

Project Yale Campus Redevelopment, Wrexham					Job Ref. DKC0051	
Part of structure Surface Water Drainage					Sheet No./Rev. Cover	
Calc. By DRB	Date July '18	Checked by JDH	Date July '18		Approved JDH	Date July '18
Ref.		Calculations			Output	

Structural Calculations

Yale Campus Redevelopment Wrexham



Project Number : DKC0051

Surface Water Drainage - Soakaways

Jul-18



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Project Yale Campus Redevelopment, Wrexham				Job Ref. DKC0051	
Part of structure Surface Water Drainage				Sheet No./Rev. 1	
Calc. By DRB	Date July '18	Checked by JDH	Date July '18	Approved JDH	Date July '18
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Surface Water Drainage

Existing

Data and Parameters

College : 1
Floors : 2

College

Appliance			m2
Building			2625.0
		Total	2625.0

Infiltration Rate = 0.0001 m/s *to be confirmed (ground investigation results required)*

2 soakaways shown on drainage survey - each can support approximately 225m2 : **Total 450m2**

SOAKAWAY DESIGN

In accordance with BRE Digest 365 - Soakaway design

Design rainfall intensity
Location of catchment area Other
Impermeable area drained to the system A = 225.0 m²
Return period Period = 100 yr
Ratio 60 min to 2 day rainfall of 5 yr return period r = 0.300
5-year return period rain fall of 60 minutes duration M5_60min = 20.0 mm
Increase of rainfall intensity due to global warming p_{climate} = 30 %

Duration, D (min)	Growth factor Z1	M5 rainfalls (mm)	Growth factor Z2	100 year rainfall, M100 (mm)	Inflow (m ³)	Outflow (m ³)	Storage required (m ³)
5	0.34	8.8	1.88	16.6	3.74	0.24	3.50
10	0.49	12.7	1.95	24.9	5.60	0.48	5.12
15	0.59	15.3	1.99	30.6	6.88	0.72	6.16
30	0.77	20.0	2.03	40.6	9.14	1.44	7.70
60	1.00	26.0	2.00	52.1	11.71	2.88	8.83
120	1.25	32.5	1.95	63.4	14.26	5.76	8.50
240	1.57	40.8	1.88	76.9	17.30	11.52	5.78
360	1.78	46.3	1.84	85.1	19.16	17.28	1.88
600	2.12	55.1	1.78	97.8	22.02	28.80	0.00
1440	2.84	73.8	1.65	121.7	27.38	69.12	0.00

Required storage volume $S_{req} = 8.83 \text{ m}^3$
Soakaway storage volume $S_{sw} = \pi \times (D_{ring}^2 / 4) \times d + (d \times W^2 - (\pi \times ((D_{ring} + 2 \times T_{ring})^2 / 4) \times d)) \times V_{ring} = 9.33 \text{ m}^3$
PASS - Soakaway storage volume
Time for emptying soakaway to half volume $t_{50} = S_{req} \times 0.5 / (A_{50} \times f) = 1 \text{ hr } 31 \text{ min } 60 \text{ s}$
PASS - Soakaway discharge time less than or equal to 24 hours

2 soakaways shown on drainage survey - the drained area, 450m2, is less than the total existing building area, 2625m2
therefore the site drainage must be split foul, surface and combined.

The combined takes approximately 80% of the current surface water drainage - typically the existing building to be demolished.



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Surface Water Drainage Proposed (Soakaway Design)

Data and Parameters

College : 1
Floors : 3

to be designed for a 1:100 year storm plus 30% Climate Change

College

Appliance			m2
Building			2760.0
		Total	2760.0

Infiltration Rate = 0.0001 m/s *to be confirmed (ground investigation results required)*

SOAKAWAY DESIGN

In accordance with BRE Digest 365 - Soakaway design

Design rainfall intensity

Location of catchment area Other
Impermeable area drained to the system A = 2760.0 m²
Return period Period = 100 yr
Ratio 60 min to 2 day rainfall of 5 yr return period r = 0.300
5-year return period rainfall of 60 minutes duration M5_60min = 20.0 mm
Increase of rainfall intensity due to global warming p_{climate} = 30 %

Good Infiltration Rate

Duration, D (min)	Growth factor Z1	M5 rainfalls (mm)	Growth factor Z2	100 year rainfall, M100 (mm)	Inflow (m ³)	Outflow (m ³)	Storage required (m ³)
5	0.34	8.8	1.88	16.6	45.92	0.88	45.07
10	0.49	12.7	1.95	24.9	68.70	1.71	66.99
15	0.59	15.3	1.99	30.8	84.37	2.57	81.80
30	0.77	20.0	2.03	40.8	112.16	5.13	107.03
60	1.00	26.0	2.00	52.1	143.66	10.26	133.40
120	1.25	32.5	1.95	63.4	174.92	20.52	154.39
240	1.57	40.8	1.88	76.9	212.19	41.04	171.15
360	1.78	46.3	1.84	85.1	235.00	61.56	173.44
600	2.12	55.1	1.78	97.8	270.06	102.60	167.46
1440	2.84	73.8	1.65	121.7	335.84	246.24	89.60

Required storage volume $S_{req} = 173.44 \text{ m}^3$
Soakaway storage volume $S_{sw} = l \times d \times w \times V_{max} = 179.55 \text{ m}^3$

Time for emptying soakaway to half volume $t_{50} = S_{sw} \times 0.5 / (S_{d50} \times f) = 8 \text{ hr } 27 \text{ min } 8 \text{ s}$
PASS - Soakaway storage volume
PASS - Soakaway discharge time less than or equal to 24 hours

Average Infiltration Rate

Duration, D (min)	Growth factor Z1	M5 rainfalls (mm)	Growth factor Z2	100 year rainfall, M100 (mm)	Inflow (m ³)	Outflow (m ³)	Storage required (m ³)
5	0.34	8.8	1.88	16.6	45.92	0.40	45.53
10	0.49	12.7	1.95	24.9	68.70	0.79	67.91
15	0.59	15.3	1.99	30.8	84.37	1.19	83.18
30	0.77	20.0	2.03	40.8	112.16	2.37	109.79
60	1.00	26.0	2.00	52.1	143.66	4.75	138.92
120	1.25	32.5	1.95	63.4	174.92	9.49	165.42
240	1.57	40.8	1.88	76.9	212.19	18.98	193.21
360	1.78	46.3	1.84	85.1	235.00	28.47	206.53
600	2.12	55.1	1.78	97.8	270.06	47.45	222.61
1440	2.84	73.8	1.65	121.7	335.84	113.89	221.95

Required storage volume $S_{req} = 222.61 \text{ m}^3$
Soakaway storage volume $S_{sw} = l \times d \times w \times V_{max} = 332.17 \text{ m}^3$
PASS - Soakaway storage volume
Time for emptying soakaway to half volume $t_{50} = S_{sw} \times 0.5 / (S_{d50} \times f) = 23 \text{ hr } 27 \text{ min } 22 \text{ s}$
PASS - Soakaway discharge time less than or equal to 24 hours

Soakaway Size Required

18m x 10.5m x 1.0m (below the incoming pipes invert level) Good Infiltration Rate

18m x 10.5m x 1.85m (below the incoming pipes invert level) Average Infiltration Rate

Refer to Surface Water - Storage Design (if Ground Investigation confirms soils not suitable for Soakaways)