IL 86.365
HW
CL 87.000
IL 86.400
n o r t h
150mØ
CL 87.800
IL 87.000
IL 86.800
150mØ HYDROBRAKE
CL 87.750
IL 87.030
150mØ
CL 87.650
IL 87.000
Pervious Pavement
Area: 2556m²
Depth: 0.40 m
Total Volume: 312 m³
Existing IDB ditch (ordinary watercourse) to be permanently culverted within development footprint in two locations. This will require land drainage consent once planning permission obtained.
It is proposed construction materials are used to raise the access level by a minimum of 300mm to ensure the proposed permanent operational access is above the surface water flood level during the lifetime of the development
Pervious Pavement
Area: 2759m²
Depth: 0.40 m
Total Volume: 331 m³
150mØ HYDROBRAKE
CL 88.900
IL 88.190
Glass reinforced cement headwall outfall for 150mmØ pipe installed in accordance with manufacturers requirements
CL 88.800
IL 88.050
The EA surface water flood mapping does not consider the presence of the culvert under the disused railway track in this location, therefore the flooding appears worse than it would actually be.
Existing IDB ditch (ordinary watercourse) to be temporarily culverted within development footprint in three locations. This will require land drainage consent once planning permission obtained.
HV 400kV
ELE
HV 132kV
0 20 40 60 80m
SCALE IN METRES
1:1000

Existing IDB ditch (ordinary watercourse) to be temporarily culverted within development footprint in three locations. This will require land drainage consent once planning permission obtained.
It is proposed construction materials are used to raise the access level by a minimum of 300mm to ensure the proposed permanent operational access is above the surface water flood level during the lifetime of the development
The EA surface water flood mapping does not consider the presence of a culvert under the disused railway track in this location, therefore the flooding appears worse than it would actually be. Also, during the 40-year lifetime of the development, Statkraft as the operator of the site will maintain the ditches and culvert associated with this location, and a management and maintenance plan has been submitted as part of the planning application in this regard. Should the temporary construction access be flooded, Statkraft will have the ability to either close the access and suspend work for the period that the temporary access is flooded until the flood water recedes or divert construction traffic to the existing disused railway track that will be raised by a minimum of 300mm during the first phase of the construction works. Lastly, it is proposed the temporary access (including the adjacent construction compound areas) design raises the level by a minimum of 300mm along its length, and ensures surface water flooding is not displaced to off-site areas.
It is proposed the temporary access (including the adjacent construction compound areas) design raises the level by a minimum of 300mm along its length, and ensures surface water flooding is not displaced to off-site areas. The temporary construction vehicle access road and construction compounds are to be built on crushed rock with a minimum 30% void ratio to facilitate the percolation and long term storage of surface water in these locations.
Drain
East Claydon Road
Station House
ETL
HV 400kV
ELE
HV 132kV
0 20 40 60 80m
SCALE IN METRES
1:1000

Notes

1. All levels and dimensions are to be checked on site before any work commences. All dimensions are in metres unless stated otherwise.
2. Any discrepancies shall be reported to the engineer immediately, so that clarification can be sought prior to the commencement of works.
3. This drawing shall be read in conjunction with all other relevant engineering details, drawings and specification.
4. The contractor is to keep a record of any variations made on site, including the relocation of sewers or drains, for their "as built" drawings to be prepared upon project completion.
5. All works to adopted systems are to be carried out in accordance with Sewerage Sector Guidance Appendix C, Approved Version 2.1, 25 May 2021. All works to private drainage systems are to be in accordance with the Building Regulations Approved Document Part "H" 2015 edition.
6. 900mm min cover to be provided for private pipes laid beneath agricultural land and public open space unless not practicable, 1200mm min cover to be provided for highways and parking areas with unrestricted access to vehicles with a gross vehicle weight in excess of 7.5 tonnes unless not practicable. Where unachievable, shallow private drains may require protection using ductile iron pipe, concrete surround or concrete slabs bridging the trench, subject to the NHBC inspector's requirements.
7. All pipes shall be laid soffit to soffit with outgoing pipes unless otherwise stated.
8. Manholes situated within areas accessible to motor vehicles are to be fitted with suitable strength covers and frames. Please refer to the manhole schedule for guidance on this.
9. This drawing has been based upon survey information supplied by Warner Surveys and Motion cannot guarantee the accuracy of the data provided.
10. Adjacent areas of hardstanding will comply with building regulations and divert water away from the buildings.
11. The top surface of the pervious pavement should finish at least 150mm below any adjoining DPC level. Advice should always be sought from the manufacturer.
12. Linear drainage channels are required to convey surface water for up to the 100 year + 45% climate change critical flow rate. Construction details and supporting calculations are to be provided at the detailed design stage.
13. The Drainage Strategy is based on preliminary levels and is subject to detailed design.
14. The exact location of all private rainwater pipes are to be confirmed with the architect details prior to commencement of works.
15. Check Dams will be required for the pervious pavement sub-bases and swales to maximise attenuation. Spacing and construction details to be provided at the detailed design stage.
16. The Type C no infiltration pervious pavement sub-base will drain to underlying surface water perforated collector pipes or diffuser units. Construction details are to be provided at the detailed design stage.
17. Purpose Designed Water Pollution Containment Device Chambers will be installed downstream of the last attenuation basins to contain site runoff such as fire water in an emergency.
18. The surface of the proposed main compound and substation areas should finish minimum of 150mm below any buildings and equipment. The scheme levels have been designed to achieve this requirement.

Legend

- Planning Site Boundary
- Proposed Type C no infiltration pervious pavement
- Proposed Type C no infiltration pervious pavement Lined with Impermeable Separating Geomembrane at the Sides and Base
- New Surface Water Gravity Pipe
- New Surface Water Catchpit Chamber
- New Surface Water Linear Drainage with Sump Unit
- Exceedance flow route
- New Surface Water Filter Drain with Perforated Collector Pipe and fill material that has a minimum 30% void ratio to facilitate the percolation and routing of surface water
- Proposed Swale
- Proposed Attenuation Basin
- New Surface Water Hydro-Brake Flow Control Chamber - Refer to MicroDrainage Calculations for 100 + 40% climate change critical flow rate
- Proposed Headwall
- EA Risk of Flooding from Rivers and Sea - Climate Change 1 - shows the overall risk, rather than the risk associated with a specific event or scenario - includes the 'Central' climate change allowance for the 2050s epoch (2040-2069) for risk of flooding from rivers - Last Updated 28 January 2025)
- EA Flood Map for Planning - Climate Change Extents (undefended) - shows the overall risk, rather than the risk associated with a specific event or scenario - includes the 'Central' climate change allowance for the 2080s epoch (2070-2125) for risk of flooding from rivers - Last Updated 25 March 2025)
- EA Risk of Flooding from Surface Water - Climate Change 1 - with Low Yearly Chance Extent Removed by Motion - shows the overall Medium and High risk, rather than the risk associated with a specific event or scenario - includes the 'Central' climate change allowance for the 2050s epoch (2040-2060) for the Medium and High risk of flooding from surface water - Last Updated 28 January 2025)
- New Purpose Designed Water Pollution Containment Device Chamber
- 8m LLFA Buffer Zone
- 9m IDB Buffer Zone
- 10m Ecological Buffer Zone

Rev.	Description	Drn	Chk	App	Date
P07	Seventh Issue	ST	CG	JM	23/04/2025
P06	Sixth Issue	ST	CG	JM	13/04/2025
P05	Fifth Issue	ST	CG	JM	08/04/2025
P04	Fourth Issue	ST	CG	JM	02/04/2025
P03	Third Issue	ST	CG	JM	07/03/2025
P02	Second Issue	ST	CG	JM	20/12/2024
P01	First Issue	ST	CG	JM	17/10/2024

Drawing Status:
FOR PLANNING
NOT FOR CONSTRUCTION

motion
Guildford - Reading - London
www.motion.co.uk

Client:
Lichfields

Project:
East Claydon Greener Grid Park

Title:
Proposed Drainage Strategy

Scale: 1:1000 (@ A1)

