

Flood Risk Assessment & Preliminary Foul & Surface Water Drainage Strategy

1.0 Introduction

- 1.1 Following instructions from Portal Construction, Muir Associates (UK) Ltd have undertaken an initial assessment of flooding and drainage issues in relation to a proposed redevelopment site located at Bryn Lane for the construction of 2 No detached industrial units and associated parking and service yards within a development site on Bryn Lane in Wrexham LL13 9UT.
- 1.2 The site is located in an existing industrial developed area.
- 1.3 The Local Authority is Wrexham County Borough Council, and the wastewater undertaker is Welsh Water.
- 1.4 The comments given in this report and recommendations made are based in the information that could be obtained from reasonably accessible sources and site visits.
- 1.5 Detailed discussions are still to be held with Welsh Water in regard to the outline proposal to make the connection for the foul wastewater to the existing unmapped foul drain to the other side of the road as shown on the plans.
- 1.6 Due to the current ground conditions on site being clay the proposed surface water generated from the site will be retained on site within a below ground storm water attenuation tank, fitted with a flow control device to limit the flow to a maximum pass forward rate of 2 l/s for each unit up to and including the 1 in 100 + 40 % Climate change allowance. The redeveloped site will be connected to the existing surface water drainage holding tank on site.
- 1.7 The proposed site has existing ponds and water courses to part of the perimeter for which the proposal will be to discharge the controlled flows into these by way of constructing headwalls or similar prior to discharge.

2.0 Drainage Hierarchy

- 2.1 Current guidance looks to outline all new developments must consider the how they will deal with their surface water drainage and follow the standard rules for such discharge in the following order of priority :
 - 2.1.1 Infiltration – Into the ground by way of soakaway or similar
 - 2.1.2 Surface Water Body – Discharge the surface water generated into a surface water water course or similar existing feature
 - 2.1.3 Existing surface water sewer or highway drain
 - 2.1.4 Existing combined sewer

3.0 Site Flood Risk

- 3.1** The existing site is located on Bryn Lane, Wrexham Industrial Estate LL13 9UT and is located within an area defined as being in a flood risk zone 1 an area with a low probability of flooding from rivers and sea.
- 3.2** A review of the information in relation to both the risk associated with flooding from surface water and reservoirs also show the site as being in a low risk area.

4.0 Existing Drainage

- 4.1** The existing site is currently vacant with some existing stoned up areas.
- 4.2** The site currently has existing surface water features for which it is proposed to be used for the new connection within the site.
- 4.3** The ground conditions on site are believed to be firm clay at relatively shallow depths and as such the use of infiltration (soakaways) is extremely unlikely to be a viable option. The adjacent site looks to have undertaken such tests on site and the results were found to demonstrate the ground conditions being unsuitable for such.
- 4.4** There are existing water courses within the land immediately around the site so the use of attenuation with a control outflow of 2 l/s for each unit is to be adopted as the drainage strategy for the site redevelopment.
- 4.5** A review of the sewer records for the area only indicate the site as having existing private combined sewers within which will be used for the discharge of foul drainage subject to agreement with Welsh Water.

