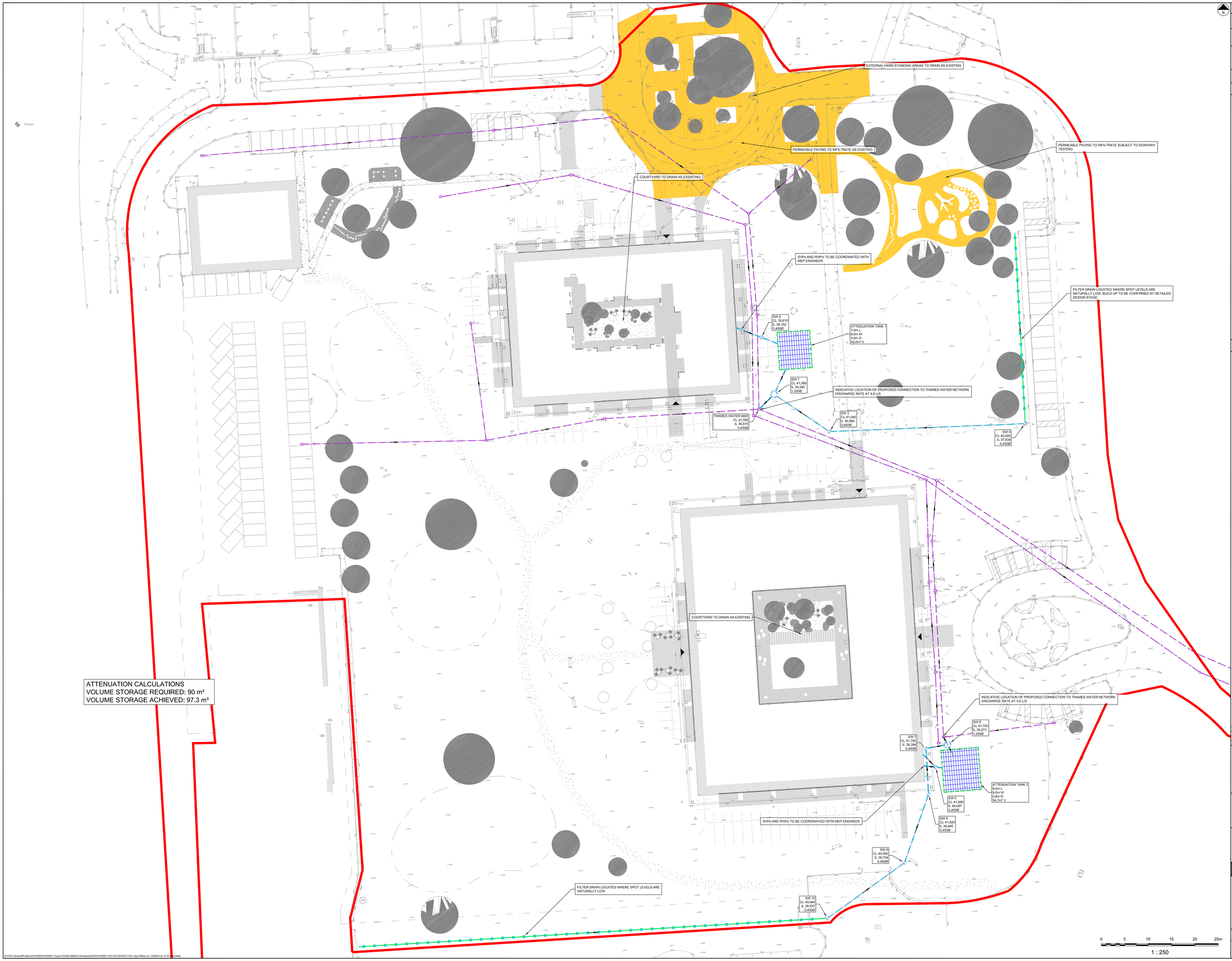
Soil characteristics	Default	Edited
SOIL type:	4	4
SPR:	0.47	0.47

Hydrological characteristics	Default	Edited
Rainfall 100 yrs 6 hrs:	--	63
Rainfall 100 yrs 12 hrs:	--	93.94
FEH / FSR conversion factor:	1.22	1.22
SAAR (mm):	623	623
M5-60 Rainfall Depth (mm):	20	20
'r' Ratio M5-60/M5-2 day:	0.4	0.4
Hydological region:	6	6
Growth curve factor 1 year:	0.85	0.85
Growth curve factor 10 year:	1.62	1.62
Growth curve factor 30 year:	2.3	2.3
Growth curve factor 100 years:	3.19	3.19
Q_{BAR} for total site area (l/s):	2.25	2.25
Q_{BAR} for net site area (l/s):	2.25	2.25

Site discharge rates	Default	Edited
1 in 1 year (l/s):	51.1	51.1
1 in 30 years (l/s):	51.1	51.1
1 in 100 year (l/s):	51.1	51.1

Estimated storage volumes	Default	Edited
Attenuation storage 1/100 years (m^3):	89	89
Long term storage 1/100 years (m^3):	0	0
Total storage 1/100 years (m^3):	89	89

Appendix G – Drainage Strategy



HEALTH AND SAFETY INFORMATION

CONSTRUCTION
THIS DRAWING SHOULD NOT BE USED FOR CONSTRUCTION PURPOSES.

