RichardJackson
Engineering Consultants

Our Ref: MG/AJL/47875
Your Ref:

13 April 2017

Mr Alastair Clark
Ball Hall (Project Management) Ltd
780 The Crescent
Colchester Business Park
Colchester
Essex
CO4 9YQ

Dear Alastair

Re: Queenswood School – Surface Water Drainage Strategy

We have reviewed the Hertfordshire Lead Local Flood Authority (LLFA) comments on the proposal to use soakaways and also our own Ground Investigation Report which concludes that due to ground water ingress, that soakaways may not be suitable for surface water disposal at this site.

This investigation suggests that ground water is generally 1.5m – 2.7m below ground level or deeper. There is one result in TP4 which has ground water higher than this at 0.6m or so. This inconsistent set of results suggests that water is perched on very local impermeable geological features.

A site visit was undertaken to review the existing surface water drainage. The sports hall is currently served by two rainwater pipes on the western elevation which connect to a piped system which flows to the north. On the northern boundary of the site there is a ditch which appears to serve the site and also appears to flow from this area in both easterly and westerly directions. The ditch has not been maintained for some time and a significant build-up of organic material and detritus was noted. This material will need to be removed. The drainage system serving this part of the school is noted as being heavily silted and this too will need to be cleansed.

It is proposed to provide enhancements to this existing surface water drainage system to serve the extended sports hall. This new system will be restricted in outflow to the existing brownfield 1 in 1 year run off rate to accord with national and local surface water policy. Calculations have been undertaken for the existing surface water system which shows that the peak runoff rate would be 21.3 l/s. to accommodate this restriction for the extended sports hall a hydrobrake will be retro fitted on the existing drainage system. This will require some water to be stored within the site in a planned manner.

The depth of the existing drainage system and the floor level of the sports hall are only 600mm different. This, together with the number of existing trees makes

Cont'd.../

the provision of any surface water storage extremely challenging. However, the proposed scheme will also include the removal of some temporary accommodation buildings currently located to the south of the sports hall. This opens a small area up that is without trees. A detention basin is proposed in this location to store water.

The attached calculations show that this detention basin will provide sufficient capacity for the surface water system to store water up to the 1 in 100 year plus 20% climate change event. 20% climate change has been selected to accord with a 50 year life for the scheme in line with Planning Policy Guidance advice.

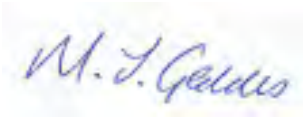
The flow rates for the 1 in 100 year event have been restricted by the hydrobrake flow control to 20.8 l/s which is below the peak rate in the current 1 in 1 year event without climate change.

The detention basin's location and the configuration of the existing pipes within trees means that it is not possible to arrange an online solution. Hence the detention basin will be off line in part. However, if soil conditions allow soakage into the ground. Within 5m of the building an impermeable liner is proposal to avoid impact on the foundations of the building.

