

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 Clywedog Road, Wrexham for the construction of 1 No detached industrial unit and associated parking and service yard on an existing area currently used partially as hardstanding and part open green space.
- 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 5 l/s for up to and including the 1 in 100 + 40 % Climate change allowance. The redeveloped site will be connected to the existing surface water drainage system within the vicinity of the site.

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 Clywedog Road North, Wrexham Industrial Estate LL13 9XE and is located within an area defined as being in a flood risk zone A 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 used partially for Industrial purposes and consists of n industrial unit with a large service yard, parking areas.
- 4.2** The existing industrial part of the site will be connected to existing surface water drainage within the demise of the property.
- 4.3** The ground conditions on site are firm clay at relatively shallow depths and as such the use of infiltration (soakaways) is extremely unlikely to be a viable option.
- 4.4** There are no water courses within the land immediately around the site and any such connection would be across third party land so the use of attenuation with a control outflow of 5 l/s is to be adopted as the drainage strategy for the site redevelopment with connection to an existing surface water sewer located within the grass verge near the junction of Clywedog Road North & Clywedog Road East.
- 4.5** A review of the sewer records for the area shows both foul and surface water sewers are present.
- 4.6** The foul drainage will be connected to the existing foul sewer at the junction of Clywedog Road North & Clywedog Road East within the grass verge.

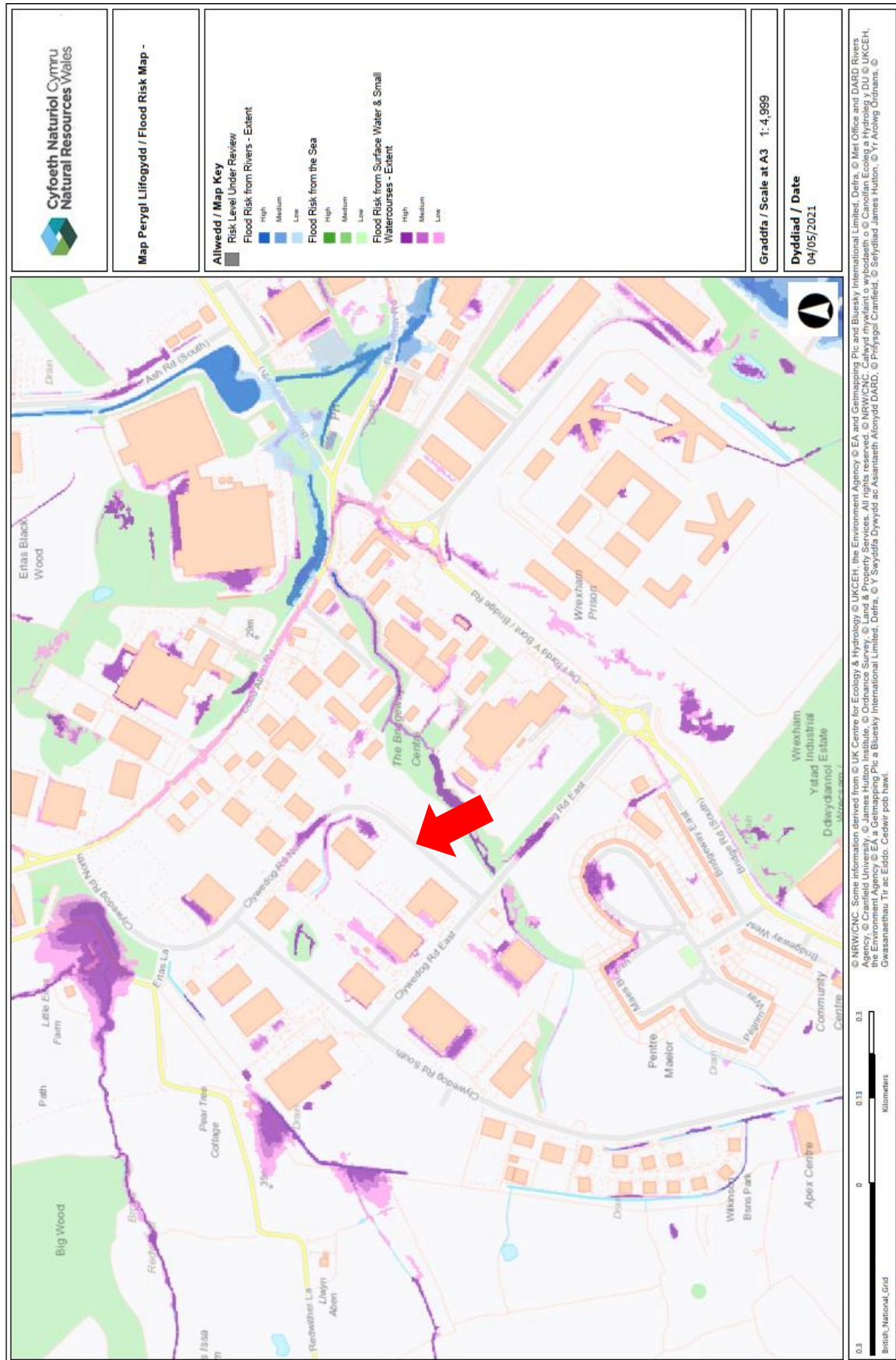
5.0 Proposed Drainage

- 5.1** The development proposal is to therefore attenuate the flow of surface water generated from the site to a control flow of 5 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** The below ground system will be designed to accommodate the 1 in 100 + 30% climate change allowance with no flooding occurring on site whilst the additional 10% will be retained on site by means of shallow flooding of service yards and the drainage network on site prior to the attenuation tank.
- 5.3** All below ground drainage will be designed to accommodate the 1 in 30 year event with no flooding occurring on site within the system.
- 5.4** 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.