IN ADDITION TO THE HAZARDS/RISKS NORMALLY ASSOCIATED WITH THE TYPES OF WORK DETAILED ON THIS DRAWING, NOTE THE FOLLOWING:

MAINTENANCE/CLEANING/OPERATION.
MAINTENANCE OF SUDS FEATURES AND THE DRAINAGE SYSTEM SHOULD BE CARRIED OUT IN ACCORDANCE WITH THE CIRIA SUDS MANUAL AND MANUFACTURERS SPECIFICATIONS

DECOMMISSIONING/DEMOLITION.
REFER TO DRAWING FOR EXTENT OF EXISTING SITE DRAINAGE TO BE ABANDONED/REMOVED

NOTES

1. DO NOT SCALE FROM THIS DRAWING. ONLY FIGURED DIMENSIONS ARE TO BE USED.
2. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE.
3. ALL LEVELS ARE IN METRES ABOVE ORDNANCE DATUM UNLESS NOTED OTHERWISE.
4. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECTS AND ENGINEERS DRAWINGS AND SPECIFICATIONS.
5. ALL FOUL AND SURFACE WATER PIPEWORK TO BE LAID AT MINIMUM GRADIENTS OF 1:40 AND 1:100 RESPECTIVELY UNLESS NOTED OTHERWISE.
6. ALL PIPEWORK TO BE 100mm DIAMETER UNLESS NOTED OTHERWISE.
7. ROCKER PIPES TO BE INSTALLED AT CONNECTION POINTS TO STRUCTURES TO ALLOW FOR MOVEMENT CAUSED BY SETTLEMENT.
8. ALL DRAINAGE IS DESIGNED TO ADOPTABLE STANDARDS WHERE POSSIBLE, AND BUILDING REGULATIONS PART H.
9. COORDINATION WITH MEP ENGINEER TO ENSURE WHICH DRAINAGE RUNS WILL NEED TO BE UTILISED.
10. CONDITION AND LINE OF EXISTING RUNS FROM HAYES PARK CENTRAL AND SOUTH BUILDINGS TO BE INVESTIGATED, PENDING A CCTV SURVEY AND CONNECTIVITY.
11. THAMES WATER PRE-PLANNING ENQUIRY WILL NEED TO BE SUBMITTED TO ENSURE SEWER CAPACITY.

KEY

- RED LINE BOUNDARY
- EXISTING COMBINED SEWER
- EXISTING FOUL WATER SEWER
- EXISTING SURFACE WATER SEWER
- PROPOSED COMBINED WATER SEWER
- PROPOSED FOUL WATER SEWER
- PROPOSED SURFACE WATER SEWER
- PROPOSED PERFORATED PIPE
- PROPOSED FILTER PIPE
- SEWER TO BE REMOVED / ABANDONED
- ATTENUATION TANK
- PERMEABLE PAVING

SS STUB STACK / SOIL VENT PIPE / RAIN WATER PIPE
SVP RWP
BD SURFACE WATER BACKDROP
NRV FOUL / SURFACE WATER NON RETURN VALVE
RE FOUL / SURFACE WATER RODDING EYE
FG FLOOR GULLY / ROAD GULLY
G
CD CHANNEL DRAIN
EXISTING MANHOLE
COMBINED / FOUL / SURFACE WATER MANHOLE

AC	-	ACCESS FITTING/CHAMBER	IL	-	INVERT LEVEL
CL	-	COVER LEVEL	MH	-	MANHOLE
C	-	COMBINED WATER	S	-	SURFACE WATER
EXT	-	EXISTING	SL	-	SOFFIT LEVEL
F	-	FOUL WATER	TBC	-	TO BE CONFIRMED
IC	-	INSPECTION CHAMBER			

REV	DESCRIPTION	DRN	CHK	APP	DATE
P3	REVISED TO UPDATED RED LINE BOUNDARY	TT	RS	RS	12.06.23
P2	DRAFT ISSUE FOR LANDSCAPE ARCHITECT	TT	RS	RS	09.05.23
P1	DRAFT ISSUE	TT	RW	RW	27.03.23

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CLIENT
SHALL DO HAYES PARK DEVELOPMENTS LIMITED

PROJECT
HAYES PARK

PRELIMINARY

DRAWING TITLE
PROPOSED DRAINAGE LAYOUT

DATE	SCALES @ A0	DRAWN BY	CHECKED	APPROVED
27.03.23	1:250	TT	RW	RW

DRAWING NUMBER
P450887-WW-XX-RF-DR-C-1001

REVISION
P2

X:\WW General\Projects\P450800\P450887 Hayes Park\03 BIM\02 Drawings\DWG\P450887-WW-XX-00-DR-C-1001.dwg Plotted on 12/06/23 at 12:16:53 BST