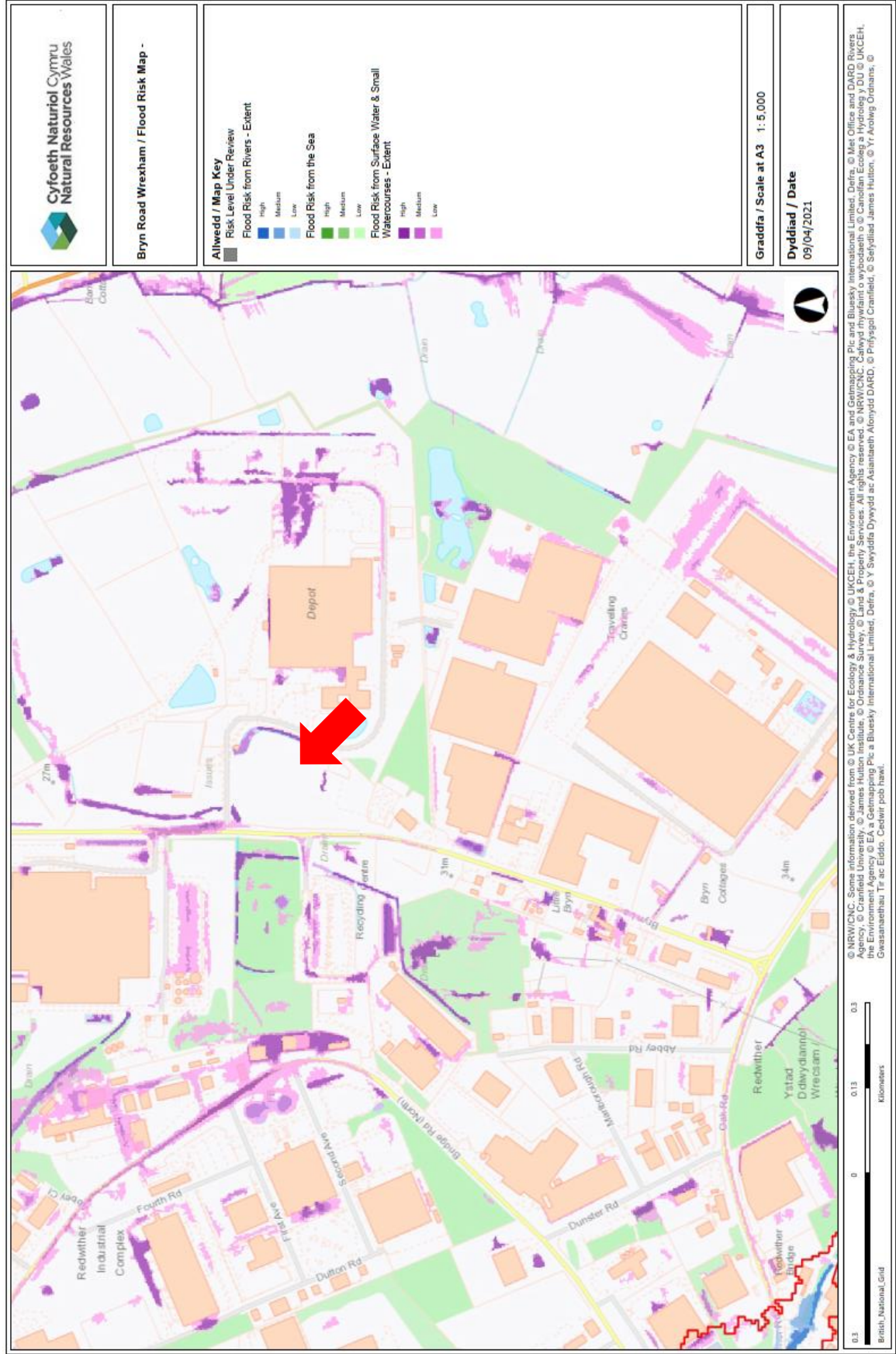
5.0 Proposed Drainage

- 5.1** The development proposal is to therefore attenuate the flow of surface water generated from the site to a control flow of 2 l/s for storm events up to and including the 1 in 100 + 40% Climate change event whilst no flooding will occur to buildings on site or to buildings or land off site.
- 5.2** All below ground drainage will be designed to accommodate the 1 in 30 year event with no flooding occurring on site within the system.
- 5.3** The use of shallow flooding or car park areas will be permitted for exceedances above the 1 in 30 year event so long as they can demonstrate that no flooding will occur of site.