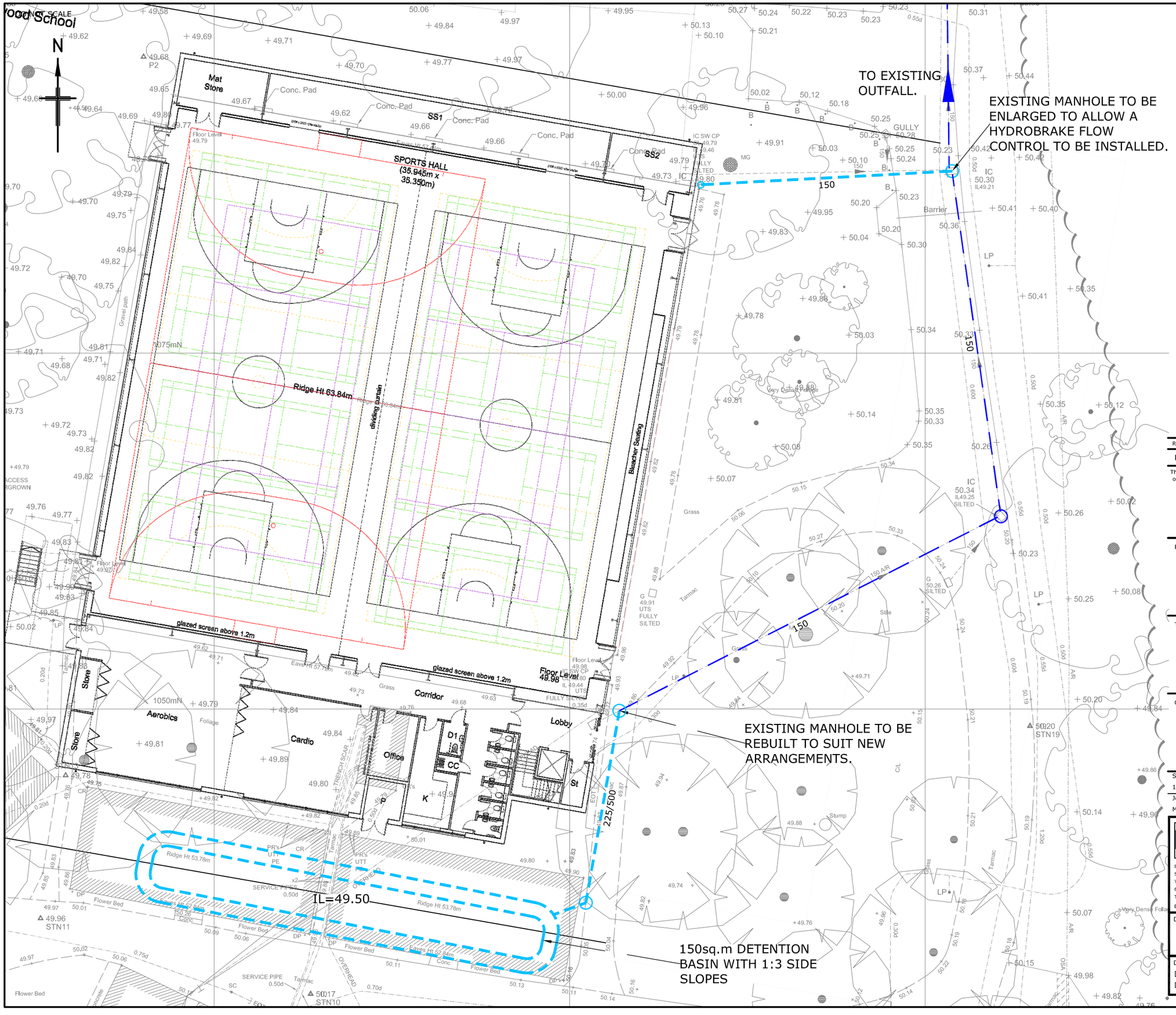
A drawing 47875/P/001 of these arrangements together with calculations of the existing 1 in 1 year event and proposed 1 in 100 year and climate change event are enclosed. In an extreme event that water will flow over the topography to the north west and eventually reach the ditch system noted above.

These proposals comply with LLFA policy for brownfield sites by reducing run off rates from those which currently could occur.

Yours sincerely



Mark Geddes
on behalf of Richard Jackson Limited



KEY.

- EXISTING SURFACE WATER SEWER.
- PROPOSED SURFACE WATER SEWER.

REV	DATE	DESCRIPTION	DRAWN	CHKD

REVISIONS

This drawing is to be read in conjunction with all other Engineer's drawings and all other project information. Any discrepancy between the Engineer's drawings and other project information is to be reported to the Engineer immediately.

Project
QUEENSWOOD SCHOOL, HATFIELD

Title
PROPOSED SURFACE WATER DRAINAGE STRATEGY

Client
BALL HALL (PROJECT MANAGEMENT) LTD.

Scale	Drawn	Date
1:250 @ A3	L.A.W.	12/04/2017
Job Manager	Checked	Approved
M.J.G.	M.J.G.	M.J.G.

RichardJackson Engineering Consultants
847 The Crescent, Colchester, Essex CO4 9YQ Tel: 01206 228800
Suite 409, 1 Alie Street, London E1 8DE Tel: 020 7448 9910
York House, 3 Station Court, Great Shelford, Cambs CB22 5NE Tel: 01223 314794
6 The Old Church, St. Matthews Road, Norwich, Norfolk NR1 1SP Tel: 01603 230240
The Wheelhouse, Bonds Mill, Stonehouse, Gloucestershire GL10 3RF Tel: 01172 020070
Email Address: mail@rj.uk.com Website: http://www.rj.uk.com