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)	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)	5.00	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	0.155	5.00	39.610	1200	508900.068	182469.770	1.425
Outfall 1			41.590	1200	508904.909	182452.385	5.075
3			39.610	1200	508905.193	182467.877	1.458
Tank 1 in			41.260	1200	508908.853	182466.504	3.132
Tank 1 out			41.310	1200	508910.683	182460.847	3.982
6			41.590	1800	508908.079	182455.191	5.050
7	0.125	5.00	41.680	1200	508940.974	182373.353	1.350
8			41.680	1200	508943.581	182373.171	1.518
Tank 2 in			41.470	1200	508945.157	182372.989	1.425
Tank 2 out			41.540	1200	508947.097	182376.960	2.370
11			41.700	1800	508946.248	182378.082	3.407
Outfall 2			41.650	1200	508945.339	182379.900	3.366
13		5.00	42.020	1200	508816.358	182333.822	1.300
14	0.042	5.00	40.940	1200	508919.293	182339.930	2.003
15		5.00	39.640	1200	508961.167	182491.115	1.300
16	0.022	5.00	40.000	1200	508963.337	182449.165	2.366
17			41.040	1200	508924.913	182446.272	4.054
18			40.990	1200	508934.447	182350.477	2.236
19			41.620	1200	508942.443	182367.188	3.050
20			41.700	1200	508942.019	182377.310	3.306
2	0.178	5.00	41.610	1200	508941.009	182376.026	1.425

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)
4.000	15	16	42.006	0.600	38.340	37.634	0.706	59.5	100	5.70	50.0
4.001	16	17	38.533	0.600	37.634	36.986	0.648	59.5	100	6.34	50.0
4.002	17	6	19.051	0.600	36.986	36.665	0.321	59.3	100	6.66	50.0
5.000	1	3	5.463	0.600	38.185	38.152	0.033	165.6	225	5.09	50.0
5.001	3	Tank 1 in	3.909	0.600	38.152	38.128	0.024	162.9	225	5.15	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)
4.000	1.000	7.9	0.0	1.200	2.266	0.000	0.0	0	0.000
4.001	1.000	7.9	4.1	2.266	3.954	0.022	0.0	51	1.010
4.002	1.001	7.9	4.1	3.954	4.825	0.022	0.0	51	1.011
5.000	1.013	40.3	29.5	1.200	1.233	0.155	0.0	144	1.105
5.001	1.022	40.6	29.5	1.233	2.907	0.155	0.0	143	1.112

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)
5.002	Tank 1 in	Tank 1 out	5.946	0.600	38.128	37.328	0.800	7.4	225	5.17	50.0
5.003	Tank 1 out	6	6.227	0.600	37.328	37.291	0.037	168.3	225	5.28	50.0
4.003	6	Outfall 1	4.234	0.600	36.540	36.515	0.025	169.3	225	6.73	50.0
1.000	13	14	103.116	0.600	40.720	38.987	1.733	59.5	100	6.72	50.0
1.001	14	18	18.463	0.600	38.937	38.754	0.183	100.9	150	7.03	50.0
1.002	18	19	18.525	0.600	38.754	38.570	0.184	100.7	150	7.33	50.0
1.003	19	20	10.131	0.600	38.570	38.469	0.101	100.3	150	7.50	50.0
1.004	20	11	4.299	0.600	38.394	38.368	0.026	165.3	225	7.57	50.0
3.000	7	8	2.613	0.600	40.330	40.237	0.093	28.1	150	5.02	50.0
2.001	8	Tank 2 in	1.586	0.600	40.162	40.045	0.117	13.6	225	5.07	50.0
2.002	Tank 2 in	Tank 2 out	4.420	0.600	40.045	39.245	0.800	5.5	225	5.08	50.0
2.003	Tank 2 out	11	1.407	0.600	39.170	39.164	0.006	234.5	300	5.11	50.0
1.005	11	Outfall 2	2.033	0.600	38.293	38.284	0.009	225.8	300	7.61	50.0
2.000	2	8	3.843	0.600	40.185	40.162	0.023	167.1	225	5.06	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)
5.002	4.829	192.0	29.5	2.907	3.757	0.155	0.0	59	3.525
5.003	1.005	40.0	29.5	3.757	4.074	0.155	0.0	144	1.096
4.003	1.002	39.8	33.6	4.825	4.850	0.177	0.0	159	1.119
1.000	1.000	7.9	0.0	1.200	1.853	0.000	0.0	0	0.000
1.001	1.000	17.7	8.0	1.853	2.086	0.042	0.0	71	0.975
1.002	1.001	17.7	8.0	2.086	2.900	0.042	0.0	71	0.976
1.003	1.003	17.7	8.0	2.900	3.081	0.042	0.0	71	0.977
1.004	1.014	40.3	8.0	3.081	3.107	0.042	0.0	68	0.795
3.000	1.906	33.7	23.8	1.200	1.293	0.125	0.0	93	2.061
2.001	3.572	142.0	57.7	1.293	1.200	0.304	0.0	100	3.392
2.002	5.603	222.8	57.7	1.200	2.070	0.304	0.0	78	4.723
2.003	1.022	72.3	57.7	2.070	2.236	0.304	0.0	203	1.131
1.005	1.042	73.6	65.7	3.107	3.066	0.346	0.0	222	1.172
2.000	1.008	40.1	33.9	1.200	1.293	0.178	0.0	159	1.127

