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Job No.	:	20762
Sheet	:	S1
Made by	:	PWJL
Date	:	02-Jun-20
Checked	:	RSC
Revision	:	-

Ref:	CALCULATIONS		Output.																
	NEW CLUBHOUSE AT MERTHYR RUGBY GROUND, CAE'R WERN, MERTHYR TYDFIL CF48 1AF																		
	Client: Blandford Consulting																		
	RCA Brief: Design of attenuated surface water storage.																		
	Design Data: - Building Regulations Approved Document Part H. - Sewers for Adoption 7th Edition. - Site Location Co-Ordinates: E 304472 N 205764 Site Grid Reference: SO 04472 05764 - Time of Entry = 4 minutes. - Welsh Ministers Standards.																		
	Information Provided: Architectural Site Plan. Land Survey.																		
	Drainage Areas:	Roof Area = 595 m ² Path Area = 109 m ² Total Area = 704	595 109 704																
	Drainage Design By: Micro Drainage - Version 2020.1																		
	Revisions: <table border="1"> <thead> <tr> <th>Revision Version:</th> <th>Description:</th> <th>Date:</th> </tr> </thead> <tbody> <tr><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td></tr> </tbody> </table>		Revision Version:	Description:	Date:														
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	<table border="1"> <tr> <th colspan="2">Calculations Prepared By:</th> <th colspan="2">Calculations Checked By:</th> </tr> <tr> <td colspan="2">Philip Lawrence</td> <td colspan="2">Roger Casey</td> </tr> <tr> <td>Signed:</td> <td>Date:</td> <td>Signed:</td> <td>Date:</td> </tr> <tr> <td></td> <td>02/06/2020</td> <td></td> <td>02/06/2020</td> </tr> </table>		Calculations Prepared By:		Calculations Checked By:		Philip Lawrence		Roger Casey		Signed:	Date:	Signed:	Date:		02/06/2020		02/06/2020	Template Issue Date: 21/03/2016
Calculations Prepared By:		Calculations Checked By:																	
Philip Lawrence		Roger Casey																	
Signed:	Date:	Signed:	Date:																
	02/06/2020		02/06/2020																

IH 124 Mean Annual Flood

Input

Return Period (years) 2 Soil 0.500
Area (ha) 50.000 Urban 0.000
SAAR (mm) 1630 Region Number Region 9

Results 1/s

QBAR Rural 742.2
QBAR Urban 742.2

Q2 years 689.4

Q1 year 653.2
Q2 years 689.4
Q5 years 898.1
Q10 years 1053.9
Q20 years 1210.6
Q25 years 1264.7
Q30 years 1308.6
Q50 years 1436.9
Q100 years 1618.0
Q200 years 1833.3
Q250 years 1907.5
Q1000 years 2367.7

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Job No. : **20762**
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 Revision : **A**

Ref:

CALCULATIONS

Output.

Determine surface water attenuation flow rateTotal Site Area = 704 m²

Brownfield Site - previous urbanisation = 0.000

Impermeable area post-development = 704 m²

IH 124 Mean Annual Flood method

Q1 = 653.2 litres/second/50 ha

QBAR = 742.2 litres/second/50 ha

These calculations consider the runoff from areas which will become impermeable. The greatest result from the following 3 methods will be considered to be the greenfield runoff rate.

1. Runoff of 2 litres/second/hectareRunoff = 2l/s/ha x 0.0704 ha = **0.141 l/s****2. Annual flood**

Reduction factor from 50 ha to 0.0704 ha = 0.001

Site 1 year runoff = **0.920 l/s****3. QBAR method**

Reduction factor from 50 ha to 0.0704 ha = 0.001

Site QBAR runoff = **1.045 l/s****Results**

Method	Greenfield runoff (l/s)
1	0.141
2	0.920
3	1.045

Greenfield run-off for attenuation based on QBAR = 1.045 litres/second

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Ty Mansel, Mansel Street Carmarthen Wales, SA31 1PX	New Clubhouse at Merthyr Rugby Ground, Cae'r Wern, Merthyr Tydfil CF48 1AF	
Date 03/06/2020 11:04 File 20762 1-100+30%.SRCX	Designed by PWJL Checked by	
Innovyze	Source Control 2020.1	

Summary of Results for 100 year Return Period (+30%)

