Appendix G – Preliminary Drainage Layout

DO NOT SCALE: CONTRACTOR TO CHECK ALL DIMENSIONS AND REPORT ANY OMISSIONS OR ERRORS

NOTES

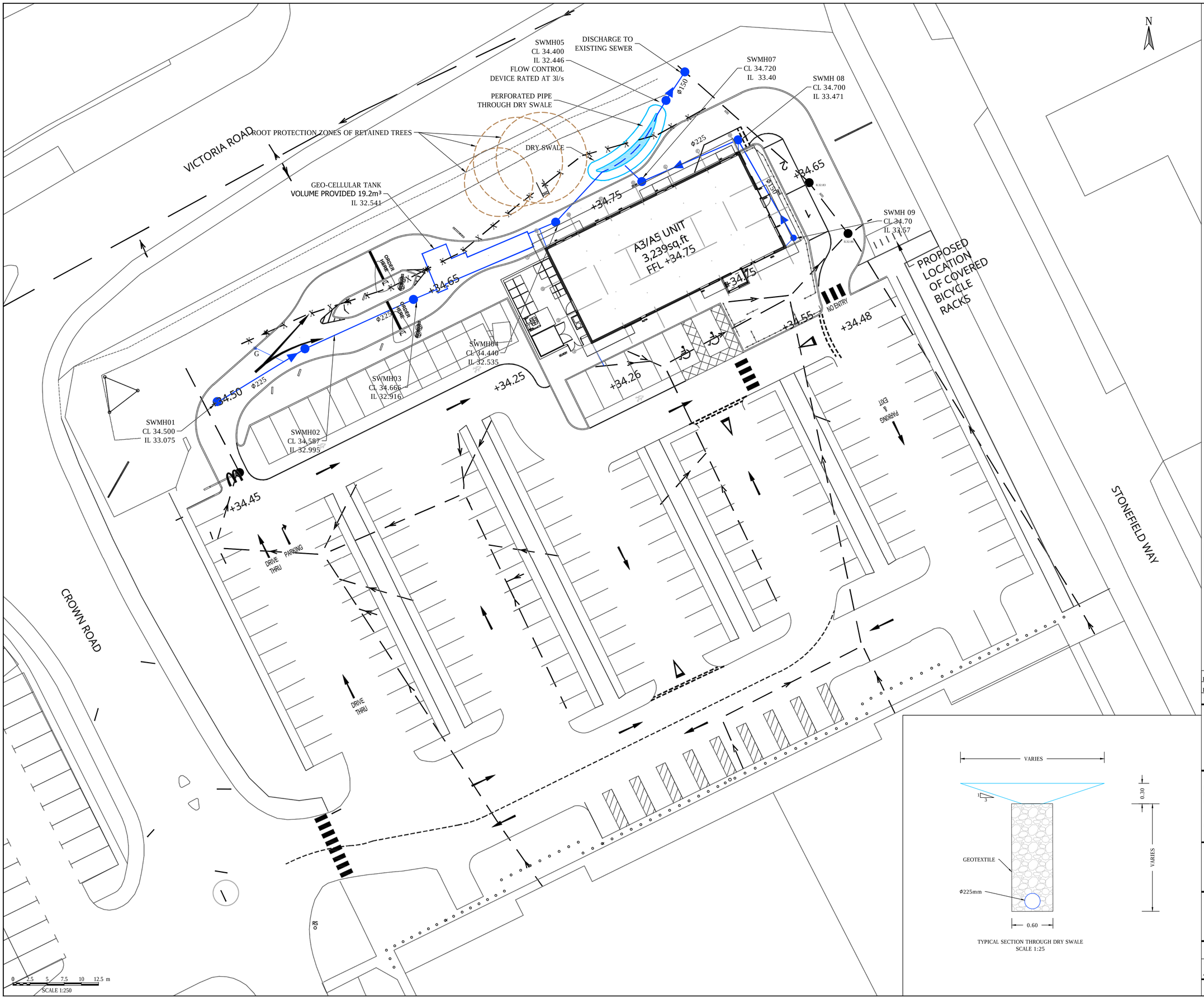
1. UNLESS NOTED OTHERWISE, ALL DIMENSIONS ARE IN METRES.
2. ALL LEVELS ARE IN METRES RELATIVE TO ORDNANCE DATUM
3. PROPOSED LAYOUT BY URBAN DESIGN LTD, DRAWING URB-DT 08 00 03, DATED FEB 2018
4. TOPOGRAPHICAL SURVEY PROVIDED BY WYG.