Drawing: 2404003-0501-02
Revision: P07

C:\Users\CGray\Motion\Staff\Site - 1\lec\ 2404003\Drawings\2404003-0501-01 & 02 P07 [Proposed Drainage Strategy].dwg

Appendix F

MicroDrainage Model Results

Summary of Results for 30 year Return Period (+35%)

Half Drain Time : 891 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	0.259	0.259	0.0	16.5	16.5	451.0	O K
30 min Summer	0.299	0.299	0.0	16.6	16.6	674.6	O K
60 min Summer	0.339	0.339	0.0	16.6	16.6	904.2	Flood Risk
120 min Summer	0.387	0.387	0.0	16.6	16.6	1178.8	Flood Risk
180 min Summer	0.412	0.412	0.0	16.6	16.6	1322.9	Flood Risk
240 min Summer	0.426	0.426	0.0	16.6	16.6	1406.7	Flood Risk
360 min Summer	0.439	0.439	0.0	16.6	16.6	1481.7	Flood Risk
480 min Summer	0.442	0.442	0.0	16.6	16.6	1498.8	Flood Risk
600 min Summer	0.440	0.440	0.0	16.6	16.6	1486.6	Flood Risk
720 min Summer	0.435	0.435	0.0	16.6	16.6	1457.6	Flood Risk
960 min Summer	0.424	0.424	0.0	16.6	16.6	1391.6	Flood Risk
1440 min Summer	0.403	0.403	0.0	16.6	16.6	1270.4	Flood Risk
2160 min Summer	0.377	0.377	0.0	16.6	16.6	1119.3	Flood Risk
2880 min Summer	0.355	0.355	0.0	16.6	16.6	993.0	Flood Risk
4320 min Summer	0.319	0.319	0.0	16.6	16.6	789.7	Flood Risk
5760 min Summer	0.291	0.291	0.0	16.6	16.6	629.3	O K
15 min Winter	0.271	0.271	0.0	16.5	16.5	516.5	O K
30 min Winter	0.315	0.315	0.0	16.6	16.6	768.1	Flood Risk
60 min Winter	0.361	0.361	0.0	16.6	16.6	1026.9	Flood Risk
120 min Winter	0.415	0.415	0.0	16.6	16.6	1340.2	Flood Risk
180 min Winter	0.444	0.444	0.0	16.6	16.6	1507.4	Flood Risk
240 min Winter	0.461	0.461	0.0	16.6	16.6	1607.3	Flood Risk
360 min Winter	0.477	0.477	0.0	16.6	16.6	1703.1	Flood Risk
480 min Winter	0.482	0.482	0.0	16.6	16.6	1734.2	Flood Risk
600 min Winter	0.482	0.482	0.0	16.6	16.6	1732.6	Flood Risk
720 min Winter	0.478	0.478	0.0	16.6	16.6	1711.7	Flood Risk
960 min Winter	0.466	0.466	0.0	16.6	16.6	1636.1	Flood Risk
1440 min Winter	0.439	0.439	0.0	16.6	16.6	1477.6	Flood Risk
2160 min Winter	0.402	0.402	0.0	16.6	16.6	1267.0	Flood Risk
2880 min Winter	0.370	0.370	0.0	16.6	16.6	1077.2	Flood Risk
4320 min Winter	0.315	0.315	0.0	16.6	16.6	763.9	Flood Risk
5760 min Winter	0.271	0.271	0.0	16.5	16.5	521.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	81.756	0.0	460.6	26
30 min Summer	58.320	0.0	692.3	41
60 min Summer	38.516	0.0	947.1	70
120 min Summer	25.252	0.0	1266.2	128
180 min Summer	19.224	0.0	1455.9	188
240 min Summer	15.653	0.0	1586.0	246
360 min Summer	11.509	0.0	1753.9	364
480 min Summer	9.166	0.0	1863.9	482
600 min Summer	7.650	0.0	1944.1	602
720 min Summer	6.584	0.0	2006.2	692
960 min Summer	5.171	0.0	2096.2	790
1440 min Summer	3.671	0.0	2218.0	1030
2160 min Summer	2.615	0.0	2370.1	1432
2880 min Summer	2.066	0.0	2480.3	1828
4320 min Summer	1.502	0.0	2670.3	2604
5760 min Summer	1.210	0.0	2842.0	3352
15 min Winter	81.756	0.0	526.0	26
30 min Winter	58.320	0.0	785.1	40
60 min Winter	38.516	0.0	1071.0	68
120 min Winter	25.252	0.0	1428.4	126
180 min Winter	19.224	0.0	1641.0	184
240 min Winter	15.653	0.0	1786.7	242
360 min Winter	11.509	0.0	1974.8	358
480 min Winter	9.167	0.0	2097.9	472
600 min Winter	7.650	0.0	2187.6	586
720 min Winter	6.584	0.0	2256.9	696
960 min Winter	5.171	0.0	2356.2	904
1440 min Winter	3.671	0.0	2478.6	1116
2160 min Winter	2.615	0.0	2673.2	1564
2880 min Winter	2.066	0.0	2799.6	1992
4320 min Winter	1.502	0.0	3019.5	2812
5760 min Winter	1.210	0.0	3217.8	3528

Rainfall Details

Rainfall Model	FEH	Winter Storms	Yes
Return Period (years)	30	Cv (Summer)	0.750
FEH Rainfall Version	2013	Cv (Winter)	0.840
Site Location	GB 474700 227450 SP 74700 27450	Shortest Storm (mins)	15
Data Type	Catchment	Longest Storm (mins)	5760
Summer Storms	Yes	Climate Change %	+35

Time Area Diagram

Total Area (ha) 3.578

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	1.193	4	8	1.193	8	12	1.193

Model Details

Storage is Online Cover Level (m) 0.600

Complex Structure

Swale

Infiltration Coefficient Base (m/hr)	0.00000	Invert Level (m)	0.000	Slope (1:X)	109.0
Infiltration Coefficient Side (m/hr)	0.00000	Base Width (m)	2.0	Cap Volume Depth (m)	0.000
Safety Factor	2.0	Length (m)	60.0	Cap Infiltration Depth (m)	0.000
Porosity	1.00	Side Slope (1:X)	3.0		

Tank or Pond

Invert Level (m) 0.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	85.0	0.600	182.0

Tank or Pond

Invert Level (m) 0.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	463.0	0.600	648.0

Porous Car Park

Infiltration Coefficient Base (m/hr)	0.00000	Porosity	0.30	Slope (1:X)	0.0
Membrane Percolation (mm/hr)	1000	Invert Level (m)	0.200	Depression Storage (mm)	5
Max Percolation (l/s)	4494.4	Width (m)	127.2	Evaporation (mm/day)	3
Safety Factor	2.0	Length (m)	127.2	Membrane Depth (m)	0

Swale

Infiltration Coefficient Base (m/hr)	0.00000	Invert Level (m)	0.300	Slope (1:X)	268.0
Infiltration Coefficient Side (m/hr)	0.00000	Base Width (m)	2.3	Cap Volume Depth (m)	0.000
Safety Factor	2.0	Length (m)	53.0	Cap Infiltration Depth (m)	0.000
Porosity	1.00	Side Slope (1:X)	3.0		

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0185-1660-0885-1660	Sump Available	Yes
Design Head (m)	0.885	Diameter (mm)	185
Design Flow (l/s)	16.6	Invert Level (m)	0.000
Flush-Flo™	Calculated	Minimum Outlet Pipe Diameter (mm)	225
Objective	Minimise upstream storage	Suggested Manhole Diameter (mm)	1200
Application	Surface		

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.885	16.6	Kick-Flo®	0.647	14.3
Flush-Flo™	0.311	16.6	Mean Flow over Head Range	-	13.9

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)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	6.5	0.600	15.1	1.600	22.0	2.600	27.8	5.000	38.0	7.500	46.3
0.200	16.1	0.800	15.8	1.800	23.3	3.000	29.7	5.500	39.8	8.000	47.8
0.300	16.6	1.000	17.6	2.000	24.5	3.500	32.0	6.000	41.6	8.500	49.2
0.400	16.4	1.200	19.2	2.200	25.6	4.000	34.2	6.500	43.2	9.000	50.3
0.500	16.0	1.400	20.6	2.400	26.7	4.500	36.2	7.000	44.8	9.500	51.7