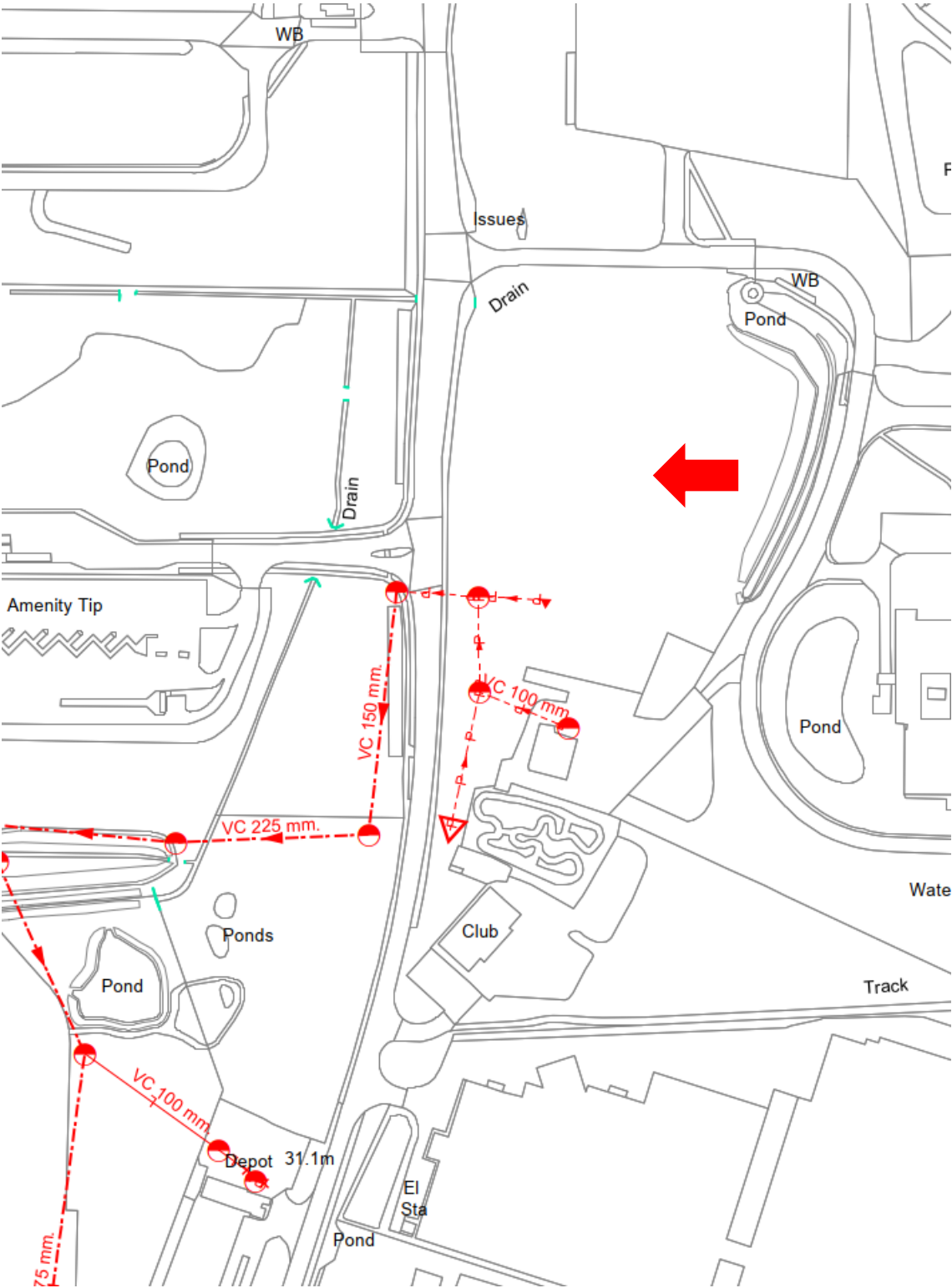
6.0 Conclusion

- 6.1** The site has available surface water drainage options available based on the current surface water courses to the perimeter of the site which will be utilised to discharge the surface water at a controlled rate as soakways are unlikely to be viable due to the ground conditions.
- 6.2** The development proposal looks to use a stormwater attenuation tank (tubosider helibore pipes) to generate the required storage volume whilst limiting the flow from each unit site to 2 l/s.
- 6.3** The maintenance strategy for the proposed attenuation tank system allows full access into the tank for periodic inspections and maintenance in the way of any silt removal should this be required.
- 6.4** Whilst infiltration tests have not been carried out on site the proposal is based on the information reviewed from site investigation data and knowledge of the surrounding area.

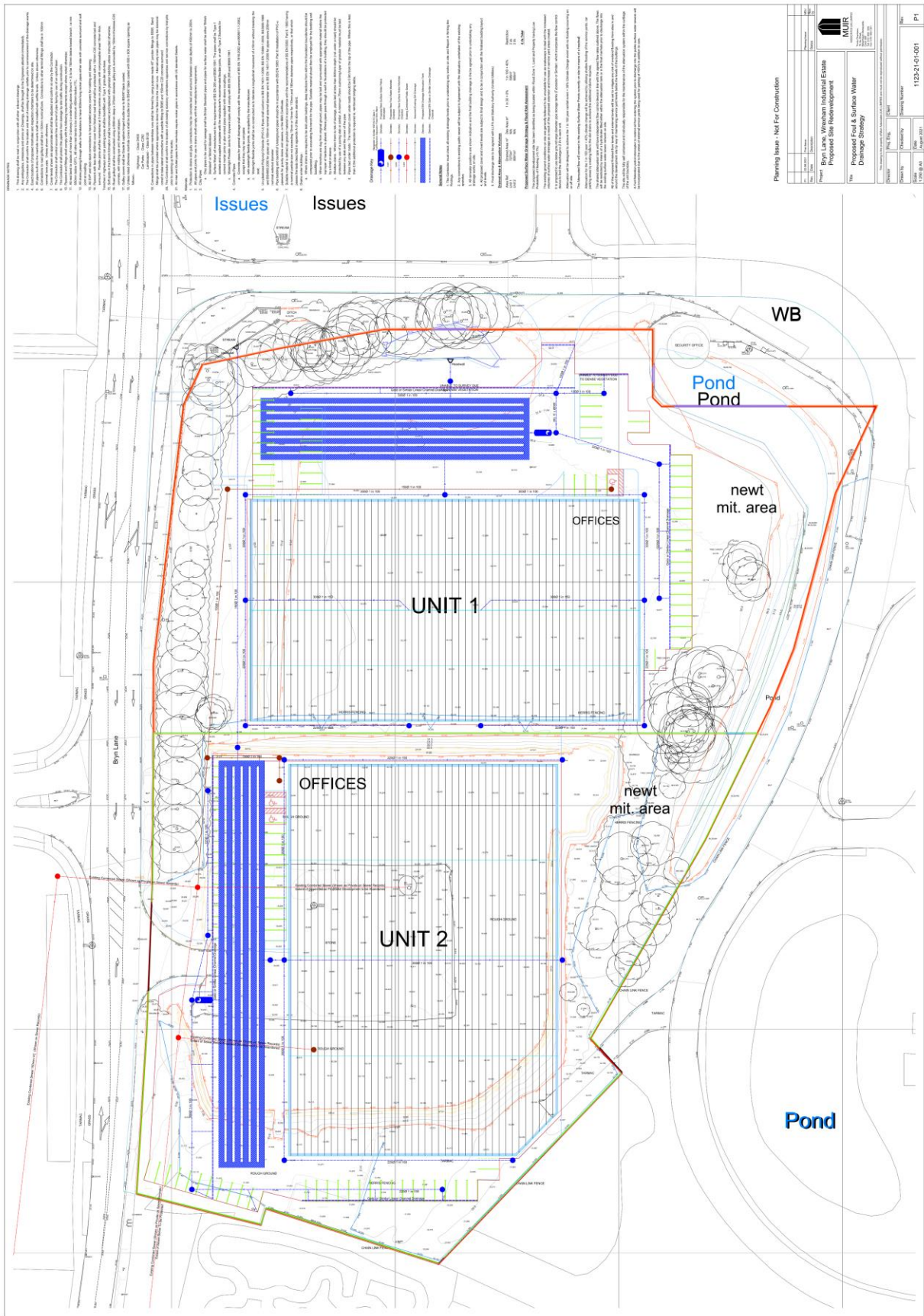
Appendix A – Flood Risk Map



Appendix B – Sewer Records Extract



Appendix C – Proposed Site Drainage Layout



Appendix E – Drainage Calculations



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Project Bryn Lane, Wrexham Industrial Estate		Sheet no. 1		Date 02/08/21
Title Unit 1 - Hydrograph Storage Estimate 1 in 100 + 40%		By	Checked	Reviewed