THIS DRAWING IS FOR PLANNING PURPOSES ONLY AND IS SUBJECT TO FURTHER DETAILED DESIGN

ALL LEVELS TO BE CONFIRMED

KEY

- PROPOSED SURFACE WATER DRAINAGE
- EXISTING SURFACE WATER DRAINAGE
- X X SURFACE WATER DRAIN TO BE ABANDONED
- RAIN WATER PIPE



TYPICAL SECTION THROUGH DRY SWALE
SCALE 1:25

FOR INFORMATION ONLY

REV	DESCRIPTION	BY	CHK	APP	DATE
P2	REVISED DUE TO RETAINED TREES	FA	TB	TB	21.03.2018
P1	INITIAL ISSUE	OC			

ARNDALE COURT
HEADINGLEY
LEEDS
LS6 2UJ

TEL: +44 (0)113 278 7111
FAX: +44 (0)113 278 3487
e-mail: leeds@wyg.com

Project:
MCDONALDS DRIVE THROUGH
SOUTH RUISLIP

Drawing Title:
PROPOSED SURFACE WATER DRAINAGE

Scale @ A1	Drawn	Date	Checked	Date	Approved	Date
1:250	OC	MAR 18	FA	MAR 18	TB	MAR 18

Project No.	Office	Type	Drawing No.	Revision
A098537-1	21	C	D100	P2

© WYG Group Ltd.

Appendix H – Supporting Micro Drainage Calculations

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	30	PIMP (%)	100
M5-60 (mm)	20.500	Add Flow / Climate Change (%)	0
Ratio R	0.429	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.116	4-8	0.014

Total Area Contributing (ha) = 0.131

Total Pipe Volume (m³) = 4.472

Network Design Table for Storm

« - Indicates pipe capacity < flow

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	15.904	0.080	200.0	0.010	2.00	0.0	0.600	o	225	Pipe/Conduit	
1.001	15.801	0.079	198.8	0.015	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.002	13.149	0.065	201.1	0.018	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.003	10.532	0.053	200.0	0.018	0.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	50.00	2.29	33.075	0.010	0.0	0.0	0.0	0.92	36.6	1.4
1.001	50.00	2.57	32.995	0.025	0.0	0.0	0.0	0.92	36.7	3.4
1.002	50.00	2.81	32.916	0.043	0.0	0.0	0.0	0.92	36.5	5.8
1.003	50.00	3.00	32.530	0.061	0.0	0.0	0.0	0.92	36.6	8.3

©1982-2016 XP Solutions

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
2.000	10.873	0.072	150.0	0.015	2.00	0.0	0.600	o	150	Pipe/Conduit	
3.000	15.241	0.122	124.9	0.015	2.00	0.0	0.600	o	150	Pipe/Conduit	
2.001	15.330	0.077	200.0	0.020	0.00	0.0	0.600	o	225	Pipe/Conduit	
2.002	3.564	0.018	200.0	0.015	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.004	3.828	0.019	200.0	0.005	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.005	9.864	0.066	150.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
1.006	2.585	0.013	200.0	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
2.000	50.00	2.22	33.300	0.015	0.0	0.0	0.0	0.82	14.5	2.0
3.000	50.00	2.28	33.350	0.015	0.0	0.0	0.0	0.90	15.9	2.0
2.001	50.00	2.56	33.153	0.050	0.0	0.0	0.0	0.92	36.6	6.8
2.002	50.00	2.62	33.076	0.065	0.0	0.0	0.0	0.92	36.6	8.8
1.004	50.00	3.07	32.477	0.131	0.0	0.0	0.0	0.92	36.6	17.7
1.005	50.00	3.27	32.458	0.131	0.0	0.0	0.0	0.82	14.5«	17.7
1.006	50.00	3.30	32.392	0.131	0.0	0.0	0.0	1.72	485.8	17.7