Summary of Results for 30 year Return Period (+35%)

Half Drain Time : 1287 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	0.370	0.370	0.0	16.7	16.7	601.2	O K
30 min Summer	0.429	0.429	0.0	16.7	16.7	902.0	O K
60 min Summer	0.466	0.466	0.0	16.7	16.7	1215.8	O K
120 min Summer	0.510	0.510	0.0	16.7	16.7	1600.7	Flood Risk
180 min Summer	0.535	0.535	0.0	16.7	16.7	1812.4	Flood Risk
240 min Summer	0.550	0.550	0.0	16.7	16.7	1944.5	Flood Risk
360 min Summer	0.567	0.567	0.0	16.7	16.7	2085.5	Flood Risk
480 min Summer	0.574	0.574	0.0	16.7	16.7	2149.5	Flood Risk
600 min Summer	0.577	0.577	0.0	16.7	16.7	2173.7	Flood Risk
720 min Summer	0.577	0.577	0.0	16.7	16.7	2173.8	Flood Risk
960 min Summer	0.572	0.572	0.0	16.7	16.7	2128.6	Flood Risk
1440 min Summer	0.557	0.557	0.0	16.7	16.7	2003.5	Flood Risk
2160 min Summer	0.539	0.539	0.0	16.7	16.7	1847.8	Flood Risk
2880 min Summer	0.524	0.524	0.0	16.7	16.7	1713.9	Flood Risk
4320 min Summer	0.498	0.498	0.0	16.7	16.7	1493.4	O K
5760 min Summer	0.477	0.477	0.0	16.7	16.7	1311.5	O K
15 min Winter	0.404	0.404	0.0	16.7	16.7	688.3	O K
30 min Winter	0.444	0.444	0.0	16.7	16.7	1026.4	O K
60 min Winter	0.485	0.485	0.0	16.7	16.7	1379.3	O K
120 min Winter	0.535	0.535	0.0	16.7	16.7	1814.8	Flood Risk
180 min Winter	0.563	0.563	0.0	16.7	16.7	2057.2	Flood Risk
240 min Winter	0.581	0.581	0.0	16.7	16.7	2210.4	Flood Risk
360 min Winter	0.600	0.600	0.0	16.7	16.7	2379.4	Flood Risk
480 min Winter	0.610	0.610	0.0	16.7	16.7	2461.1	Flood Risk
600 min Winter	0.614	0.614	0.0	16.7	16.7	2498.4	Flood Risk
720 min Winter	0.615	0.615	0.0	16.7	16.7	2508.8	Flood Risk
960 min Winter	0.612	0.612	0.0	16.7	16.7	2481.0	Flood Risk
1440 min Winter	0.597	0.597	0.0	16.7	16.7	2350.0	Flood Risk
2160 min Winter	0.572	0.572	0.0	16.7	16.7	2132.6	Flood Risk
2880 min Winter	0.550	0.550	0.0	16.7	16.7	1943.1	Flood Risk
4320 min Winter	0.511	0.511	0.0	16.7	16.7	1603.7	Flood Risk
5760 min Winter	0.477	0.477	0.0	16.7	16.7	1311.7	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	81.756	0.0	574.1	26
30 min Summer	58.320	0.0	868.6	41
60 min Summer	38.516	0.0	1233.5	70
120 min Summer	25.252	0.0	1650.3	130
180 min Summer	19.224	0.0	1895.1	188
240 min Summer	15.653	0.0	2060.1	248
360 min Summer	11.509	0.0	2265.5	366
480 min Summer	9.166	0.0	2389.6	486
600 min Summer	7.650	0.0	2467.1	604
720 min Summer	6.584	0.0	2510.0	724
960 min Summer	5.171	0.0	2505.6	960
1440 min Summer	3.671	0.0	2380.0	1178
2160 min Summer	2.615	0.0	3123.0	1540
2880 min Summer	2.066	0.0	3264.4	1936
4320 min Summer	1.502	0.0	3500.8	2732
5760 min Summer	1.210	0.0	3755.2	3520
15 min Winter	81.756	0.0	658.1	26
30 min Winter	58.320	0.0	983.6	40
60 min Winter	38.516	0.0	1395.9	70
120 min Winter	25.252	0.0	1860.3	128
180 min Winter	19.224	0.0	2130.2	186
240 min Winter	15.653	0.0	2307.9	244
360 min Winter	11.509	0.0	2510.9	360
480 min Winter	9.167	0.0	2590.9	478
600 min Winter	7.650	0.0	2577.6	592
720 min Winter	6.584	0.0	2543.4	708
960 min Winter	5.171	0.0	2480.5	932
1440 min Winter	3.671	0.0	2368.7	1360
2160 min Winter	2.615	0.0	3521.8	1672
2880 min Winter	2.066	0.0	3683.3	2112
4320 min Winter	1.502	0.0	3950.7	2988
5760 min Winter	1.210	0.0	4254.7	3808

Rainfall Details

Rainfall Model	FEH	Winter Storms	Yes
Return Period (years)	30	Cv (Summer)	0.750
FEH Rainfall Version	2013	Cv (Winter)	0.840
Site Location	GB 474700 227450 SP 74700 27450	Shortest Storm (mins)	15
Data Type	Catchment	Longest Storm (mins)	5760
Summer Storms	Yes	Climate Change %	+35

Time Area Diagram

Total Area (ha) 4.755

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	1.585	4	8	1.585	8	12	1.585

Model Details

Storage is Online Cover Level (m) 0.800

Complex Structure

Tank or Pond

Invert Level (m) 0.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	1477.0	0.800	2153.0

Porous Car Park

Infiltration Coefficient Base (m/hr)	0.00000	Porosity	0.30	Slope (1:X)	0.0
Membrane Percolation (mm/hr)	1000	Invert Level (m)	0.400	Depression Storage (mm)	5
Max Percolation (l/s)	6225.0	Width (m)	149.7	Evaporation (mm/day)	3
Safety Factor	2.0	Length (m)	149.7	Membrane Depth (m)	0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0186-1670-0800-1670	Sump Available	Yes
Design Head (m)	0.800	Diameter (mm)	186
Design Flow (l/s)	16.7	Invert Level (m)	0.000
Flush-Flo™	Calculated	Minimum Outlet Pipe Diameter (mm)	225
Objective	Minimise upstream storage	Suggested Manhole Diameter (mm)	1200
Application	Surface		

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.800	16.7	Kick-Flo®	0.596	14.5
Flush-Flo™	0.298	16.7	Mean Flow over Head Range	-	13.8

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)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	6.5	0.600	14.6	1.600	23.2	2.600	29.3	5.000	40.2	7.500	48.9
0.200	16.2	0.800	16.7	1.800	24.6	3.000	31.4	5.500	42.1	8.000	50.5
0.300	16.7	1.000	18.6	2.000	25.8	3.500	33.8	6.000	43.9	8.500	51.8
0.400	16.4	1.200	20.2	2.200	27.1	4.000	36.1	6.500	45.6	9.000	53.3
0.500	15.9	1.400	21.8	2.400	28.2	4.500	38.2	7.000	47.3	9.500	54.7

Summary of Results for 30 year Return Period (+35%)