Drawing No. 47875/P/001

Revision

Drawing Status
☒ INFORMATION ☐ APPROVAL ☐ COSTING
☐ TENDER ☐ CONSTRUCTION ☐ AS CONSTRUCTED

A3

Summary of Results for 1 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	49.717	0.507	20.3	1.6	O K
30 min Summer	49.609	0.399	18.5	1.3	O K
60 min Summer	49.425	0.215	14.8	0.6	O K
120 min Summer	49.359	0.149	10.2	0.3	O K
180 min Summer	49.337	0.127	7.9	0.3	O K
240 min Summer	49.322	0.112	6.5	0.2	O K
360 min Summer	49.302	0.092	4.9	0.2	O K
480 min Summer	49.292	0.082	4.0	0.1	O K
600 min Summer	49.287	0.077	3.4	0.1	O K
720 min Summer	49.282	0.072	2.9	0.1	O K
960 min Summer	49.275	0.065	2.4	0.1	O K
1440 min Summer	49.265	0.055	1.8	0.1	O K
2160 min Summer	49.258	0.048	1.3	0.1	O K
2880 min Summer	49.253	0.043	1.1	0.1	O K
4320 min Summer	49.247	0.037	0.8	0.0	O K
5760 min Summer	49.244	0.034	0.7	0.0	O K
7200 min Summer	49.241	0.031	0.6	0.0	O K
8640 min Summer	49.238	0.028	0.5	0.0	O K
10080 min Summer	49.237	0.027	0.4	0.0	O K
15 min Winter	49.777	0.567	21.3	1.6	O K
30 min Winter	49.542	0.332	17.2	1.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	31.547	0.0	9.9	11
30 min Summer	20.414	0.0	12.9	19
60 min Summer	12.800	0.0	16.1	34
120 min Summer	7.858	0.0	19.8	64
180 min Summer	5.877	0.0	22.2	92
240 min Summer	4.776	0.0	24.1	122
360 min Summer	3.550	0.0	26.8	184
480 min Summer	2.865	0.0	28.9	240
600 min Summer	2.426	0.0	30.6	300
720 min Summer	2.117	0.0	32.0	364
960 min Summer	1.708	0.0	34.4	482
1440 min Summer	1.263	0.0	38.2	724
2160 min Summer	0.934	0.0	42.4	1076
2880 min Summer	0.754	0.0	45.6	1464
4320 min Summer	0.557	0.0	50.5	2176
5760 min Summer	0.449	0.0	54.3	2936
7200 min Summer	0.380	0.0	57.5	3624
8640 min Summer	0.332	0.0	60.3	4312
10080 min Summer	0.296	0.0	62.7	5112
15 min Winter	31.547	0.0	11.1	11
30 min Winter	20.414	0.0	14.4	19

Summary of Results for 1 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m^3)	Status
60 min Winter	49.377	0.167	12.2	0.4	O K
120 min Winter	49.336	0.126	7.7	0.3	O K
180 min Winter	49.314	0.104	5.8	0.2	O K
240 min Winter	49.301	0.091	4.8	0.2	O K
360 min Winter	49.288	0.078	3.5	0.1	O K
480 min Winter	49.282	0.072	2.9	0.1	O K
600 min Winter	49.276	0.066	2.4	0.1	O K
720 min Winter	49.271	0.061	2.1	0.1	O K
960 min Winter	49.265	0.055	1.7	0.1	O K
1440 min Winter	49.257	0.047	1.3	0.1	O K
2160 min Winter	49.250	0.040	1.0	0.0	O K
2880 min Winter	49.246	0.036	0.8	0.0	O K
4320 min Winter	49.241	0.031	0.6	0.0	O K
5760 min Winter	49.238	0.028	0.5	0.0	O K
7200 min Winter	49.236	0.026	0.4	0.0	O K
8640 min Winter	49.235	0.025	0.4	0.0	O K
10080 min Winter	49.233	0.023	0.3	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m^3)	Discharge Volume (m^3)	Time-Peak (mins)
60 min Winter	12.800	0.0	18.1	34
120 min Winter	7.858	0.0	22.2	64
180 min Winter	5.877	0.0	24.9	94
240 min Winter	4.776	0.0	27.0	122
360 min Winter	3.550	0.0	30.1	188
480 min Winter	2.865	0.0	32.3	252
600 min Winter	2.426	0.0	34.2	300
720 min Winter	2.117	0.0	35.8	376
960 min Winter	1.708	0.0	38.6	476
1440 min Winter	1.263	0.0	42.8	730
2160 min Winter	0.934	0.0	47.4	1108
2880 min Winter	0.754	0.0	51.1	1468
4320 min Winter	0.557	0.0	56.6	2180
5760 min Winter	0.449	0.0	60.9	2992
7200 min Winter	0.380	0.0	64.4	3488
8640 min Winter	0.332	0.0	67.5	4368
10080 min Winter	0.296	0.0	70.2	5088