©1982-2016 XP Solutions

Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	Pipe Out PN	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	Pipes In PN	Pipes In Invert Level (m)	Pipes In Diameter (mm)	Backdrop (mm)
1	34.500	1.425	Open Manhole	1200	1.000	33.075	225				
3	34.587	1.592	Open Manhole	1200	1.001	32.995	225	1.000	32.995	225	
4	34.666	1.750	Open Manhole	1200	1.002	32.916	225	1.001	32.916	225	
5	34.690	2.160	Open Manhole		1.003	32.530	225	1.002	32.851	225	321
6	34.650	1.350	Open Manhole	1200	2.000	33.300	150				
6	34.700	1.350	Open Manhole	1200	3.000	33.350	150				
7	34.700	1.547	Open Manhole	1200	2.001	33.153	225	2.000	33.228	150	
								3.000	33.228	150	
7	34.700	1.624	Open Manhole		2.002	33.076	225	2.001	33.076	225	
6	34.700	2.223	Junction	0	1.004	32.477	225	1.003	32.477	225	
								2.002	33.059	225	582
9	34.692	2.234	Open Manhole	1200	1.005	32.458	150	1.004	32.458	225	
7	34.683	2.291	Open Manhole	1500	1.006	32.392	600	1.005	32.392	150	
	34.000	1.621	Open Manhole	450		OUTFALL		1.006	32.379	600	

©1982-2016 XP Solutions

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., L*W (mm)
1.000	o	225	1	34.500	33.075	1.200	Open Manhole	1200
1.001	o	225	3	34.587	32.995	1.367	Open Manhole	1200
1.002	o	225	4	34.666	32.916	1.525	Open Manhole	1200
1.003	o	225	5	34.690	32.530	1.935	Open Manhole	1200
2.000	o	150	6	34.650	33.300	1.200	Open Manhole	1200
3.000	o	150	6	34.700	33.350	1.200	Open Manhole	1200
2.001	o	225	7	34.700	33.153	1.322	Open Manhole	1200
2.002	o	225	7	34.700	33.076	1.399	Open Manhole	1200
1.004	o	225	6	34.700	32.477	1.998	Junction	
1.005	o	150	9	34.692	32.458	2.084	Open Manhole	1200
1.006	o	600	7	34.683	32.392	1.691	Open Manhole	1500

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	15.904	200.0	3	34.587	32.995	1.367	Open Manhole	1200
1.001	15.801	198.8	4	34.666	32.916	1.525	Open Manhole	1200
1.002	13.149	201.1	5	34.690	32.851	1.614	Open Manhole	1200
1.003	10.532	200.0	6	34.700	32.477	1.998	Junction	
2.000	10.873	150.0	7	34.700	33.228	1.322	Open Manhole	1200
3.000	15.241	124.9	7	34.700	33.228	1.322	Open Manhole	1200
2.001	15.330	200.0	7	34.700	33.076	1.399	Open Manhole	1200
2.002	3.564	200.0	6	34.700	33.059	1.416	Junction	
1.004	3.828	200.0	9	34.692	32.458	2.009	Open Manhole	1200
1.005	9.864	150.0	7	34.683	32.392	2.141	Open Manhole	1500
1.006	2.585	200.0		34.000	32.379	1.021	Open Manhole	450

©1982-2016 XP Solutions

Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	-	-	100	0.010	0.010	0.010
1.001	-	-	100	0.015	0.015	0.015
1.002	-	-	100	0.018	0.018	0.018
1.003	-	-	100	0.018	0.018	0.018
2.000	-	-	100	0.015	0.015	0.015
3.000	-	-	100	0.015	0.015	0.015
2.001	-	-	100	0.020	0.020	0.020
2.002	-	-	100	0.015	0.015	0.015
1.004	User	-	37	0.012	0.005	0.005
1.005	-	-	100	0.000	0.000	0.000
1.006	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				0.138	0.131	0.131

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)
1.006		34.000	32.379	0.000	450	0

Simulation Criteria for Storm

Volumetric Runoff Coeff	1.000	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coeffiecient	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)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