Half Drain Time : 1176 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	0.036	0.036	0.0	0.4	0.4	29.7	O K
30 min Summer	0.058	0.058	0.0	0.7	0.7	47.8	O K
60 min Summer	0.081	0.081	0.0	1.0	1.0	66.6	O K
120 min Summer	0.109	0.109	0.0	1.0	1.0	89.8	Flood Risk
180 min Summer	0.124	0.124	0.0	1.1	1.1	102.7	Flood Risk
240 min Summer	0.134	0.134	0.0	1.1	1.1	110.7	Flood Risk
360 min Summer	0.144	0.144	0.0	1.1	1.1	119.4	Flood Risk
480 min Summer	0.149	0.149	0.0	1.1	1.1	123.5	Flood Risk
600 min Summer	0.151	0.151	0.0	1.1	1.1	125.2	Flood Risk
720 min Summer	0.152	0.152	0.0	1.1	1.1	125.4	Flood Risk
960 min Summer	0.150	0.150	0.0	1.1	1.1	123.7	Flood Risk
1440 min Summer	0.146	0.146	0.0	1.1	1.1	120.4	Flood Risk
2160 min Summer	0.140	0.140	0.0	1.1	1.1	115.7	Flood Risk
2880 min Summer	0.134	0.134	0.0	1.1	1.1	111.1	Flood Risk
4320 min Summer	0.124	0.124	0.0	1.1	1.1	102.9	Flood Risk
5760 min Summer	0.116	0.116	0.0	1.0	1.0	95.7	Flood Risk
15 min Winter	0.042	0.042	0.0	0.5	0.5	34.9	O K
30 min Winter	0.067	0.067	0.0	0.8	0.8	55.2	O K
60 min Winter	0.092	0.092	0.0	1.0	1.0	76.4	O K
120 min Winter	0.124	0.124	0.0	1.1	1.1	102.6	Flood Risk
180 min Winter	0.142	0.142	0.0	1.1	1.1	117.3	Flood Risk
240 min Winter	0.153	0.153	0.0	1.1	1.1	126.5	Flood Risk
360 min Winter	0.165	0.165	0.0	1.1	1.1	136.7	Flood Risk
480 min Winter	0.171	0.171	0.0	1.1	1.1	141.7	Flood Risk
600 min Winter	0.174	0.174	0.0	1.1	1.1	144.1	Flood Risk
720 min Winter	0.175	0.175	0.0	1.1	1.1	144.8	Flood Risk
960 min Winter	0.174	0.174	0.0	1.1	1.1	143.5	Flood Risk
1440 min Winter	0.166	0.166	0.0	1.1	1.1	137.6	Flood Risk
2160 min Winter	0.157	0.157	0.0	1.1	1.1	130.2	Flood Risk
2880 min Winter	0.148	0.148	0.0	1.1	1.1	122.6	Flood Risk
4320 min Winter	0.131	0.131	0.0	1.1	1.1	108.7	Flood Risk
5760 min Winter	0.117	0.117	0.0	1.0	1.0	96.6	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	81.756	0.0	17.2	27
30 min Summer	58.320	0.0	32.0	41
60 min Summer	38.516	0.0	58.0	70
120 min Summer	25.252	0.0	81.3	130
180 min Summer	19.224	0.0	94.8	188
240 min Summer	15.653	0.0	103.7	248
360 min Summer	11.509	0.0	114.6	366
480 min Summer	9.166	0.0	121.1	484
600 min Summer	7.650	0.0	125.3	602
720 min Summer	6.584	0.0	128.1	720
960 min Summer	5.171	0.0	130.9	848
1440 min Summer	3.671	0.0	130.5	1084
2160 min Summer	2.615	0.0	166.2	1476
2880 min Summer	2.066	0.0	171.3	1880
4320 min Summer	1.502	0.0	177.4	2684
5760 min Summer	1.210	0.0	198.1	3464
15 min Winter	81.756	0.0	21.3	26
30 min Winter	58.320	0.0	38.0	41
60 min Winter	38.516	0.0	67.2	70
120 min Winter	25.252	0.0	93.2	128
180 min Winter	19.224	0.0	108.0	186
240 min Winter	15.653	0.0	117.7	244
360 min Winter	11.509	0.0	129.4	360
480 min Winter	9.167	0.0	136.1	474
600 min Winter	7.650	0.0	140.2	588
720 min Winter	6.584	0.0	142.8	700
960 min Winter	5.171	0.0	144.6	918
1440 min Winter	3.671	0.0	141.8	1156
2160 min Winter	2.615	0.0	189.6	1604
2880 min Winter	2.066	0.0	195.7	2052
4320 min Winter	1.502	0.0	203.1	2900
5760 min Winter	1.210	0.0	228.4	3696

Rainfall Details

Rainfall Model	FEH	Winter Storms	Yes
Return Period (years)	30	Cv (Summer)	0.750
FEH Rainfall Version	2013	Cv (Winter)	0.840
Site Location	GB 474700 227450 SP 74700 27450	Shortest Storm (mins)	15
Data Type	Catchment	Longest Storm (mins)	5760
Summer Storms	Yes	Climate Change %	+35

Time Area Diagram

Total Area (ha) 0.286

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.095	4	8	0.095	8	12	0.095

Model Details

Storage is Online Cover Level (m) 0.400

Porous Car Park Structure

Infiltration Coefficient Base (m/hr)	0.00000	Porosity	0.30	Slope (1:X)	0.0
Membrane Percolation (mm/hr)	1000	Invert Level (m)	0.000	Depression Storage (mm)	5
Max Percolation (l/s)	765.6	Width (m)	52.5	Evaporation (mm/day)	3
Safety Factor	2.0	Length (m)	52.5	Membrane Depth (m)	0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0054-1100-0660-1100	Sump Available	Yes
Design Head (m)	0.660	Diameter (mm)	54
Design Flow (l/s)	1.1	Invert Level (m)	0.000
Flush-Flo™	Calculated	Minimum Outlet Pipe Diameter (mm)	75
Objective	Minimise upstream storage	Suggested Manhole Diameter (mm)	1200
Application	Surface		

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.660	1.1	Kick-Flo®	0.421	0.9
Flush-Flo™	0.204	1.1	Mean Flow over Head Range	-	1.0

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)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	1.0	0.600	1.1	1.600	1.6	2.600	2.0	5.000	2.8	7.500	3.3
0.200	1.1	0.800	1.2	1.800	1.7	3.000	2.2	5.500	2.9	8.000	3.5
0.300	1.1	1.000	1.3	2.000	1.8	3.500	2.3	6.000	3.0	8.500	3.6
0.400	1.0	1.200	1.4	2.200	1.9	4.000	2.5	6.500	3.1	9.000	3.7
0.500	1.0	1.400	1.5	2.400	2.0	4.500	2.6	7.000	3.2	9.500	3.8

Summary of Results for 100 year Return Period (+40%)