Half Drain Time : 482 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m ³)	Status
15 min Summer	8.183	0.283	0.0	0.5	0.5	12.9	O K
30 min Summer	8.314	0.414	0.0	0.6	0.6	18.9	O K
60 min Summer	8.474	0.574	0.0	0.8	0.8	26.2	O K
120 min Summer	8.640	0.740	0.0	0.9	0.9	33.7	O K
180 min Summer	8.725	0.825	0.0	0.9	0.9	37.6	O K
240 min Summer	8.780	0.880	0.0	0.9	0.9	40.1	O K
360 min Summer	8.842	0.942	0.0	1.0	1.0	42.9	O K
480 min Summer	8.879	0.979	0.0	1.0	1.0	44.7	O K
600 min Summer	8.904	1.004	0.0	1.0	1.0	45.8	O K
720 min Summer	8.920	1.020	0.0	1.0	1.0	46.5	O K
960 min Summer	8.935	1.035	0.0	1.0	1.0	47.2	O K
1440 min Summer	8.929	1.029	0.0	1.0	1.0	46.9	O K
2160 min Summer	8.893	0.993	0.0	1.0	1.0	45.3	O K
2880 min Summer	8.848	0.948	0.0	1.0	1.0	43.2	O K
4320 min Summer	8.762	0.862	0.0	0.9	0.9	39.3	O K
5760 min Summer	8.692	0.792	0.0	0.9	0.9	36.1	O K
7200 min Summer	8.634	0.734	0.0	0.9	0.9	33.5	O K
8640 min Summer	8.580	0.680	0.0	0.8	0.8	31.0	O K
10080 min Summer	8.531	0.631	0.0	0.8	0.8	28.8	O K
15 min Winter	8.218	0.318	0.0	0.6	0.6	14.5	O K
30 min Winter	8.365	0.465	0.0	0.7	0.7	21.2	O K
60 min Winter	8.546	0.646	0.0	0.8	0.8	29.4	O K
120 min Winter	8.736	0.836	0.0	0.9	0.9	38.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Discharge Volume (m ³)	Time-Peak (mins)
15 min Summer	100.646	0.0	13.2	26
30 min Summer	74.363	0.0	19.6	40
60 min Summer	52.662	0.0	28.0	68
120 min Summer	35.497	0.0	37.7	126
180 min Summer	27.508	0.0	43.9	184
240 min Summer	22.929	0.0	48.7	242
360 min Summer	17.658	0.0	56.3	328
480 min Summer	14.625	0.0	62.2	388
600 min Summer	12.613	0.0	67.0	454
720 min Summer	11.163	0.0	71.2	520
960 min Summer	9.187	0.0	78.1	658
1440 min Summer	6.965	0.0	88.7	936
2160 min Summer	5.294	0.0	101.4	1348
2880 min Summer	4.365	0.0	111.5	1756
4320 min Summer	3.346	0.0	128.2	2520
5760 min Summer	2.792	0.0	142.7	3288
7200 min Summer	2.438	0.0	155.7	4040
8640 min Summer	2.180	0.0	167.1	4760
10080 min Summer	1.984	0.0	177.4	5544
15 min Winter	100.646	0.0	14.8	26
30 min Winter	74.363	0.0	21.9	40
60 min Winter	52.662	0.0	31.3	68
120 min Winter	35.497	0.0	42.3	124

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Summary of Results for 100 year Return Period (+30%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (1/s)	Max Control (1/s)	Max Σ Outflow (1/s)	Max Volume (m³)	Status
180 min Winter	8.835	0.935	0.0	1.0	1.0	42.6	O K
240 min Winter	8.901	1.001	0.0	1.0	1.0	45.7	O K
360 min Winter	8.977	1.077	0.0	1.0	1.0	49.1	O K
480 min Winter	9.014	1.114	0.0	1.1	1.1	50.8	Flood Risk
600 min Winter	9.039	1.139	0.0	1.1	1.1	52.0	Flood Risk
720 min Winter	9.055	1.155	0.0	1.1	1.1	52.7	Flood Risk
960 min Winter	9.063	1.163	0.0	1.1	1.1	53.0	Flood Risk
1440 min Winter	9.035	1.135	0.0	1.1	1.1	51.8	Flood Risk
2160 min Winter	8.962	1.062	0.0	1.0	1.0	48.4	O K
2880 min Winter	8.883	0.983	0.0	1.0	1.0	44.8	O K
4320 min Winter	8.744	0.844	0.0	0.9	0.9	38.5	O K
5760 min Winter	8.636	0.736	0.0	0.9	0.9	33.5	O K
7200 min Winter	8.550	0.650	0.0	0.8	0.8	29.6	O K
8640 min Winter	8.477	0.577	0.0	0.8	0.8	26.3	O K
10080 min Winter	8.416	0.516	0.0	0.7	0.7	23.5	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
180 min Winter	27.508	0.0	49.1	180
240 min Winter	22.929	0.0	54.6	238
360 min Winter	17.658	0.0	63.1	346
480 min Winter	14.625	0.0	69.6	440
600 min Winter	12.613	0.0	75.1	476
720 min Winter	11.163	0.0	79.7	554
960 min Winter	9.187	0.0	87.4	710
1440 min Winter	6.965	0.0	99.2	1012
2160 min Winter	5.294	0.0	113.6	1448
2880 min Winter	4.365	0.0	124.9	1872
4320 min Winter	3.346	0.0	143.5	2680
5760 min Winter	2.792	0.0	159.8	3456
7200 min Winter	2.438	0.0	174.4	4184
8640 min Winter	2.180	0.0	187.2	4936
10080 min Winter	1.984	0.0	198.7	5656

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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	0.200	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+30

Time Area Diagram

Total Area (ha) 0.071

Time (mins)	Area	Time (mins)	Area	Time (mins)	Area
From: To: (ha)		From: To: (ha)		From: To: (ha)	
0 4	0.024	4 8	0.024	8 12	0.023

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Model Details

Storage is Online Cover Level (m) 9.100

Cellular Storage Structure

Invert Level (m) 7.900 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)
0.000	48.0	48.0	1.300	0.0	110.4
1.200	48.0	110.4			

Orifice Outflow Control

Diameter (m) 0.022 Discharge Coefficient 0.600 Invert Level (m) 7.900