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)
4.000	42.006	59.5	100	Circular	39.640	38.340	1.200	40.000	37.634	2.266
4.001	38.533	59.5	100	Circular	40.000	37.634	2.266	41.040	36.986	3.954
4.002	19.051	59.3	100	Circular	41.040	36.986	3.954	41.590	36.665	4.825
5.000	5.463	165.6	225	Circular	39.610	38.185	1.200	39.610	38.152	1.233
5.001	3.909	162.9	225	Circular	39.610	38.152	1.233	41.260	38.128	2.907
5.002	5.946	7.4	225	Circular	41.260	38.128	2.907	41.310	37.328	3.757

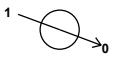
Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
4.000	15	1200	Manhole	Adoptable	16	1200	Manhole	Adoptable
4.001	16	1200	Manhole	Adoptable	17	1200	Manhole	Adoptable
4.002	17	1200	Manhole	Adoptable	6	1800	Manhole	Adoptable
5.000	1	1200	Manhole	Adoptable	3	1200	Manhole	Adoptable
5.001	3	1200	Manhole	Adoptable	Tank 1 in	1200	Manhole	Adoptable
5.002	Tank 1 in	1200	Manhole	Adoptable	Tank 1 out	1200	Manhole	Adoptable

Pipeline Schedule

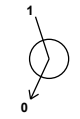
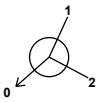
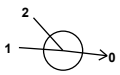
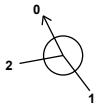
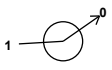
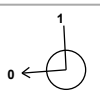
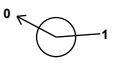
Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
5.003	6.227	168.3	225	Circular	41.310	37.328	3.757	41.590	37.291	4.074
4.003	4.234	169.3	225	Circular	41.590	36.540	4.825	41.590	36.515	4.850
1.000	103.116	59.5	100	Circular	42.020	40.720	1.200	40.940	38.987	1.853
1.001	18.463	100.9	150	Circular	40.940	38.937	1.853	40.990	38.754	2.086
1.002	18.525	100.7	150	Circular	40.990	38.754	2.086	41.620	38.570	2.900
1.003	10.131	100.3	150	Circular	41.620	38.570	2.900	41.700	38.469	3.081
1.004	4.299	165.3	225	Circular	41.700	38.394	3.081	41.700	38.368	3.107
3.000	2.613	28.1	150	Circular	41.680	40.330	1.200	41.680	40.237	1.293
2.001	1.586	13.6	225	Circular	41.680	40.162	1.293	41.470	40.045	1.200
2.002	4.420	5.5	225	Circular	41.470	40.045	1.200	41.540	39.245	2.070
2.003	1.407	234.5	300	Circular	41.540	39.170	2.070	41.700	39.164	2.236
1.005	2.033	225.8	300	Circular	41.700	38.293	3.107	41.650	38.284	3.066
2.000	3.843	167.1	225	Circular	41.610	40.185	1.200	41.680	40.162	1.293

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
5.003	Tank 1 out	1200	Manhole	Adoptable	6	1800	Manhole	Adoptable
4.003	6	1800	Manhole	Adoptable	Outfall 1	1200	Manhole	Adoptable
1.000	13	1200	Manhole	Adoptable	14	1200	Manhole	Adoptable
1.001	14	1200	Manhole	Adoptable	18	1200	Manhole	Adoptable
1.002	18	1200	Manhole	Adoptable	19	1200	Manhole	Adoptable
1.003	19	1200	Manhole	Adoptable	20	1200	Manhole	Adoptable
1.004	20	1200	Manhole	Adoptable	11	1800	Manhole	Adoptable
3.000	7	1200	Manhole	Adoptable	8	1200	Manhole	Adoptable
2.001	8	1200	Manhole	Adoptable	Tank 2 in	1200	Manhole	Adoptable
2.002	Tank 2 in	1200	Manhole	Adoptable	Tank 2 out	1200	Manhole	Adoptable
2.003	Tank 2 out	1200	Manhole	Adoptable	11	1800	Manhole	Adoptable
1.005	11	1800	Manhole	Adoptable	Outfall 2	1200	Manhole	Adoptable
2.000	2	1200	Manhole	Adoptable	8	1200	Manhole	Adoptable

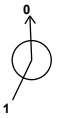
Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
1	508900.068	182469.770	39.610	1.425	1200	 0	5.000	38.185	225
Outfall 1	508904.909	182452.385	41.590	5.075	1200	 1	4.003	36.515	225
3	508905.193	182467.877	39.610	1.458	1200	1  0	5.000 5.001	38.152 38.152	225 225
Tank 1 in	508908.853	182466.504	41.260	3.132	1200	1  0	5.001 5.002	38.128 38.128	225 225