Half Drain Time : 1194 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	0.290	0.290	0.0	16.6	16.6	628.3	O K
30 min Summer	0.345	0.345	0.0	16.6	16.6	936.3	Flood Risk
60 min Summer	0.400	0.400	0.0	16.6	16.6	1253.8	Flood Risk
120 min Summer	0.458	0.458	0.0	16.6	16.6	1590.3	Flood Risk
180 min Summer	0.488	0.488	0.0	16.6	16.6	1770.7	Flood Risk
240 min Summer	0.507	0.507	0.0	16.6	16.6	1881.5	Flood Risk
360 min Summer	0.526	0.526	0.0	16.6	16.6	1997.8	Flood Risk
480 min Summer	0.533	0.533	0.0	16.6	16.6	2038.0	Flood Risk
600 min Summer	0.533	0.533	0.0	16.6	16.6	2040.7	Flood Risk
720 min Summer	0.530	0.530	0.0	16.6	16.6	2021.4	Flood Risk
960 min Summer	0.517	0.517	0.0	16.6	16.6	1945.1	Flood Risk
1440 min Summer	0.490	0.490	0.0	16.6	16.6	1781.0	Flood Risk
2160 min Summer	0.457	0.457	0.0	16.6	16.6	1587.9	Flood Risk
2880 min Summer	0.431	0.431	0.0	16.6	16.6	1433.6	Flood Risk
4320 min Summer	0.388	0.388	0.0	16.6	16.6	1185.1	Flood Risk
5760 min Summer	0.353	0.353	0.0	16.6	16.6	984.4	Flood Risk
15 min Winter	0.306	0.306	0.0	16.6	16.6	715.2	Flood Risk
30 min Winter	0.367	0.367	0.0	16.6	16.6	1061.1	Flood Risk
60 min Winter	0.429	0.429	0.0	16.6	16.6	1419.4	Flood Risk
120 min Winter	0.494	0.494	0.0	16.6	16.6	1802.6	Flood Risk
180 min Winter	0.528	0.528	0.0	16.6	16.6	2011.3	Flood Risk
240 min Winter	0.550	0.550	0.0	16.6	16.6	2141.9	Flood Risk
360 min Winter	0.574	0.574	0.0	16.6	16.6	2285.6	Flood Risk
480 min Winter	0.583	0.583	0.0	16.6	16.6	2344.0	Flood Risk
600 min Winter	0.586	0.586	0.0	16.6	16.6	2360.5	Flood Risk
720 min Winter	0.585	0.585	0.0	16.6	16.6	2352.4	Flood Risk
960 min Winter	0.575	0.575	0.0	16.6	16.6	2293.5	Flood Risk
1440 min Winter	0.543	0.543	0.0	16.6	16.6	2099.3	Flood Risk
2160 min Winter	0.501	0.501	0.0	16.6	16.6	1845.8	Flood Risk
2880 min Winter	0.464	0.464	0.0	16.6	16.6	1626.2	Flood Risk
4320 min Winter	0.399	0.399	0.0	16.6	16.6	1249.3	Flood Risk
5760 min Winter	0.345	0.345	0.0	16.6	16.6	939.7	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	108.360	0.0	637.8	26
30 min Summer	77.924	0.0	951.5	41
60 min Summer	51.660	0.0	1299.2	70
120 min Summer	33.019	0.0	1681.7	130
180 min Summer	24.878	0.0	1909.0	188
240 min Summer	20.160	0.0	2066.8	248
360 min Summer	14.791	0.0	2276.9	366
480 min Summer	11.751	0.0	2409.9	486
600 min Summer	9.787	0.0	2503.6	604
720 min Summer	8.409	0.0	2572.0	722
960 min Summer	6.595	0.0	2642.8	936
1440 min Summer	4.656	0.0	2567.0	1138
2160 min Summer	3.290	0.0	3021.7	1500
2880 min Summer	2.581	0.0	3143.1	1908
4320 min Summer	1.852	0.0	3346.1	2692
5760 min Summer	1.477	0.0	3528.1	3464
15 min Winter	108.360	0.0	724.2	26
30 min Winter	77.924	0.0	1073.6	40
60 min Winter	51.660	0.0	1465.1	70
120 min Winter	33.019	0.0	1893.2	128
180 min Winter	24.878	0.0	2147.2	186
240 min Winter	20.160	0.0	2322.5	244
360 min Winter	14.791	0.0	2551.4	360
480 min Winter	11.751	0.0	2678.0	476
600 min Winter	9.787	0.0	2702.3	592
720 min Winter	8.409	0.0	2684.5	706
960 min Winter	6.595	0.0	2649.3	930
1440 min Winter	4.656	0.0	2575.5	1332
2160 min Winter	3.290	0.0	3402.8	1640
2880 min Winter	2.581	0.0	3541.7	2080
4320 min Winter	1.852	0.0	3774.7	2940
5760 min Winter	1.477	0.0	3985.9	3704

Rainfall Details

Rainfall Model	FEH	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
FEH Rainfall Version	2013	Cv (Winter)	0.840
Site Location	GB 474700 227450 SP 74700 27450	Shortest Storm (mins)	15
Data Type	Catchment	Longest Storm (mins)	5760
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 3.578

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	1.193	4	8	1.193	8	12	1.193

Model Details

Storage is Online Cover Level (m) 0.600

Complex Structure

Swale

Infiltration Coefficient Base (m/hr)	0.00000	Invert Level (m)	0.000	Slope (1:X)	109.0
Infiltration Coefficient Side (m/hr)	0.00000	Base Width (m)	2.0	Cap Volume Depth (m)	0.000
Safety Factor	2.0	Length (m)	60.0	Cap Infiltration Depth (m)	0.000
Porosity	1.00	Side Slope (1:X)	3.0		

Tank or Pond

Invert Level (m) 0.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	85.0	0.600	182.0

Tank or Pond

Invert Level (m) 0.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	463.0	0.600	648.0

Porous Car Park

Infiltration Coefficient Base (m/hr)	0.00000	Porosity	0.30	Slope (1:X)	0.0
Membrane Percolation (mm/hr)	1000	Invert Level (m)	0.200	Depression Storage (mm)	5
Max Percolation (l/s)	4494.4	Width (m)	127.2	Evaporation (mm/day)	3
Safety Factor	2.0	Length (m)	127.2	Membrane Depth (m)	0

Swale

Infiltration Coefficient Base (m/hr)	0.00000	Invert Level (m)	0.300	Slope (1:X)	268.0
Infiltration Coefficient Side (m/hr)	0.00000	Base Width (m)	2.3	Cap Volume Depth (m)	0.000
Safety Factor	2.0	Length (m)	53.0	Cap Infiltration Depth (m)	0.000
Porosity	1.00	Side Slope (1:X)	3.0		

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0185-1660-0885-1660	Sump Available	Yes
Design Head (m)	0.885	Diameter (mm)	185
Design Flow (l/s)	16.6	Invert Level (m)	0.000
Flush-Flo™	Calculated	Minimum Outlet Pipe Diameter (mm)	225
Objective	Minimise upstream storage	Suggested Manhole Diameter (mm)	1200
Application	Surface		

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.885	16.6	Kick-Flo®	0.647	14.3
Flush-Flo™	0.311	16.6	Mean Flow over Head Range	-	13.9

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)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	6.5	0.600	15.1	1.600	22.0	2.600	27.8	5.000	38.0	7.500	46.3
0.200	16.1	0.800	15.8	1.800	23.3	3.000	29.7	5.500	39.8	8.000	47.8
0.300	16.6	1.000	17.6	2.000	24.5	3.500	32.0	6.000	41.6	8.500	49.2
0.400	16.4	1.200	19.2	2.200	25.6	4.000	34.2	6.500	43.2	9.000	50.3
0.500	16.0	1.400	20.6	2.400	26.7	4.500	36.2	7.000	44.8	9.500	51.7

Summary of Results for 100 year Return Period (+40%)