Number of Input Hydrographs	0	Number of Storage Structures	2
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	FEH
Return Period (years)	30
FEH Rainfall Version	1999
Site Location	GB 511850 185500 TQ 11850 85500
C (1km)	-0.025
D1 (1km)	0.295
D2 (1km)	0.353
D3 (1km)	0.233
E (1km)	0.311
F (1km)	2.531
Summer Storms	Yes

©1982-2016 XP Solutions

Synthetic Rainfall Details

Winter Storms	No
Cv (Summer)	1.000
Cv (Winter)	0.840
Storm Duration (mins)	30

©1982-2016 XP Solutions

Online Controls for Storm

Hydro-Brake® Optimum Manhole: 9, DS/PN: 1.005, Volume (m³): 2.7

Unit Reference	MD-SHE-0069-3000-2100-3000
Design Head (m)	2.100
Design Flow (l/s)	3.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	69
Invert Level (m)	32.458
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	2.100	3.0
Flush-Flo™	0.306	2.1
Kick-Flo®	0.622	1.7
Mean Flow over Head Range	-	2.3

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	1.8	1.200	2.3	3.000	3.5	7.000	5.3
0.200	2.1	1.400	2.5	3.500	3.8	7.500	5.4
0.300	2.1	1.600	2.6	4.000	4.0	8.000	5.6
0.400	2.1	1.800	2.8	4.500	4.3	8.500	5.8
0.500	2.0	2.000	2.9	5.000	4.5	9.000	5.9
0.600	1.8	2.200	3.1	5.500	4.7	9.500	6.1
0.800	1.9	2.400	3.2	6.000	4.9		
1.000	2.1	2.600	3.3	6.500	5.1		

©1982-2016 XP Solutions

Storage Structures for Storm

Tank or Pond Manhole: 5, DS/PN: 1.003

Invert Level (m) 32.530

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	20.0	0.600	20.0

Dry Swale Manhole: 6, DS/PN: 1.004

Warning:- Volume should always be included unless the upstream pipe is being used for storage and/or as a carrier

Infiltration Coefficient Base (m/hr)	0.00000	Trench Infiltration Side (m/hr)	0.00000
Infiltration Coefficient Side (m/hr)	0.00000	Trench Porosity	0.30
Safety Factor	2.0	Side Slope (1:X)	3.0
Porosity	1.00	Slope (1:X)	200.0
Invert Level (m)	32.477	Cap Volume Depth (m)	0.000
Trench Height (m)	1.570	Cap Infiltration Depth (m)	0.000
Trench Width (m)	0.3	Include Swale Volume	Yes
Trench Length (m)	10.6		

©1982-2016 XP Solutions

1 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 Coeffiecient 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 2
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	FEH
FEH Rainfall Version	1999
Site Location	GB 511850 185500 TQ 11850 85500
C (1km)	-0.025
D1 (1km)	0.295
D2 (1km)	0.353
D3 (1km)	0.233
E (1km)	0.311
F (1km)	2.531
Cv (Summer)	1.000
Cv (Winter)	1.000

Margin for Flood Risk Warning (mm) 300.0
Analysis Timestep 2.5 Second Increment (Extended)
DTS Status ON
DVD Status ON
Inertia Status ON

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years) 1, 2, 30, 100
Climate Change (%) 0, 0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	1	15 Summer	1	+0%	30/15 Summer	100/15 Summer			33.118
1.001	3	15 Summer	1	+0%	30/15 Summer				33.054
1.002	4	15 Summer	1	+0%	30/15 Summer				32.991
1.003	5	60 Summer	1	+0%	1/15 Summer				32.923
2.000	6	15 Summer	1	+0%	30/15 Summer				33.358
3.000	6	15 Summer	1	+0%	30/15 Summer				33.403
2.001	7	15 Summer	1	+0%	30/15 Summer				33.244
2.002	7	15 Summer	1	+0%	30/15 Summer				33.192
1.004	6	60 Summer	1	+0%	1/15 Summer				32.924
1.005	9	60 Summer	1	+0%	1/15 Summer				32.923
1.006	7	30 Summer	1	+0%					32.442