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
Tank 1 out	508910.683	182460.847	41.310	3.982	1200	 1	5.002	37.328	225
						0	5.003	37.328	225
6	508908.079	182455.191	41.590	5.050	1800	 1	5.003	37.291	225
						2	4.002	36.665	100
						0	4.003	36.540	225
7	508940.974	182373.353	41.680	1.350	1200				
						0	3.000	40.330	150
8	508943.581	182373.171	41.680	1.518	1200	 1	3.000	40.237	150
						2	2.000	40.162	225
						0	2.001	40.162	225
Tank 2 in	508945.157	182372.989	41.470	1.425	1200	 1	2.001	40.045	225
						0	2.002	40.045	225
Tank 2 out	508947.097	182376.960	41.540	2.370	1200	 1	2.002	39.245	225
						0	2.003	39.170	300
11	508946.248	182378.082	41.700	3.407	1800	 1	2.003	39.164	300
						2	1.004	38.368	225
						0	1.005	38.293	300
Outfall 2	508945.339	182379.900	41.650	3.366	1200	 1	1.005	38.284	300
13	508816.358	182333.822	42.020	1.300	1200				
						0	1.000	40.720	100
14	508919.293	182339.930	40.940	2.003	1200	 1	1.000	38.987	100
						0	1.001	38.937	150
15	508961.167	182491.115	39.640	1.300	1200				
						0	4.000	38.340	100
16	508963.337	182449.165	40.000	2.366	1200	 1	4.000	37.634	100
						0	4.001	37.634	100
17	508924.913	182446.272	41.040	4.054	1200	 1	4.001	36.986	100
						0	4.002	36.986	100

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
18	508934.447	182350.477	40.990	2.236	1200	 1	1.001	38.754	150
						0	1.002	38.754	150
19	508942.443	182367.188	41.620	3.050	1200	 1	1.002	38.570	150
						0	1.003	38.570	150
20	508942.019	182377.310	41.700	3.306	1200	 1	1.003	38.469	150
						0	1.004	38.394	225
2	508941.009	182376.026	41.610	1.425	1200	 0	2.000	40.185	225

Simulation Settings

Rainfall Methodology	FSR	Drain Down Time (mins)	240
FSR Region	England and Wales	Additional Storage (m³/ha)	20.0
M5-60 (mm)	20.000	Check Discharge Rate(s)	✓
Ratio-R	0.400	1 year (l/s)	0.0
Summer CV	0.750	30 year (l/s)	0.0
Winter CV	0.840	100 year (l/s)	0.0
Analysis Speed	Normal	Check Discharge Volume	x
Skip Steady State	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 %)
1	0	0	0
30	0	0	0
100	35	0	0

Pre-development Discharge Rate

Site Makeup	Brownfield	Time of Concentration (mins)	5.00
Brownfield Method	MRM	Betterment (%)	95
Contributing Area (ha)	0.517	Q 1 year (l/s)	
PIMP (%)	100	Q 30 year (l/s)	
CV	1.000	Q 100 year (l/s)	

Node 11 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	38.293	Product Number	CTL-SHE-0214-2810-2115-2810
Design Depth (m)	2.115	Min Outlet Diameter (m)	0.300
Design Flow (l/s)	28.1	Min Node Diameter (mm)	1800

Node 6 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	36.540	Product Number	CTL-SHE-0195-2310-2115-2310
Design Depth (m)	2.115	Min Outlet Diameter (m)	0.225
Design Flow (l/s)	23.1	Min Node Diameter (mm)	1800

Node Tank 2 in Offline Orifice Control

Flap Valve	x	Invert Level (m)	40.045	Discharge Coefficient	0.600
Loop to Node	Tank 1 out	Diameter (m)	0.225		

Node Tank 1 in Offline Orifice Control

Flap Valve	x	Invert Level (m)	38.128	Discharge Coefficient	0.600
Loop to Node	Tank 1 out	Diameter (m)	0.225		

Node 16 Link Surround Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Porosity	0.30	Link	4.000
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	37.634	Surround Shape	(Trench)
Safety Factor	2.0	Time to half empty (mins)	9	Diameter (mm)	100

Node 14 Link Surround Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Porosity	0.30	Link	1.000
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	38.987	Surround Shape	(Trench)
Safety Factor	2.0	Time to half empty (mins)	33	Diameter (mm)	100

Node Tank 1 out Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	37.328
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	31

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	56.0	0.0	0.800	56.0	0.0	0.801	0.0	0.0

Node Tank 2 out Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	39.170
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	32

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	72.0	0.0	0.800	72.0	0.0	0.801	0.0	0.0