Half Drain Time : 1746 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	0.421	0.421	0.0	16.7	16.7	837.0	O K
30 min Summer	0.470	0.470	0.0	16.7	16.7	1250.3	O K
60 min Summer	0.520	0.520	0.0	16.7	16.7	1682.0	Flood Risk
120 min Summer	0.574	0.574	0.0	16.7	16.7	2151.0	Flood Risk
180 min Summer	0.604	0.604	0.0	16.7	16.7	2413.1	Flood Risk
240 min Summer	0.624	0.624	0.0	16.7	16.7	2581.2	Flood Risk
360 min Summer	0.646	0.646	0.0	16.7	16.7	2776.4	Flood Risk
480 min Summer	0.657	0.657	0.0	16.7	16.7	2869.4	Flood Risk
600 min Summer	0.662	0.662	0.0	16.7	16.7	2912.6	Flood Risk
720 min Summer	0.663	0.663	0.0	16.7	16.7	2926.6	Flood Risk
960 min Summer	0.661	0.661	0.0	16.7	16.7	2903.8	Flood Risk
1440 min Summer	0.644	0.644	0.0	16.7	16.7	2762.0	Flood Risk
2160 min Summer	0.621	0.621	0.0	16.7	16.7	2556.5	Flood Risk
2880 min Summer	0.601	0.601	0.0	16.7	16.7	2387.4	Flood Risk
4320 min Summer	0.569	0.569	0.0	16.7	16.7	2105.7	Flood Risk
5760 min Summer	0.543	0.543	0.0	16.7	16.7	1879.4	Flood Risk
15 min Winter	0.435	0.435	0.0	16.7	16.7	952.7	O K
30 min Winter	0.489	0.489	0.0	16.7	16.7	1416.6	O K
60 min Winter	0.545	0.545	0.0	16.7	16.7	1902.3	Flood Risk
120 min Winter	0.607	0.607	0.0	16.7	16.7	2432.9	Flood Risk
180 min Winter	0.641	0.641	0.0	16.7	16.7	2730.1	Flood Risk
240 min Winter	0.663	0.663	0.0	16.7	16.7	2922.5	Flood Risk
360 min Winter	0.689	0.689	0.0	16.7	16.7	3150.3	Flood Risk
480 min Winter	0.702	0.702	0.0	16.7	16.7	3264.0	Flood Risk
600 min Winter	0.708	0.708	0.0	16.7	16.7	3321.9	Flood Risk
720 min Winter	0.711	0.711	0.0	16.7	16.7	3347.2	Flood Risk
960 min Winter	0.710	0.710	0.0	16.7	16.7	3341.0	Flood Risk
1440 min Winter	0.697	0.697	0.0	16.7	16.7	3220.1	Flood Risk
2160 min Winter	0.668	0.668	0.0	16.7	16.7	2965.6	Flood Risk
2880 min Winter	0.644	0.644	0.0	16.7	16.7	2758.2	Flood Risk
4320 min Winter	0.601	0.601	0.0	16.7	16.7	2380.7	Flood Risk
5760 min Winter	0.559	0.559	0.0	16.7	16.7	2023.0	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	108.360	0.0	800.5	26
30 min Summer	77.924	0.0	1179.0	41
60 min Summer	51.660	0.0	1693.7	70
120 min Summer	33.019	0.0	2181.8	130
180 min Summer	24.878	0.0	2450.0	190
240 min Summer	20.160	0.0	2597.2	250
360 min Summer	14.791	0.0	2617.3	368
480 min Summer	11.751	0.0	2578.1	486
600 min Summer	9.787	0.0	2546.1	606
720 min Summer	8.409	0.0	2516.7	724
960 min Summer	6.595	0.0	2461.2	962
1440 min Summer	4.656	0.0	2352.5	1376
2160 min Summer	3.290	0.0	3975.3	1708
2880 min Summer	2.581	0.0	4122.9	2076
4320 min Summer	1.852	0.0	4309.0	2860
5760 min Summer	1.477	0.0	4666.0	3648
15 min Winter	108.360	0.0	908.9	26
30 min Winter	77.924	0.0	1303.3	41
60 min Winter	51.660	0.0	1908.1	70
120 min Winter	33.019	0.0	2434.6	128
180 min Winter	24.878	0.0	2651.7	186
240 min Winter	20.160	0.0	2641.1	246
360 min Winter	14.791	0.0	2598.5	362
480 min Winter	11.751	0.0	2569.2	478
600 min Winter	9.787	0.0	2544.1	596
720 min Winter	8.409	0.0	2520.8	710
960 min Winter	6.595	0.0	2476.2	940
1440 min Winter	4.656	0.0	2388.2	1384
2160 min Winter	3.290	0.0	4463.0	1948
2880 min Winter	2.581	0.0	4610.8	2224
4320 min Winter	1.852	0.0	4497.2	3152
5760 min Winter	1.477	0.0	5273.9	3984

Rainfall Details

Rainfall Model	FEH	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
FEH Rainfall Version	2013	Cv (Winter)	0.840
Site Location	GB 474700 227450 SP 74700 27450	Shortest Storm (mins)	15
Data Type	Catchment	Longest Storm (mins)	5760
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 4.755

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	1.585	4	8	1.585	8	12	1.585

Model Details

Storage is Online Cover Level (m) 0.800

Complex Structure

Tank or Pond

Invert Level (m) 0.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	1477.0	0.800	2153.0

Porous Car Park

Infiltration Coefficient Base (m/hr)	0.00000	Porosity	0.30	Slope (1:X)	0.0
Membrane Percolation (mm/hr)	1000	Invert Level (m)	0.400	Depression Storage (mm)	5
Max Percolation (l/s)	6225.0	Width (m)	149.7	Evaporation (mm/day)	3
Safety Factor	2.0	Length (m)	149.7	Membrane Depth (m)	0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0186-1670-0800-1670	Sump Available	Yes
Design Head (m)	0.800	Diameter (mm)	186
Design Flow (l/s)	16.7	Invert Level (m)	0.000
Flush-Flo™	Calculated	Minimum Outlet Pipe Diameter (mm)	225
Objective	Minimise upstream storage	Suggested Manhole Diameter (mm)	1200
Application	Surface		

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.800	16.7	Kick-Flo®	0.596	14.5
Flush-Flo™	0.298	16.7	Mean Flow over Head Range	-	13.8

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)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	6.5	0.600	14.6	1.600	23.2	2.600	29.3	5.000	40.2	7.500	48.9
0.200	16.2	0.800	16.7	1.800	24.6	3.000	31.4	5.500	42.1	8.000	50.5
0.300	16.7	1.000	18.6	2.000	25.8	3.500	33.8	6.000	43.9	8.500	51.8
0.400	16.4	1.200	20.2	2.200	27.1	4.000	36.1	6.500	45.6	9.000	53.3
0.500	15.9	1.400	21.8	2.400	28.2	4.500	38.2	7.000	47.3	9.500	54.7

Summary of Results for 100 year Return Period (+40%)

Half Drain Time : 1529 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	0.053	0.053	0.0	0.7	0.7	43.7	O K
30 min Summer	0.083	0.083	0.0	1.0	1.0	68.5	O K
60 min Summer	0.114	0.114	0.0	1.0	1.0	94.4	Flood Risk
120 min Summer	0.148	0.148	0.0	1.1	1.1	122.6	Flood Risk
180 min Summer	0.167	0.167	0.0	1.1	1.1	138.4	Flood Risk
240 min Summer	0.180	0.180	0.0	1.1	1.1	148.6	Flood Risk
360 min Summer	0.194	0.194	0.0	1.1	1.1	160.5	Flood Risk
480 min Summer	0.201	0.201	0.0	1.1	1.1	166.4	Flood Risk
600 min Summer	0.205	0.205	0.0	1.1	1.1	169.2	Flood Risk
720 min Summer	0.206	0.206	0.0	1.1	1.1	170.2	Flood Risk
960 min Summer	0.205	0.205	0.0	1.1	1.1	169.2	Flood Risk
1440 min Summer	0.197	0.197	0.0	1.1	1.1	163.2	Flood Risk
2160 min Summer	0.188	0.188	0.0	1.1	1.1	155.7	Flood Risk
2880 min Summer	0.180	0.180	0.0	1.1	1.1	149.1	Flood Risk
4320 min Summer	0.166	0.166	0.0	1.1	1.1	137.3	Flood Risk
5760 min Summer	0.154	0.154	0.0	1.1	1.1	126.9	Flood Risk
15 min Winter	0.061	0.061	0.0	0.8	0.8	50.6	O K
30 min Winter	0.095	0.095	0.0	1.0	1.0	78.4	O K
60 min Winter	0.130	0.130	0.0	1.1	1.1	107.6	Flood Risk
120 min Winter	0.169	0.169	0.0	1.1	1.1	139.5	Flood Risk
180 min Winter	0.190	0.190	0.0	1.1	1.1	157.4	Flood Risk
240 min Winter	0.204	0.204	0.0	1.1	1.1	169.0	Flood Risk
360 min Winter	0.221	0.221	0.0	1.1	1.1	182.9	Flood Risk
480 min Winter	0.230	0.230	0.0	1.1	1.1	189.9	Flood Risk
600 min Winter	0.234	0.234	0.0	1.1	1.1	193.6	Flood Risk
720 min Winter	0.236	0.236	0.0	1.1	1.1	195.3	Flood Risk
960 min Winter	0.236	0.236	0.0	1.1	1.1	195.2	Flood Risk
1440 min Winter	0.228	0.228	0.0	1.1	1.1	188.5	Flood Risk
2160 min Winter	0.214	0.214	0.0	1.1	1.1	177.2	Flood Risk
2880 min Winter	0.202	0.202	0.0	1.1	1.1	167.4	Flood Risk
4320 min Winter	0.180	0.180	0.0	1.1	1.1	148.9	Flood Risk
5760 min Winter	0.160	0.160	0.0	1.1	1.1	132.4	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	108.360	0.0	28.5	27
30 min Summer	77.924	0.0	48.6	41
60 min Summer	51.660	0.0	84.1	70
120 min Summer	33.019	0.0	111.2	130
180 min Summer	24.878	0.0	126.4	190
240 min Summer	20.160	0.0	136.2	248
360 min Summer	14.791	0.0	147.7	366
480 min Summer	11.751	0.0	153.3	486
600 min Summer	9.787	0.0	156.0	604
720 min Summer	8.409	0.0	157.0	724
960 min Summer	6.595	0.0	155.9	960
1440 min Summer	4.656	0.0	147.8	1198
2160 min Summer	3.290	0.0	215.5	1556
2880 min Summer	2.581	0.0	220.6	1960
4320 min Summer	1.852	0.0	223.9	2768
5760 min Summer	1.477	0.0	252.6	3568
15 min Winter	108.360	0.0	34.1	26
30 min Winter	77.924	0.0	56.1	41
60 min Winter	51.660	0.0	96.2	70
120 min Winter	33.019	0.0	125.8	128
180 min Winter	24.878	0.0	141.8	186
240 min Winter	20.160	0.0	151.6	244
360 min Winter	14.791	0.0	161.8	360
480 min Winter	11.751	0.0	165.6	478
600 min Winter	9.787	0.0	166.5	592
720 min Winter	8.409	0.0	165.9	708
960 min Winter	6.595	0.0	162.5	932
1440 min Winter	4.656	0.0	153.3	1358
2160 min Winter	3.290	0.0	243.7	1672
2880 min Winter	2.581	0.0	249.3	2132
4320 min Winter	1.852	0.0	251.0	2992
5760 min Winter	1.477	0.0	289.3	3856