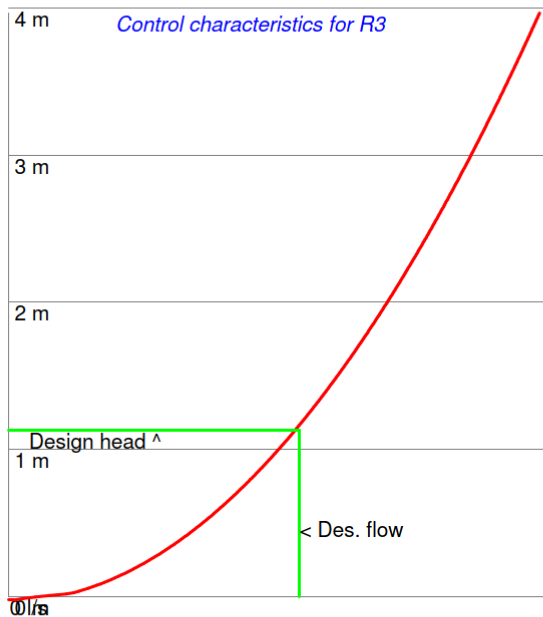
Data:-

Location = WREXHAM
 M5-60 (mm) = 18
 Soil index = 0.45
 Return period = 100
 UCWI = 0.0
 Grid reference = SJ3349
 $r = 0.32$
 SAAR (mm/yr) = 800
 WRAP = 4
 Climate change = +40%

Clayey, or loamy over clayey soils with an impermeable layer at shallow depth.

Percentage runoff = 95.0% (manual setting)

Imperv. area = 7275 m²
 Total area = 7275 m²
 Total runoff = 603.0 m³
 Design Head = 1.2m
 Control device = R3
 Max. calc. depth = 1.19 m
 Pervious area = 0 m²
 Equiv area = 6911 m² (Tot. area x % runoff).
 Discharge rate = 2.000 l/s
 Peak flow = 1.99 l/s
 Orifice diam = 37.8 mm
 Available depth = 0.0 m³
 Pipeline storage = 0.0 m³
 Offline storage = 0.0 m³
 Total storage = 595.0 m³
 Available MH storage = 0.0 m³
 Peak input flow = 69.79 l/s



Head (m)	Flow (l/s)	Head (m)	Flow (l/s)
0.01	0.04	2.01	2.59
0.05	0.39	2.05	2.61
0.10	0.58	2.10	2.65
0.15	0.71	2.15	2.68
0.20	0.82	2.20	2.71
0.25	0.91	2.25	2.74
0.30	1.00	2.30	2.77
0.35	1.08	2.35	2.80
0.40	1.15	2.40	2.83
0.45	1.22	2.45	2.86
0.50	1.29	2.50	2.89
0.55	1.35	2.55	2.92
0.60	1.41	2.60	2.94
0.65	1.47	2.65	2.97
0.70	1.53	2.70	3.00
0.75	1.58	2.75	3.03
0.80	1.63	2.80	3.06
0.85	1.68	2.85	3.08
0.90	1.73	2.90	3.11
0.95	1.78	2.95	3.14
1.00	1.83	3.00	3.16
1.05	1.87	3.05	3.19
1.10	1.91	3.10	3.21
1.15	1.96	3.15	3.24
1.20	2.00	3.20	3.27
1.25	2.04	3.25	3.29
1.30	2.08	3.30	3.32
1.35	2.12	3.35	3.34
1.40	2.16	3.40	3.37
1.45	2.20	3.45	3.39
1.50	2.24	3.50	3.42
1.55	2.27	3.55	3.44
1.60	2.31	3.60	3.46
1.65	2.35	3.65	3.49
1.70	2.38	3.70	3.51
1.75	2.42	3.75	3.54
1.80	2.45	3.80	3.56
1.85	2.48	3.85	3.58
1.90	2.52	3.90	3.61
1.95	2.55	3.95	3.63
2.00	2.58	4.00	3.65