©1982-2016 XP Solutions

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

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1	-0.182	0.000	0.08		2.7	OK	14
1.001	3	-0.166	0.000	0.15		4.9	OK	
1.002	4	-0.150	0.000	0.25		7.8	OK	
1.003	5	0.168	0.000	0.07		2.0	SURCHARGED	
2.000	6	-0.092	0.000	0.31		4.1	OK	
3.000	6	-0.097	0.000	0.28		4.0	OK	
2.001	7	-0.134	0.000	0.34		10.9	OK	
2.002	7	-0.110	0.000	0.52		13.4	OK	
1.004	6	0.222	0.000	0.10		3.1	SURCHARGED*	
1.005	9	0.315	0.000	0.17		2.1	SURCHARGED	
1.006	7	-0.550	0.000	0.01		2.1	OK	

©1982-2016 XP Solutions

2 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 Coeffiecient 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 2
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	FEH
FEH Rainfall Version	1999
Site Location	GB 511850 185500 TQ 11850 85500
C (1km)	-0.025
D1 (1km)	0.295
D2 (1km)	0.353
D3 (1km)	0.233
E (1km)	0.311
F (1km)	2.531
Cv (Summer)	1.000
Cv (Winter)	1.000

Margin for Flood Risk Warning (mm) 300.0
Analysis Timestep 2.5 Second Increment (Extended)
DTS Status ON
DVD Status ON
Inertia Status ON

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years) 1, 2, 30, 100
Climate Change (%) 0, 0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	1	15 Summer	2	+0%	30/15 Summer	100/15 Summer			33.124
1.001	3	15 Summer	2	+0%	30/15 Summer				33.062
1.002	4	60 Winter	2	+0%	30/15 Summer				33.049
1.003	5	60 Winter	2	+0%	1/15 Summer				33.048
2.000	6	15 Summer	2	+0%	30/15 Summer				33.366
3.000	6	15 Summer	2	+0%	30/15 Summer				33.411
2.001	7	15 Summer	2	+0%	30/15 Summer				33.257
2.002	7	15 Summer	2	+0%	30/15 Summer				33.210
1.004	6	60 Winter	2	+0%	1/15 Summer				33.048
1.005	9	60 Winter	2	+0%	1/15 Summer				33.048
1.006	7	30 Summer	2	+0%					32.442

©1982-2016 XP Solutions

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

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1	-0.176	0.000	0.10		3.4	OK	14
1.001	3	-0.158	0.000	0.19		6.2	OK	
1.002	4	-0.092	0.000	0.14		4.5	OK	
1.003	5	0.293	0.000	0.07		2.0	SURCHARGED	
2.000	6	-0.084	0.000	0.40		5.2	OK	
3.000	6	-0.089	0.000	0.35		5.1	OK	
2.001	7	-0.121	0.000	0.43		13.8	OK	
2.002	7	-0.091	0.000	0.65		17.0	OK	
1.004	6	0.346	0.000	0.10		2.8	SURCHARGED*	
1.005	9	0.440	0.000	0.17		2.1	SURCHARGED	
1.006	7	-0.550	0.000	0.01		2.1	OK	

©1982-2016 XP Solutions

30 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 Coeffiecient	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	2
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	FEH
FEH Rainfall Version	1999
Site Location	GB 511850 185500 TQ 11850 85500
C (1km)	-0.025
D1 (1km)	0.295
D2 (1km)	0.353
D3 (1km)	0.233
E (1km)	0.311
F (1km)	2.531
Cv (Summer)	1.000
Cv (Winter)	1.000

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	ON
DVD Status	ON
Inertia Status	ON

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years)	1, 2, 30, 100
Climate Change (%)	0, 0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
1.000	1	120 Winter	30	+0%	30/15 Summer	100/15 Summer		
1.001	3	120 Winter	30	+0%	30/15 Summer			
1.002	4	120 Winter	30	+0%	30/15 Summer			
1.003	5	120 Winter	30	+0%	1/15 Summer			
2.000	6	120 Winter	30	+0%	30/15 Summer			
3.000	6	120 Winter	30	+0%	30/15 Summer			
2.001	7	120 Winter	30	+0%	30/15 Summer			
2.002	7	120 Winter	30	+0%	30/15 Summer			
1.004	6	120 Winter	30	+0%	1/15 Summer			
1.005	9	120 Winter	30	+0%	1/15 Summer			
1.006	7	120 Winter	30	+0%				