Rainfall Details

Rainfall Model	FEH	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
FEH Rainfall Version	2013	Cv (Winter)	0.840
Site Location	GB 474700 227450 SP 74700 27450	Shortest Storm (mins)	15
Data Type	Catchment	Longest Storm (mins)	5760
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.286

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.095	4	8	0.095	8	12	0.095

Model Details

Storage is Online Cover Level (m) 0.400

Porous Car Park Structure

Infiltration Coefficient Base (m/hr)	0.00000	Porosity	0.30	Slope (1:X)	0.0
Membrane Percolation (mm/hr)	1000	Invert Level (m)	0.000	Depression Storage (mm)	5
Max Percolation (l/s)	765.6	Width (m)	52.5	Evaporation (mm/day)	3
Safety Factor	2.0	Length (m)	52.5	Membrane Depth (m)	0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0054-1100-0660-1100	Sump Available	Yes
Design Head (m)	0.660	Diameter (mm)	54
Design Flow (l/s)	1.1	Invert Level (m)	0.000
Flush-Flo™	Calculated	Minimum Outlet Pipe Diameter (mm)	75
Objective	Minimise upstream storage	Suggested Manhole Diameter (mm)	1200
Application	Surface		

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.660	1.1	Kick-Flo®	0.421	0.9
Flush-Flo™	0.204	1.1	Mean Flow over Head Range	-	1.0

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)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	1.0	0.600	1.1	1.600	1.6	2.600	2.0	5.000	2.8	7.500	3.3
0.200	1.1	0.800	1.2	1.800	1.7	3.000	2.2	5.500	2.9	8.000	3.5
0.300	1.1	1.000	1.3	2.000	1.8	3.500	2.3	6.000	3.0	8.500	3.6
0.400	1.0	1.200	1.4	2.200	1.9	4.000	2.5	6.500	3.1	9.000	3.7
0.500	1.0	1.400	1.5	2.400	2.0	4.500	2.6	7.000	3.2	9.500	3.8

Appendix G

Drainage Management and Maintenance Plan

East Claydon Greener Grid Park, Land north of East Claydon Substation, East Claydon Road, Buckingham, MK18 3ND

Drainage Management & Maintenance Plan

For

Statkraft UK LTD

motion

Document Control Sheet

East Claydon Greener Grid Park, Land north of East Claydon Substation, East Claydon Road, Buckingham, MK18 3ND

Statkraft UK LTD

This document has been issued and amended as follows:

Date	Issue	Prepared by	Approved by
08/04/2025	Final	Chris Gray	Jason Morgans

Motion
84 North Street
Guildford
GU1 4AU
T 01483 531300
F 01483 531333
E info@motion.co.uk
W www.motion.co.uk

Contents

1.0 Introduction

1.1 This document sets out the principles for the long-term management and maintenance of the proposed surface water drainage system at the East Claydon Greener Grid Park development.

1.2 The purpose of this document is to ensure that the site management company or their agents have a robust inspection and maintenance plan going forwards. This ensures the optimum operation of the surface water drainage system and that it will be continually maintained for the lifetime of the development. This will contribute to reducing the risk of surface water flooding both on- and off-site.

1.3 All those responsible for maintenance should follow relevant health and safety legislation for all activities listed within this report (including lone working, if relevant). Method statements and risk assessments should always be undertaken and made available, if requested.

1.4 This document has been produced by Motion on behalf of their client, Statkraft UK LTD. This document describes the typical management and maintenance tasks that are known at the outline design stage (maintenance frequencies and typical tasks, for example). These have been drawn from industry guidance such as CIRIA C753 - The SuDS Manual – and manufacturer's own guidance.

1.5 Maintenance is considered as a construction activity under the CDM Regulations 2015. Under the CDM Regulations, it is a requirement that a competent person be appointed to carry out a required role. CDM defines a competent person as an individual with sufficient knowledge of the specific tasks to be undertaken, as well as sufficient experience and ability to carry out their duties in relation to the task in a way that secures health and safety on site.

1.6 In recognition of the requirements of the CDM Regulations 2015, this surface water management and maintenance plan expects that the maintenance work will be carried out by a competent person who must have prior knowledge of the drainage components and SuDS systems on site.

1.7 There are limitations on what this document can prescribe at this time. At this stage this document cannot name the specific individuals who will carry out the maintenance and what equipment is to be used. Related to this, this document is unable to provide method statements for exactly how maintenance practices will be carried out. These can only be determined at the time of the maintenance being carried out and the exact maintenance need. Therefore, this is to be the responsibility of the site management company and/or the individuals carrying out the work. We urge those who are carrying out the maintenance to record this information and make it available to the Local Planning Authority (LPA), if required to do so. This drainage management and maintenance plan needs to be a living document that is owned and maintained by the adopting site management company. The intention of the report is to set out the principles for the long-term management and maintenance of the proposed surface water drainage system at the East Claydon Greener Grid Park development.

2.0 Maintenance Categories

2.1 There are three categories of maintenance activities referred to in this report. These are:

Regular maintenance (including inspections and monitoring)

- Regular maintenance consists of basic tasks done on a frequent and predictable schedule, including inspections, vegetation management, and litter, silt and debris removal.

Occasional maintenance

- Occasional maintenance comprises tasks that are likely to be required periodically, but on a much less frequent and predictable basis than the routine tasks (sediment removal is an example).

Remedial maintenance

- Remedial maintenance comprises of intermittent tasks that may be required to rectify faults associated with the system. The likelihood of faults can be minimised by correct installation, regular inspection and timely maintenance. Where remedial work is found to be necessary, it is likely to be due to site-specific characteristics or unforeseen events and, as such, timings are difficult to predict.
- This document should be read in conjunction with the design drawings of the drainage system, so that the location and type of each feature can be recognised and understood.

3.0 The Surface Water Drainage System

3.1 The proposed surface water drainage system is made up of a number of components. These include:

- Pervious pavements/Filter Drains
- Swale/Detention Basins
- Catchpit manholes/Silt traps (Including filter drains)
- Hydrobrake/Flow Controls
- Manholes
- Pipes (Including filter drains and existing culvert under proposed permanent operational access).

3.2 All components should be installed in accordance with the manufacturer's instructions and to the levels/arrangement as defined on the designer's drawings. Not doing so will invalidate any warranty provided by the manufacturer.