Calculation data provided by Crown Water Ltd, SL5 7NT



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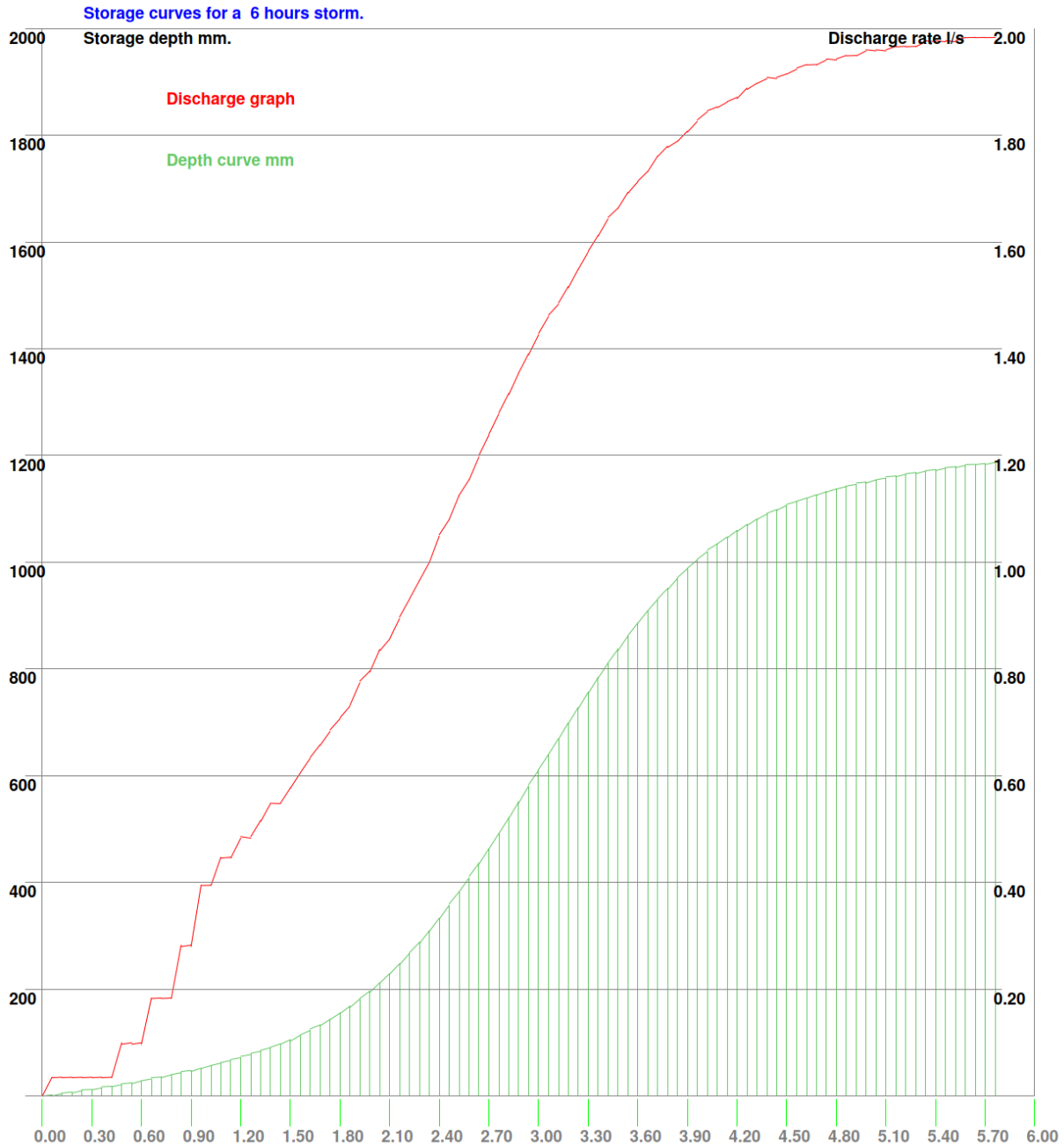
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Date 02/08/21		
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Project **Bryn Lane, Wrexham Industrial Estate**

Title **Unit 1 - Hydrograph Storage Estimate 1 in 100 + 40%**





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Bryn Lane, Wrexham Industrial Estate

Title
Unit 1 - Hydrograph Storage Estimate 1 in 100 + 40%

Incremental rainfall figures.

Storm Mins	Storage Depth mm	Control Flow l/s	Storm Mins	Storage Depth mm	Control Flow l/s
3.6	2.4	0.04	183.6	640.1	1.46
7.2	4.8	0.04	187.2	669.7	1.48
10.8	7.4	0.04	190.8	699.2	1.52
14.4	9.9	0.04	194.4	728.2	1.55
18.0	12.6	0.04	198.0	756.6	1.58
21.6	15.4	0.04	201.6	784.3	1.61
25.2	18.3	0.04	205.2	811.1	1.64
28.8	21.4	0.10	208.8	837.0	1.66
32.4	24.7	0.10	212.4	862.0	1.69
36.0	28.1	0.10	216.0	886.1	1.71
39.6	31.9	0.18	219.6	908.9	1.73
43.2	35.7	0.18	223.2	930.4	1.76
46.8	39.6	0.18	226.8	950.7	1.78
50.4	43.7	0.28	230.4	969.9	1.79
54.0	47.9	0.28	234.0	987.8	1.81
57.6	52.4	0.39	237.6	1004.4	1.83
61.2	57.0	0.39	241.2	1020.1	1.84
64.8	61.7	0.45	244.8	1034.5	1.85
68.4	66.6	0.45	248.4	1047.5	1.86
72.0	71.9	0.48	252.0	1059.5	1.87
75.6	77.6	0.48	255.6	1070.6	1.89
79.2	83.9	0.52	259.2	1080.8	1.90
82.8	90.6	0.55	262.8	1090.2	1.91
86.4	97.9	0.55	266.4	1098.7	1.91
90.0	105.7	0.58	270.0	1106.5	1.91
93.6	114.0	0.61	273.6	1113.7	1.92
97.2	123.1	0.63	277.2	1120.4	1.93
100.8	133.1	0.66	280.8	1126.5	1.93
104.4	143.9	0.68	284.4	1132.1	1.94
108.0	155.5	0.71	288.0	1137.2	1.94
111.6	167.9	0.73	291.6	1141.9	1.95
115.2	181.5	0.77	295.2	1146.1	1.95
118.8	196.3	0.80	298.8	1150.1	1.96
122.4	212.4	0.84	302.4	1154.0	1.96
126.0	229.4	0.86	306.0	1157.8	1.96
129.6	247.8	0.89	309.6	1161.3	1.97
133.2	267.3	0.93	313.2	1164.6	1.97
136.8	288.0	0.97	316.8	1167.8	1.97
140.4	309.8	1.00	320.4	1170.8	1.97
144.0	333.0	1.05	324.0	1173.7	1.97
147.6	357.3	1.08	327.6	1176.4	1.97
151.2	382.6	1.13	331.2	1178.8	1.97
154.8	408.8	1.15	334.8	1181.1	1.98
158.4	435.8	1.20	338.4	1183.2	1.98
162.0	463.6	1.24	342.0	1185.1	1.98
165.6	492.1	1.28	345.6	1186.9	1.98
169.2	521.2	1.32	349.2	1188.6	1.98
172.8	550.8	1.35	352.8	1190.3	1.99
176.4	580.5	1.39	356.4	1191.8	1.99
180.0	610.3	1.43	360.0	1193.4	1.99