Results for 1 year Critical Storm Duration. Lowest mass balance: 99.51%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	1	10	38.317	0.132	21.9	0.4373	0.0000	OK
15 minute summer	Outfall 1	1	36.515	0.000	18.2	0.0000	0.0000	OK
15 minute winter	3	10	38.270	0.118	21.6	0.1336	0.0000	OK
15 minute winter	Tank 1 in	10	38.174	0.046	21.4	0.0525	0.0000	OK
15 minute winter	Tank 1 out	13	37.444	0.116	27.6	6.3148	0.0000	OK
15 minute winter	6	14	36.769	0.229	20.4	0.5832	0.0000	SURCHARGED
15 minute winter	7	10	40.427	0.097	17.7	0.2899	0.0000	OK
15 minute winter	8	10	40.288	0.126	42.2	0.1430	0.0000	OK
15 minute winter	Tank 2 in	10	40.116	0.071	42.1	0.0801	0.0000	OK
15 minute winter	Tank 2 out	13	39.297	0.127	35.7	8.8540	0.0000	OK
15 minute winter	11	14	38.547	0.254	25.6	0.6470	0.0000	OK
15 minute summer	Outfall 2	1	38.284	0.000	22.9	0.0000	0.0000	OK
15 minute summer	13	1	40.720	0.000	0.0	0.0000	0.0000	OK
15 minute winter	14	10	38.998	0.061	6.0	0.0946	0.0000	OK
15 minute summer	15	1	38.340	0.000	0.0	0.0000	0.0000	OK
15 minute winter	16	11	37.677	0.043	3.1	0.0573	0.0000	OK
15 minute winter	17	11	37.029	0.043	3.0	0.0489	0.0000	OK
15 minute winter	18	11	38.815	0.061	5.8	0.0688	0.0000	OK
15 minute winter	19	11	38.632	0.062	5.8	0.0703	0.0000	OK
15 minute winter	20	14	38.547	0.153	5.8	0.1733	0.0000	OK
15 minute winter	2	10	40.331	0.146	25.2	0.5296	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	5.000	3	21.6	0.952	0.535	0.1238	
15 minute winter	3	5.001	Tank 1 in	21.4	1.632	0.527	0.0528	
15 minute winter	Tank 1 in	5.002	Tank 1 out	18.1	2.522	0.094	0.0747	
15 minute winter	Tank 1 in	Orifice	Tank 1 out	3.3				1.9
15 minute winter	Tank 1 out	5.003	6	18.0	0.927	0.450	0.1207	
15 minute winter	6	Hydro-Brake®	Outfall 1	19.7				14.5
15 minute winter	7	3.000	8	17.5	1.653	0.518	0.0275	
15 minute winter	8	2.001	Tank 2 in	42.1	2.515	0.296	0.0267	
15 minute winter	Tank 2 in	2.002	Tank 2 out	35.7	3.711	0.160	0.0426	
15 minute winter	Tank 2 in	Orifice	Tank 1 out	6.3				3.2
15 minute winter	Tank 2 out	2.003	11	21.3	0.821	0.295	0.0365	
15 minute winter	11	Hydro-Brake®	Outfall 2	24.7				19.0
15 minute summer	13	1.000	14	0.0	0.000	0.000	0.0189	
15 minute winter	14	1.001	18	5.8	0.871	0.327	0.1232	
15 minute summer	15	4.000	16	0.0	0.000	0.000	0.0658	
15 minute winter	16	4.001	17	3.0	0.940	0.382	0.1250	
15 minute winter	17	4.002	6	3.0	0.889	0.375	0.0998	
15 minute winter	18	1.002	19	5.8	0.860	0.330	0.1258	
15 minute winter	19	1.003	20	5.8	0.870	0.326	0.0701	
15 minute winter	20	1.004	11	5.0	0.622	0.125	0.1348	
15 minute winter	2	2.000	8	24.8	0.987	0.618	0.0964	

Results for 30 year Critical Storm Duration. Lowest mass balance: 99.51%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	1	10	38.464	0.279	53.8	0.9245	0.0000	SURCHARGED
15 minute summer	Outfall 1	1	36.515	0.000	23.1	0.0000	0.0000	OK
15 minute winter	3	10	38.357	0.205	52.6	0.2315	0.0000	OK
15 minute winter	Tank 1 in	10	38.202	0.074	52.3	0.0839	0.0000	OK
30 minute winter	Tank 1 out	25	37.639	0.311	51.5	16.9183	0.0000	SURCHARGED
30 minute winter	6	25	37.625	1.085	37.3	2.7625	0.0000	SURCHARGED
15 minute winter	7	11	40.747	0.417	43.4	1.2470	0.0000	SURCHARGED
15 minute winter	8	11	40.464	0.302	99.2	0.3412	0.0000	SURCHARGED
15 minute winter	Tank 2 in	10	40.162	0.117	99.2	0.1325	0.0000	OK
30 minute winter	Tank 2 out	25	39.515	0.345	69.5	24.0015	0.0000	SURCHARGED
30 minute winter	11	25	39.512	1.219	51.9	3.1035	0.0000	SURCHARGED
15 minute summer	Outfall 2	1	38.284	0.000	28.1	0.0000	0.0000	OK
15 minute summer	13	1	40.720	0.000	0.0	0.0000	0.0000	OK
30 minute winter	14	23	39.541	0.604	15.4	1.1736	0.0000	SURCHARGED
15 minute summer	15	1	38.340	0.000	0.0	0.0000	0.0000	OK
15 minute winter	16	14	37.790	0.156	7.5	0.2157	0.0000	SURCHARGED
30 minute winter	17	24	37.674	0.688	7.5	0.7782	0.0000	SURCHARGED
30 minute winter	18	24	39.529	0.775	13.0	0.8760	0.0000	SURCHARGED
30 minute winter	19	25	39.519	0.949	10.5	1.0730	0.0000	SURCHARGED
30 minute winter	20	25	39.513	1.119	14.8	1.2655	0.0000	SURCHARGED
15 minute winter	2	11	40.570	0.385	61.7	1.3986	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)
15 minute winter	1	5.000	3	52.6	1.324	1.306	0.2123	
15 minute winter	3	5.001	Tank 1 in	52.3	2.028	1.288	0.0965	
15 minute winter	Tank 1 in	5.002	Tank 1 out	45.5	2.853	0.237	0.1488	
15 minute winter	Tank 1 in	Orifice	Tank 1 out	6.7				3.8
30 minute winter	Tank 1 out	5.003	6	37.3	1.105	0.934	0.2477	
30 minute winter	6	Hydro-Brake®	Outfall 1	23.1				45.6
15 minute winter	7	3.000	8	40.7	2.311	1.208	0.0460	
15 minute winter	8	2.001	Tank 2 in	99.2	2.887	0.699	0.0481	
15 minute winter	Tank 2 in	2.002	Tank 2 out	86.3	4.314	0.387	0.1167	
15 minute winter	Tank 2 in	Orifice	Tank 1 out	13.3				6.7
30 minute winter	Tank 2 out	2.003	11	51.9	1.077	0.718	0.0991	
30 minute winter	11	Hydro-Brake®	Outfall 2	28.1				62.7
15 minute summer	13	1.000	14	0.0	0.000	0.000	0.4034	
30 minute winter	14	1.001	18	11.4	1.006	0.644	0.3250	
15 minute summer	15	4.000	16	0.0	0.000	0.000	0.1510	
15 minute winter	16	4.001	17	7.3	1.127	0.934	0.3015	
30 minute winter	17	4.002	6	5.7	0.876	0.725	0.1491	
30 minute winter	18	1.002	19	10.5	0.952	0.593	0.3261	
30 minute winter	19	1.003	20	12.9	0.883	0.727	0.1784	
30 minute winter	20	1.004	11	15.2	0.561	0.376	0.1710	
15 minute winter	2	2.000	8	58.5	1.472	1.460	0.1528	