3.3 All maintenance and cleaning must be carried out in accordance with manufacturer's recommendations and by competent and suitably qualified staff, as defined in the CDM regulations 2015.

3.4 With regards to details of which body will be responsible for managing the maintenance for individual aspects of the drainage proposals over the lifetime of the development, appropriate and regular maintenance of all the drainage infrastructure will be undertaken by the operator of the Greener Grid Park which is Statkraft.

4.0 General Maintenance Principles

4.1 All surface water drainage systems, whether piped gravity systems, Sustainable Drainage Systems (SuDS), or flow control devices and pumps, require regular maintenance to keep them working at optimum efficiency and capacity. The maintenance of the surface water drainage system on the development should be carried out alongside other regular maintenance tasks on site.

4.2 Timely and adequate maintenance will increase the lifespan of all the drainage components. Inadequate maintenance will do the reverse. Therefore, the projected lifespan and anticipated replacement date of each drainage component cannot be forecast at the time of this document being produced.

4.3 The site management company and/or their agents are responsible for the maintenance of the surface water drainage system.

4.4 Construction activities can create and discharge significant quantities of sediment that will quickly clog the surface water drainage system. Therefore, construction-stage sediment removal is required immediately post-construction. This may require several cleans of the system during the first year after installation. The construction site manager should assess this and carry out cleaning as necessary.

4.5 Catchpit manholes/silt traps will be specified upstream of the SuDS. They will remove gross solids and the majority of silts. It is important that any debris build-up in the catchpit manholes/silt traps is removed at regular intervals. This will reduce the risk of the pervious pavements becoming silted up. It will maintain its design capacity and function.

4.6 Cleaning should also take place after large storms when there have been increased surface water flows and visible entrainment and deposition of debris.

4.7 An increased frequency of inspection and maintenance should be programmed into the autumn and winter months in acknowledgement that:

- Leaf fall from deciduous trees in autumn will result in an increased amount of leaf litter and an elevated blockage risk of drainage infrastructure.
- Increased rainfall during winter months will result in greater quantities of water moving through the drainage system and a greater input of silt and other debris.

4.8 Table 4.1, below, gives an overview of typical maintenance tasks and the frequency with which they need to be undertaken. Section 5 – Inspection and Maintenance Frequency of Components – will assign typical maintenance frequencies and tasks to the specific components used within the surface water drainage system used on the development.

Table 4.1: Typical maintenance tasks and frequencies

Activity	Indicative Frequency	Typical Tasks
Routine/regular maintenance	Monthly to annually	▸ Litter picking ▸ Silt removal ▸ Inspection of all inlets, outlets and control structures ▸ Weed removal and invasive plant control
Occasional maintenance	Annually up to 25 years	▸ Silt control around components ▸ Vegetation management around components ▸ Sweeping of pavement areas to remove surface silt ▸ Silt removal from catchpits, cellular storage structures
Remedial maintenance	As required	▸ Inlet/outlet repairs ▸ Erosion repairs ▸ Reinstatement of edgings ▸ Reinstatement following pollution ▸ Removal of silt build-up and leaf litter after storms ▸ Repair of vandalism ▸ Replacement of any blocked filter ▸ membranes/materials

5.0 Inspection and Maintenance Frequency of Components

5.1 Table 5.1 below lists each of the components used within the site's surface water drainage system. It suggests an indicative maintenance frequency for each component and ascribes typical maintenance tasks to them.

5.2 This list is not exhaustive, nor is it prescriptive. As mentioned in Section 3, additional, unscheduled maintenance may be required following adverse weather conditions or after autumn leaf falls. Additional maintenance tasks may be required to adequately clean and maintain individual components.

5.3 The list of components should be cross-referenced with the designer's drawings so that the location of each component can be identified.

5.4 It is the responsibility of the site management company and/or their agents to ensure that all necessary maintenance activities are carried out in a timely manner and that the design performance of each drainage component is preserved.

5.5 If there is any uncertainty regarding the correct and safe methods of cleaning, or what equipment should be used, the manufacturer should be consulted.

5.6 Upon completion of maintenance activities, a record should be kept of the work carried out. This should be retained and an annual maintenance report should be compiled, which should include the following:

- Observations resulting from inspections
- Maintenance and operation activities undertaken during the year
- Recommendations for inspections and maintenance programmes for the following year

5.7 On the last page is a table with suggested information should be recorded and included with the maintenance plan. As mentioned in the introduction to this document, this should be a living document and regularly updated, as required.

5.8 The Local Planning Authority Buckinghamshire Council - Aylesbury Vale Area (BC) may request to check and sign off any maintenance activities. Therefore, it is recommended that the LPA is contacted prior to any scheduled routine maintenance. Also, with reference to Table 5.1, the annual maintenance report, including a completed version of the table on the last page, should be offered to the LPA for their records and approval.

Table 5.1: Maintenance Frequency and Task for Drainage Components

Activity	Indicative Frequency	Anticipated Tasks
Pipes (filter drains and existing culvert under proposed permanent operational access)	As required	▸ Identify any pipes that may not be operating properly and employ a competent, qualified contractor to inspect using CCTV. ▸ If the pipe is blocked with silt or debris, the pipe should be jetted clean from an upstream access point. All silt and debris should be captured and removed at a downstream access point. ▸ Clear perforated pipework of blockages ▸ Inspect once clean. ▸ If any other defects are encountered (cracks, displaced joints, root ingress), appropriate solutions should be discussed with a competent and qualified contractor. These

		services are usually provided by the same companies that offer CCTV surveys and pipe jetting services. ▸ The proposed culvert under the access should be desilted and cleared of leaf litter and other debris after storms; monthly in the autumn and winter; and quarterly during the rest of the year.
Manholes	Annually	▸ Inspect/identify any damage or areas that are not operating correctly ▸ Remove silt, litter, leaves and other detritus. ▸ Inspect once clean.
Catchpit Manholes/Silt Traps (Including filter drains)	Twice a year, before and after autumn/winter	▸ Inspect/identify any damage or areas that are not operating correctly ▸ Remove silt, litter, leaves and other detritus. ▸ Inspect once clean.
Swale/Detention Basin	Monthly in Summer, as required in Winter	▸ Responsibility should be with landscape contractors. ▸ Maintenance tasks are not that different from standard public open space. ▸ Adequate access needs to be provided to the area. ▸ Regular mowing should take place across maintenance access routes, amenity areas, across embankments and the main storage area. Remaining areas can remain as 'meadow'. Mowed grass lengths of 75 – 100mm are appropriate. ▸ Grass clippings should be disposed of off-site. ▸ Any dead growth should be cleared before the start of the growing season. ▸ Any permanently wet areas with emergent aquatic vegetation should be managed as ponds or wetlands. ▸ Remove any sediment build-up as required. ▸ Check any inlets and outlets for blockages and clear as required. ▸ Check any flow control devices, if present.
Hydrobrake chamber	Every three months for the first year, then annually thereafter	▸ Contact manufacturer for instruction on approved and safe inspection and maintenance practices. ▸ Inspect Hydrobrake and check functionality. Remove any detritus as required. ▸ Inspect once clean.
Pervious pavements/Filter Drains	Once a year after autumn leaf fall, or reduced frequency as required, based on site-specific observations of clogging or manufacturer's recommendations.	▸ Remove litter including leaf litter and debris from surface and agitate surface to ensure no vegetation or moss is allowed to establish and grow. ▸ Locally refill with the correct aggregate once a year or as appropriate ▸ Remove weeds from the surface through the application of glyphosate-based weed killers

		▸ Stabilise and mow contributing and adjacent areas. ▸ Inspect once clean. ▸ See Table 20.15 of CIRIA C753 for more information. ▸ Major oil spills have the potential to contaminate the surface and the underlying crushed stone. In the event of a major oil spill, the area of crushed stone that is affected should be removed, cleaned and reinstalled.

Date	Component requiring maintenance	Issues prompting maintenance	Scheduled maintenance (Y/N)	Maintenance carried out	Additional works required (Y/N). If yes, please detail	Next scheduled date of inspection and maintenance