Using the Get Max button causes the program to step through a series of storm durations until a maximum volume is obtained.
Each duration is sampled 600 times and the results recorded. The storm durations (hrs) are:-

0.25, 0.5, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 12, 15, 18, 20, 24, 30, 36, 42, 48, 54, 60, 66, 72, 84, 96, 120, 150, 175, 200, 250, 300, 375, 500, 750, 1000, 1250, 1500, 1570, 2000, 2500, 3000, 3500, 4000

It should be noted that the six hour storm frequently requested rarely demonstrates the worst case for storage.



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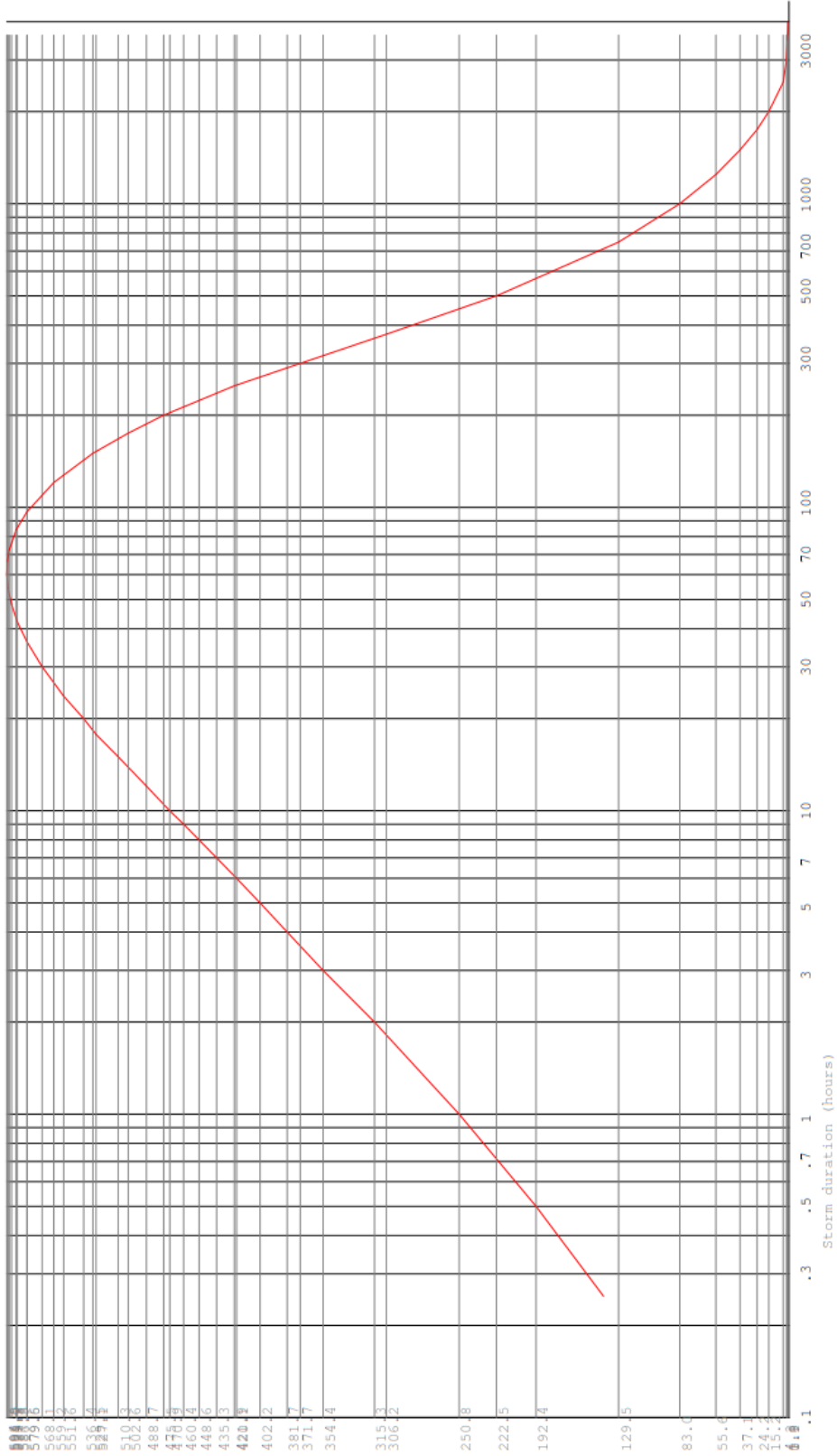
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Sequential storage volume at specific storm durations.

m³





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1		
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Project **Bryn Lane, Wrexham Industrial Estate**
Title **Unit 2 - Hydrograph Storage Estimate 1 in 100 + 40%**

Data:-

Location = WREXHAM
M5-60 (mm) = 18
Soil index = 0.45
Return period = 100
UCWI = 0.0

Grid reference = SJ3349
r = 0.32
SAAR (mm/yr) = 800
WRAP = 4
Climate change = +40%

Clayey, or loamy over clayey soils with an impermeable layer at shallow depth.