©1982-2016 XP Solutions

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

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1	33.781	0.481	0.000	0.04		1.3	SURCHARGED	14
1.001	3	33.780	0.560	0.000	0.09		2.9	SURCHARGED	
1.002	4	33.779	0.638	0.000	0.15		4.6	SURCHARGED	
1.003	5	33.778	1.023	0.000	0.06		1.8	SURCHARGED	
2.000	6	33.781	0.331	0.000	0.17		2.2	SURCHARGED	
3.000	6	33.781	0.281	0.000	0.15		2.2	SURCHARGED	
2.001	7	33.780	0.402	0.000	0.22		7.1	SURCHARGED	
2.002	7	33.778	0.477	0.000	0.34		8.9	SURCHARGED	
1.004	6	33.778	1.076	0.000	0.09		2.6	SURCHARGED*	
1.005	9	33.777	1.169	0.000	0.19		2.4	SURCHARGED	
1.006	7	32.442	-0.550	0.000	0.01		2.4	OK	

©1982-2016 XP Solutions

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 * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	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	2
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	FEH
FEH Rainfall Version	1999
Site Location	GB 511850 185500 TQ 11850 85500
C (1km)	-0.025
D1 (1km)	0.295
D2 (1km)	0.353
D3 (1km)	0.233
E (1km)	0.311
F (1km)	2.531
Cv (Summer)	1.000
Cv (Winter)	1.000

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	ON
DVD Status	ON
Inertia Status	ON

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 240, 360, 480, 960, 1440
Return Period(s) (years)	1, 2, 30, 100
Climate Change (%)	0, 0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
1.000	1	120 Winter	100	+40%	30/15 Summer	100/15 Summer		
1.001	3	60 Winter	100	+40%	30/15 Summer			
1.002	4	120 Winter	100	+40%	30/15 Summer			
1.003	5	60 Winter	100	+40%	1/15 Summer			
2.000	6	60 Winter	100	+40%	30/15 Summer			
3.000	6	60 Winter	100	+40%	30/15 Summer			
2.001	7	60 Winter	100	+40%	30/15 Summer			
2.002	7	60 Winter	100	+40%	30/15 Summer			
1.004	6	60 Winter	100	+40%	1/15 Summer			
1.005	9	60 Winter	100	+40%	1/15 Summer			
1.006	7	60 Winter	100	+40%				

©1982-2016 XP Solutions

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

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1	34.518	1.218	17.935	0.09		2.8	FLOOD	14
1.001	3	34.538	1.318	0.000	0.24		7.8	FLOOD RISK	
1.002	4	34.562	1.421	0.000	0.28		8.7	FLOOD RISK	
1.003	5	34.580	1.825	0.000	0.11		3.2	FLOOD RISK	
2.000	6	34.609	1.159	0.000	0.42		5.4	FLOOD RISK	
3.000	6	34.610	1.110	0.000	0.40		5.8	FLOOD RISK	
2.001	7	34.604	1.226	0.000	0.55		17.7	FLOOD RISK	
2.002	7	34.595	1.294	0.000	0.89		23.2	FLOOD RISK	
1.004	6	34.591	1.889	0.000	0.15		4.6	FLOOD RISK*	
1.005	9	34.601	1.993	0.000	0.23		3.0	FLOOD RISK	
1.006	7	32.444	-0.548	0.000	0.01		3.0	OK	

©1982-2016 XP Solutions

Appendix I – Hillingdon LLFA SuDS Proforma

SuDS Flows and Volumes – Hillingdon LLFA Technical Assessment Proforma

2.15 Design level used for surcharge water level at point of discharge(14).....34.4....mAOD

2.16 Provide outfall levels if discharging to a watercourse.....

CALCULATION OUTPUTS REQUIRED

Note: Sections 3 and 4 refer to site where storage is provided by attenuation and / or partial infiltration.
Where all flows are infiltrated to ground omit Sections 3 -5 and complete Section 6.