Results for 100 year +35% CC Critical Storm Duration. Lowest mass balance: 99.51%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	1	11	38.885	0.700	94.2	2.3179	0.0000	SURCHARGED
15 minute summer	Outfall 1	1	36.515	0.000	23.1	0.0000	0.0000	OK
15 minute winter	3	11	38.581	0.429	90.4	0.4847	0.0000	SURCHARGED
30 minute winter	Tank 1 in	29	38.339	0.211	72.5	0.2381	0.0000	OK
30 minute winter	Tank 1 out	29	38.336	1.008	93.1	43.7272	0.0000	SURCHARGED
30 minute winter	6	29	38.321	1.781	40.7	4.5328	0.0000	SURCHARGED
15 minute winter	7	11	41.668	1.338	76.0	3.9980	0.0000	FLOOD RISK
15 minute winter	8	11	40.892	0.730	168.1	0.8251	0.0000	SURCHARGED
15 minute winter	Tank 2 in	12	40.235	0.190	167.8	0.2154	0.0000	OK
30 minute winter	Tank 2 out	28	40.121	0.951	116.6	55.8298	0.0000	SURCHARGED
30 minute winter	11	28	40.118	1.825	56.7	4.6440	0.0000	SURCHARGED
15 minute summer	Outfall 2	1	38.284	0.000	28.1	0.0000	0.0000	OK
15 minute summer	13	1	40.720	0.000	0.0	0.0000	0.0000	OK
30 minute winter	14	28	40.144	1.207	21.3	2.9890	0.0000	SURCHARGED
30 minute winter	15	30	38.363	0.023	0.4	0.0264	0.0000	OK
30 minute winter	16	30	38.360	0.726	10.2	1.3673	0.0000	SURCHARGED
30 minute winter	17	29	38.334	1.348	7.4	1.5251	0.0000	SURCHARGED
30 minute winter	18	28	40.135	1.381	13.1	1.5614	0.0000	SURCHARGED
30 minute winter	19	28	40.124	1.554	10.4	1.7576	0.0000	SURCHARGED
30 minute winter	20	28	40.118	1.724	14.9	1.9502	0.0000	SURCHARGED
15 minute winter	2	11	41.207	1.022	108.2	3.7157	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)
15 minute winter	1	5.000	3	90.4	2.273	2.244	0.2173	
15 minute winter	3	5.001	Tank 1 in	90.7	2.622	2.233	0.1195	
30 minute winter	Tank 1 in	5.002	Tank 1 out	61.8	2.838	0.322	0.2332	
30 minute winter	Tank 1 in	Orifice	Tank 1 out	11.5				9.6
30 minute winter	Tank 1 out	5.003	6	40.7	1.138	1.020	0.2477	
30 minute winter	6	Hydro-Brake®	Outfall 1	23.1				83.4
15 minute winter	7	3.000	8	67.3	3.822	1.997	0.0460	
15 minute winter	8	2.001	Tank 2 in	167.8	4.286	1.181	0.0600	
15 minute winter	Tank 2 in	2.002	Tank 2 out	141.5	4.483	0.635	0.1671	
15 minute winter	Tank 2 in	Orifice	Tank 1 out	27.6				13.4
30 minute winter	Tank 2 out	2.003	11	56.7	1.112	0.785	0.0991	
30 minute winter	11	Hydro-Brake®	Outfall 2	28.1				108.5
15 minute summer	13	1.000	14	0.0	0.000	0.000	0.4034	
30 minute winter	14	1.001	18	13.1	1.005	0.740	0.3250	
30 minute winter	15	4.000	16	-0.4	-0.074	-0.047	0.1935	
30 minute winter	16	4.001	17	6.7	1.090	0.854	0.3015	
30 minute winter	17	4.002	6	5.4	0.870	0.684	0.1491	
30 minute winter	18	1.002	19	10.0	0.925	0.566	0.3261	
30 minute winter	19	1.003	20	12.7	0.863	0.718	0.1784	
30 minute winter	20	1.004	11	15.1	0.610	0.374	0.1710	
15 minute winter	2	2.000	8	100.9	2.536	2.515	0.1528	