Percentage runoff = 95.0% (manual setting)

Imperv. area = 8091 m²
Total area = 8091 m²
Total runoff = 670.6 m³

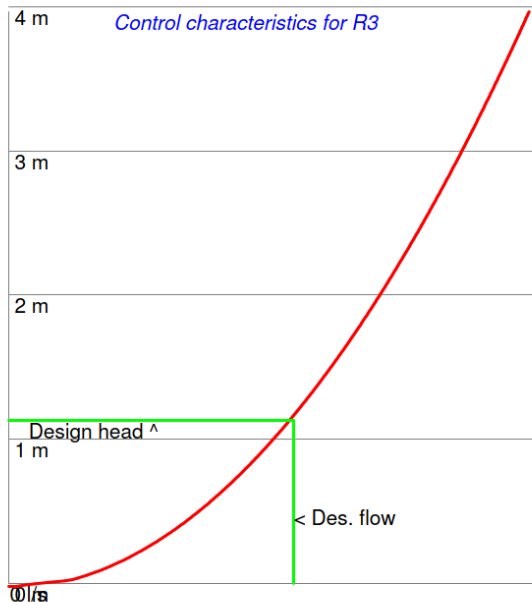
Pervious area = 0 m²
Equiv area = 7686 m² (Tot. area x % runoff).
Discharge rate = 2.000 l/s

Design Head = 1.2m
Control device = R3
Max. calc. depth = 1.19 m

Peak flow = 1.99 l/s
Orifice diam = 37.8 mm
Available depth = 0.0 m³

Pipeline storage = 0.0 m³
Offline storage = 0.0 m³
Total storage = 665.0 m³

Available MH storage = 0.0 m³
Peak input flow = 77.62 l/s



Head (m)	Flow (l/s)	Head (m)	Flow (l/s)
0.01	0.04	2.01	2.59
0.05	0.39	2.05	2.61
0.10	0.58	2.10	2.65
0.15	0.71	2.15	2.68
0.20	0.82	2.20	2.71
0.25	0.91	2.25	2.74
0.30	1.00	2.30	2.77
0.35	1.08	2.35	2.80
0.40	1.15	2.40	2.83
0.45	1.22	2.45	2.86
0.50	1.29	2.50	2.89
0.55	1.35	2.55	2.92
0.60	1.41	2.60	2.94
0.65	1.47	2.65	2.97
0.70	1.53	2.70	3.00
0.75	1.58	2.75	3.03
0.80	1.63	2.80	3.06
0.85	1.68	2.85	3.08
0.90	1.73	2.90	3.11
0.95	1.78	2.95	3.14
1.00	1.83	3.00	3.16
1.05	1.87	3.05	3.19
1.10	1.91	3.10	3.21
1.15	1.96	3.15	3.24
1.20	2.00	3.20	3.27
1.25	2.04	3.25	3.29
1.30	2.08	3.30	3.32
1.35	2.12	3.35	3.34
1.40	2.16	3.40	3.37
1.45	2.20	3.45	3.39
1.50	2.24	3.50	3.42
1.55	2.27	3.55	3.44
1.60	2.31	3.60	3.46
1.65	2.35	3.65	3.49
1.70	2.38	3.70	3.51
1.75	2.42	3.75	3.54
1.80	2.45	3.80	3.56
1.85	2.48	3.85	3.58
1.90	2.52	3.90	3.61
1.95	2.55	3.95	3.63
2.00	2.58	4.00	3.65

Calculation data provided by Crown Water Ltd, SL5 7NT



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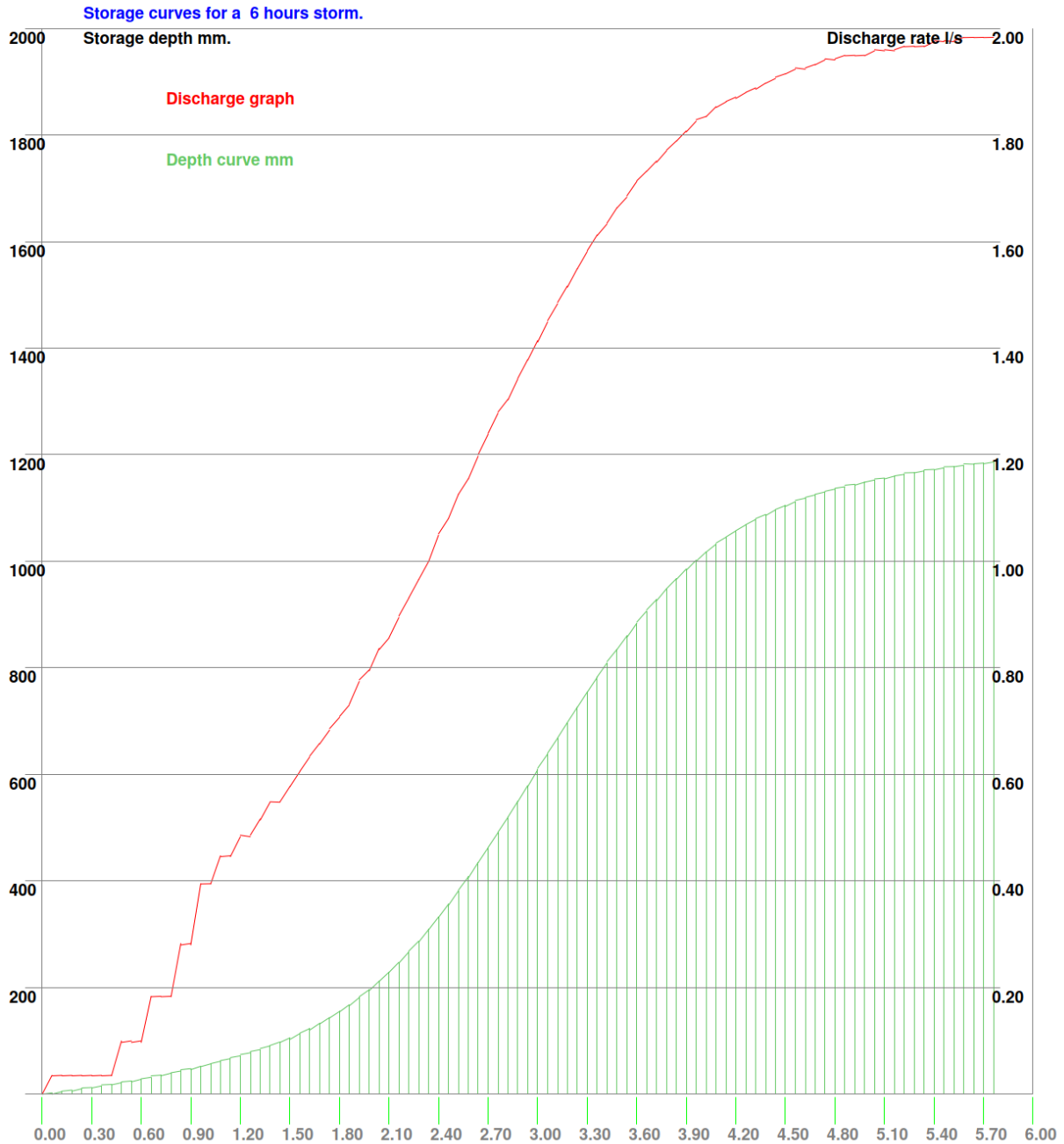
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Incremental rainfall figures.