3.0 Defining rate of runoff from the site. These values must be calculated for each return period and should vary.

3.2 Max. discharge for 1 in 1 year rainfall ....3.6....l/s/ha, ...2.1....l/s for the site

3.2 Max. discharge for Q_{med} rainfall ....3.7....l/s/ha, ...2.1....l/s for the site

3.3 Max. discharge for 1 in 30 year rainfall ....9.7....l/s/ha, ...2.4....l/s for the site

3.4 Max. discharge for 1 in 100 year rainfall ....13.4....l/s/ha, ...2.8....l/s for the site

3.5 Max. discharge for 1 in 100 year plus 40%CC ....l/s/ha, ...3.0....l/s for the site

4.0 Attenuation storage to manage peak runoff rates from the site. These values must be calculated for each return period

4.1 Storage - 1 in 1 year ....4.6....m³ ....0.0033....m³/m² (of developed impermeable area)

4.2 Storage - 1in 30 year (7) ....9.4....m³ ....m³/m² 0.0068

4.3 Storage - 1in 100 year (8) ....14.2....m³ ....0.010....m³/m²

4.4 Storage - 1 in 100 year plus 40%CC (9) ....23.8....m³ ....0.017....m³/m²

5.0 Controlling volume of runoff from the site

5.1 Pre development runoff volume(10) ....54.38.... m³ for the site

5.2 Post development runoff volume (unmitigated) (10) ....57.29.... m³ for the site

5.3 Volume to be controlled/does not leave site (5.2 - 5.1)....2.91.... m³ for the site → But we now restrict to 3 l/s

5.4 Volume control provided by:
1. Interception losses(11) ....0....m³
2. Rain harvesting(12) ....0....m³
3. Infiltration (even at very low rates) ....0....m³
4. Separate area designated as long term storage(13) ....23.8....m³

5.5 Total volume control (sum of inputs for 5.4 (1-4) ....23.8....m³ (15)

6.0 Site storage volumes (full infiltration only) N/A

6.1 Storage - 1in 30 year (7) ....m³ ....m³/m² (of developed impermeable area)

6.2 Storage - 1 in 100 year plus CC (9) ....m³ ....m³/m²

SuDS Flows and Volumes – Hillingdon LLFA Technical Assessment Proforma

This form identifies the information required by the LLFA to enable technical assessment of flows and volumes determined as part of drainage / SuDS calculations.

*Note : * means delete as appropriate; Numbers in brackets refer to accompanying notes.*

SITE BACKGROUND INFORMATION

1.0 SITE DETAILS AND RELEVANT CLASSIFICIATIONS

1.1 Planning application reference ....NOT YET SUBMITTED....

1.2 Site name ....VICTORIA RETAIL PARK....

1.3 Total application site area (1) ....1700....m² ....0.17....ha

1.4 Is the site located in a area at SW flood risk, a CDA or LFRZ (see L.B. Hillingdon website SWMP) Y / N

1.5 Is the site located in a SPZ (refer to Environment Agency website Groundwater) Y / N

2.0 VOLUME AND FLOW DESIGN INPUTS

2.1 Site area which is positively drained by SuDS (2) ....0....m²

2.2 Impermeable area drained pre development (3) ....815....m²

2.3 Impermeable area drained post development (3) ....1380....m²

2.4 Additional impermeable area (2.3 minus 2.2) ....565....m²

2.5 Predevelopment use (4) Greenfield / Brownfield / Mixed*

2.6 Method of discharge (5) Infiltration / waterbody / storm sewer / combined sewer*

2.7 Infiltration rate (evidence to be supplied to BRE365 as minimum)....0....m/s

2.8 Influencing factors on infiltration ....LONDON CLAY....

2.9 Depth to highest known ground water table ....–....mAOD

2.10 Coefficient of runoff (Cv) (6) ....1.0....

The LLFA would typically anticipate a Cv of 0.95 from roofed areas and a Cv of 0.9 from other hard standing areas. These values should be applied for both summer and winter scenarios if using hydraulic design software

2.11 Justification for Cv used if less than this ....

2.12 FEH rainfall data used (for Hillingdon typical value 4l/s/ha (Note that FSR not to be used)) Y / N

2.13 Will storage be subject to surcharge by elevated water levels in watercourse / sewer Y / N

2.14 Invert level at outlet (invert level of final flow control) ....32.392....mAOD