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	1	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.000	Shortest Storm (mins)	15
Ratio R	0.422	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Pipe Network

Volume in Pipe Network (m^3)	1	Dia of Outfall Pipe (m)	0.2
Slope of Outfall Pipe (1:X)	150	Roughness of Outfall Pipe (mm)	0.600

Time Area Diagram

Total Area (ha) 0.168

Time (mins) From:	To:	Area (ha)
0	4	0.168

Model Details

Storage is Online Cover Level (m) 50.300

Pipe Structure

Diameter (m)	0.150	Length (m)	60.000
Slope (1:X)	150.000	Invert Level (m)	49.210

Pipe Outflow Control

Diameter (m)	0.150	Entry Loss Coefficient	0.500
Slope (1:X)	150.0	Coefficient of Contraction	0.600
Length (m)	40.000	Upstream Invert Level (m)	49.210
Roughness k (mm)	0.600		

Summary of Results for 100 year Return Period (+20%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m^3)	Status
15 min Summer	49.398	0.098	18.5	29.4	O K
30 min Summer	49.412	0.112	20.1	33.7	O K
60 min Summer	49.408	0.108	19.6	32.3	O K
120 min Summer	49.395	0.095	18.2	28.4	O K
180 min Summer	49.381	0.081	16.5	24.2	O K
240 min Summer	49.369	0.069	15.0	20.7	O K
360 min Summer	49.352	0.052	12.6	15.5	O K
480 min Summer	49.340	0.040	11.0	11.9	O K
600 min Summer	49.330	0.030	9.7	9.1	O K
720 min Summer	49.323	0.023	8.8	7.0	O K
960 min Summer	49.313	0.013	7.4	3.8	O K
1440 min Summer	49.301	0.001	6.0	0.3	O K
2160 min Summer	49.300	0.000	4.5	0.0	O K
2880 min Summer	49.300	0.000	3.6	0.0	O K
4320 min Summer	49.300	0.000	2.6	0.0	O K
5760 min Summer	49.300	0.000	2.1	0.0	O K
7200 min Summer	49.300	0.000	1.7	0.0	O K
8640 min Summer	49.300	0.000	1.4	0.0	O K
10080 min Summer	49.300	0.000	1.3	0.0	O K
15 min Winter	49.414	0.114	20.1	34.2	O K
30 min Winter	49.428	0.128	20.3	38.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m^3)	Discharge Volume (m^3)	Time-Peak (mins)
15 min Summer	120.653	0.0	41.1	15
30 min Summer	78.493	0.0	55.0	24
60 min Summer	48.611	0.0	67.2	42
120 min Summer	29.095	0.0	81.5	76
180 min Summer	21.273	0.0	89.9	106
240 min Summer	16.942	0.0	95.3	138
360 min Summer	12.241	0.0	103.3	200
480 min Summer	9.724	0.0	109.7	262
600 min Summer	8.128	0.0	114.6	322
720 min Summer	7.017	0.0	118.6	384
960 min Summer	5.561	0.0	125.3	502
1440 min Summer	4.002	0.0	135.4	736
2160 min Summer	2.875	0.0	145.9	0
2880 min Summer	2.272	0.0	153.8	0
4320 min Summer	1.628	0.0	165.3	0
5760 min Summer	1.285	0.0	173.9	0
7200 min Summer	1.068	0.0	180.7	0
8640 min Summer	0.918	0.0	186.5	0
10080 min Summer	0.808	0.0	191.4	0
15 min Winter	120.653	0.0	46.7	16
30 min Winter	78.493	0.0	61.5	26