Storm Mins	Storage Depth mm	Control Flow l/s	Storm Mins	Storage Depth mm	Control Flow l/s
3.6	2.4	0.04	183.6	638.3	1.45
7.2	4.8	0.04	187.2	667.9	1.48
10.8	7.4	0.04	190.8	697.3	1.52
14.4	9.9	0.04	194.4	726.2	1.55
18.0	12.5	0.04	198.0	754.6	1.58
21.6	15.3	0.04	201.6	782.1	1.61
25.2	18.2	0.04	205.2	808.9	1.63
28.8	21.3	0.10	208.8	834.7	1.66
32.4	24.6	0.10	212.4	859.7	1.68
36.0	28.0	0.10	216.0	883.8	1.71
39.6	31.7	0.18	219.6	906.6	1.73
43.2	35.5	0.18	223.2	928.0	1.75
46.8	39.5	0.18	226.8	948.3	1.77
50.4	43.5	0.28	230.4	967.5	1.79
54.0	47.7	0.28	234.0	985.4	1.81
57.6	52.2	0.39	237.6	1002.0	1.83
61.2	56.8	0.39	241.2	1017.6	1.83
64.8	61.5	0.45	244.8	1032.0	1.85
68.4	66.4	0.45	248.4	1045.1	1.86
72.0	71.7	0.48	252.0	1057.1	1.87
75.6	77.4	0.48	255.6	1068.2	1.88
79.2	83.6	0.52	259.2	1078.5	1.89
82.8	90.3	0.55	262.8	1087.9	1.90
86.4	97.6	0.55	266.4	1096.5	1.91
90.0	105.4	0.58	270.0	1104.4	1.91
93.6	113.8	0.61	273.6	1111.6	1.92
97.2	122.8	0.63	277.2	1118.3	1.92
100.8	132.8	0.66	280.8	1124.5	1.93
104.4	143.5	0.68	284.4	1130.2	1.94
108.0	155.1	0.71	288.0	1135.3	1.94
111.6	167.5	0.73	291.6	1140.0	1.95
115.2	181.1	0.77	295.2	1144.3	1.95
118.8	195.9	0.80	298.8	1148.4	1.95
122.4	211.9	0.84	302.4	1152.4	1.96
126.0	228.9	0.86	306.0	1156.2	1.96
129.6	247.2	0.89	309.6	1159.8	1.96
133.2	266.7	0.93	313.2	1163.2	1.97
136.8	287.3	0.97	316.8	1166.4	1.97
140.4	309.0	1.00	320.4	1169.5	1.97
144.0	332.1	1.05	324.0	1172.5	1.97
147.6	356.4	1.08	327.6	1175.2	1.97
151.2	381.6	1.13	331.2	1177.7	1.97
154.8	407.7	1.15	334.8	1180.1	1.98
158.4	434.6	1.20	338.4	1182.2	1.98
162.0	462.3	1.24	342.0	1184.2	1.98
165.6	490.8	1.28	345.6	1186.1	1.98
169.2	519.8	1.30	349.2	1187.9	1.98
172.8	549.3	1.34	352.8	1189.7	1.98
176.4	578.9	1.38	356.4	1191.3	1.99
180.0	608.6	1.41	360.0	1193.0	1.99

Using the Get Max button causes the program to step through a series of storm durations until a maximum volume is obtained.

Each duration is sampled 600 times and the results recorded. The storm durations (hrs) are:-

0.25, 0.5, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 12, 15, 18, 20, 24, 30, 36, 42, 48, 54, 60, 66, 72, 84, 96, 120, 150, 175, 200, 250, 300, 375, 500, 750, 1000, 1250, 1500, 1570, 2000, 2500, 3000, 3500, 4000

It should be noted that the six hour storm frequently requested rarely demonstrates the worst case for storage.



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Sequential storage volume at specific storm durations.

m³