Appendix F – SuDs Proforma

HILLINGDON LONDON

GREATER LONDON AUTHORITY

LoDEG

1. Project & Site Details

Project / Site Name (including sub-catchment / stage / phase where appropriate)	Hayes Park - Stage 2
Address & post code	Hayes Park, Hayes End Road, Hayes, UB4 8FE
OS Grid ref. (Easting, Northing)	E 508877
	N 182442
LPA reference (if applicable)	
Brief description of proposed work	The proposed development will bring two long-term vacant office buildings for the purpose of Offfices (class E) and Residential (Class C3)
Total site Area	37300 m^2
Total existing impervious area	5170 m^2
Total proposed impervious area	5170 m^2
Is the site in a surface water flood risk catchment (ref. local Surface Water Management Plan)?	N/a, Areas of Low risk according to DEFRA data
Existing drainage connection type and location	Connection to Thames Water Surface Water and Foul Water Networks
Designer Name	Tom Tosetti
Designer Position	Graduate Civil Engineer
Designer Company	Whitby Wood

2. Proposed Discharge Arrangements

2a. Infiltration Feasibility

Superficial geology classification	Boyn Hill Gravel Member (Sand and Gravel)	
Bedrock geology classification	London Clay Formation (Clay, Silt and Sand)	
Site infiltration rate	N/A	m/s
Depth to groundwater level	N/A	m below ground level
Is infiltration feasible?	No	

2b. Drainage Hierarchy

	Feasible (Y/N)	*Proposed (Y/N)*
1 store rainwater for later use	N	N
2 use infiltration techniques, such as porous surfaces in non-clay areas	N	N
3 attenuate rainwater in ponds or open water features for gradual release	N	N
4 attenuate rainwater by storing in tanks or sealed water features for gradual release	Y	Y
5 discharge rainwater direct to a watercourse	N	N
6 discharge rainwater to a surface water sewer/drain	Y	Y
7 discharge rainwater to the combined sewer.	N	N

2c. Proposed Discharge Details

Proposed discharge location	Exisiting Surface and Foul Water network
Has the owner/regulator of the discharge location been consulted?	quiry with Thames Water has been submitt

3. Drainage Strategy

3a. Discharge Rates & Required Storage

	Greenfield (GF) runoff rate (l/s)	*Existing discharge rate (l/s)*	*Required storage for GF rate (m^3)*	*Proposed discharge rate (l/s)*
Qbar	2.18			
1 in 1	1.85	102.2	90	51.1
1 in 30	5.01	241.6	90	51.1
1 in 100	6.95	306.3	90	51.1
1 in 100 + CC			90	51.1
Climate change allowance used		40%		
3b. Principal Method of Flow Control		HydroBrake		

3c. Proposed SuDS Measures

	Catchment area (m^2)	*Plan area (m^2)*	*Storage vol. (m^3)*
Rainwater harvesting	0		0
Infiltration systems	0		0
Green roofs	0	0	0
Blue roofs	0	0	0
Filter strips	0	0	0
Filter drains	30	0	n/a
Bioretention / tree pits	0	0	0
Pervious pavements	0	0	0
Swales	0	0	0
Basins/ponds	0	0	0
Attenuation tanks	5170		97
Total	**5200**	**0**	**97**

4. Supporting Information

4a. Discharge & Drainage Strategy	*Page/section of drainage report*
Infiltration feasibility (2a) – geotechnical factual and interpretive reports, including infiltration results	To be conducted at a later stage
Drainage hierarchy (2b)	Section 3.1.1
Proposed discharge details (2c) – utility plans, correspondence / approval from owner/regulator of discharge location	Section 3
Discharge rates & storage (3a) – detailed hydrologic and hydraulic calculations	Appendix G
Proposed SuDS measures & specifications (3b)	Section 4
4b. Other Supporting Details	*Page/section of drainage report*
Detailed Development Layout	Appendix G
Detailed drainage design drawings, including exceedance flow routes	Appendix G
Detailed landscaping plans	Appendix G
Maintenance strategy	Section 4
Demonstration of how the proposed SuDS measures improve:	
a) water quality of the runoff?	Section 3
b) biodiversity?	Section 3
c) amenity?	Section 3

whitby wood

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