Summary of Results for 100 year Return Period (+20%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m^3)	Status
60 min Winter	49.422	0.122	20.2	36.7	O K
120 min Winter	49.398	0.098	18.5	29.5	O K
180 min Winter	49.379	0.079	16.3	23.6	O K
240 min Winter	49.364	0.064	14.3	19.1	O K
360 min Winter	49.343	0.043	11.4	12.9	O K
480 min Winter	49.329	0.029	9.6	8.7	O K
600 min Winter	49.319	0.019	8.2	5.8	O K
720 min Winter	49.312	0.012	7.3	3.5	O K
960 min Winter	49.301	0.001	6.0	0.4	O K
1440 min Winter	49.300	0.000	4.5	0.0	O K
2160 min Winter	49.300	0.000	3.3	0.0	O K
2880 min Winter	49.300	0.000	2.6	0.0	O K
4320 min Winter	49.300	0.000	1.9	0.0	O K
5760 min Winter	49.300	0.000	1.5	0.0	O K
7200 min Winter	49.300	0.000	1.2	0.0	O K
8640 min Winter	49.300	0.000	1.1	0.0	O K
10080 min Winter	49.300	0.000	0.9	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m^3)	Discharge Volume (m^3)	Time-Peak (mins)
60 min Winter	48.611	0.0	76.2	44
120 min Winter	29.095	0.0	92.0	78
180 min Winter	21.273	0.0	101.0	112
240 min Winter	16.942	0.0	106.9	144
360 min Winter	12.241	0.0	116.0	208
480 min Winter	9.724	0.0	122.6	268
600 min Winter	8.128	0.0	128.2	330
720 min Winter	7.017	0.0	132.8	390
960 min Winter	5.561	0.0	140.5	502
1440 min Winter	4.002	0.0	151.7	0
2160 min Winter	2.875	0.0	163.5	0
2880 min Winter	2.272	0.0	172.2	0
4320 min Winter	1.628	0.0	185.2	0
5760 min Winter	1.285	0.0	194.7	0
7200 min Winter	1.068	0.0	202.4	0
8640 min Winter	0.918	0.0	208.9	0
10080 min Winter	0.808	0.0	214.4	0

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.000	Shortest Storm (mins)	15
Ratio R	0.422	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+20

Pipe Network

Volume in Pipe Network (m^3)	1	Dia of Outfall Pipe (m)	0.2
Slope of Outfall Pipe (1:X)	150	Roughness of Outfall Pipe (mm)	0.600

Time Area Diagram

Total Area (ha) 0.188

Time (mins) From:	To:	Area (ha)
0	4	0.188

Model Details

Storage is Online Cover Level (m) 50.000

Tank or Pond Structure

Invert Level (m) 49.300

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	300.0	0.700	300.0	1.400	300.0	2.100	300.0
0.100	300.0	0.800	300.0	1.500	300.0	2.200	300.0
0.200	300.0	0.900	300.0	1.600	300.0	2.300	300.0
0.300	300.0	1.000	300.0	1.700	300.0	2.400	300.0
0.400	300.0	1.100	300.0	1.800	300.0	2.500	300.0
0.500	300.0	1.200	300.0	1.900	300.0		
0.600	300.0	1.300	300.0	2.000	300.0		

Hydro-Brake Optimum® Outflow Control

Unit Reference	MD-SHE-0206-2100-0600-2100
Design Head (m)	0.600
Design Flow (l/s)	21.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Diameter (mm)	206
Invert Level (m)	49.210
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.600	20.8
Flush-Flo™	0.300	20.8
Kick-Flo®	0.491	18.9
Mean Flow over Head Range	-	16.2

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	7.1	1.200	28.9	3.000	45.0	7.000	67.6
0.200	19.8	1.400	31.2	3.500	48.5	7.500	70.0
0.300	20.8	1.600	33.2	4.000	51.7	8.000	72.3
0.400	20.3	1.800	35.2	4.500	54.8	8.500	74.6
0.500	19.1	2.000	37.0	5.000	57.7	9.000	76.8
0.600	20.8	2.200	38.8	5.500	60.4	9.500	78.9
0.800	23.8	2.400	40.4	6.000	63.0		
1.000	26.5	2.600	42.0	6.500	65.1		

ICP SUDS Mean Annual Flood

Input

Return Period (years)	100	Soil	0.150
Area (ha)	0.189	Urban	0.000
SAAR (mm)	687	Region Number	Region 6

Results l/s

QBAR Rural	0.1
QBAR Urban	0.1
Q100 years	0.2
Q1 year	0.1
Q30 years	0.2
Q100 years	0.2