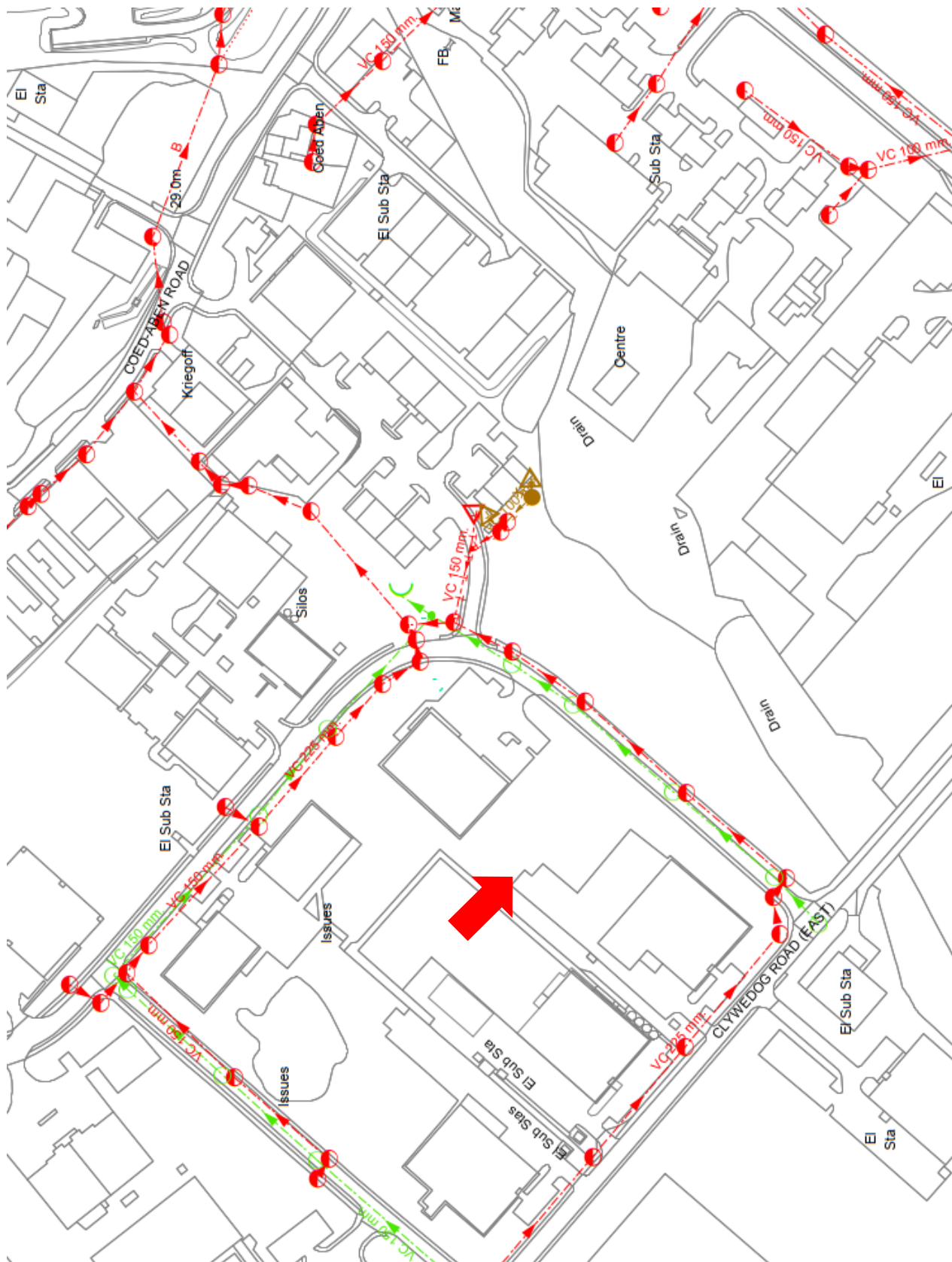
6.0 Conclusion

- 6.1** The site has limited available surface water drainage options available and based on the current surface water drainage hierarchy the use of the existing surface water sewer is likely to be the only appropriate option.
- 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 site to 5 l/s.
- 6.3** The proposal looks to limit the flow from site to 5 l/s which will allow the prevention of silting up of any drainage downstream of the attenuation tank and is deemed to be an acceptable discharge flow for new developments.
- 6.4** 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.
- 6.5** 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.

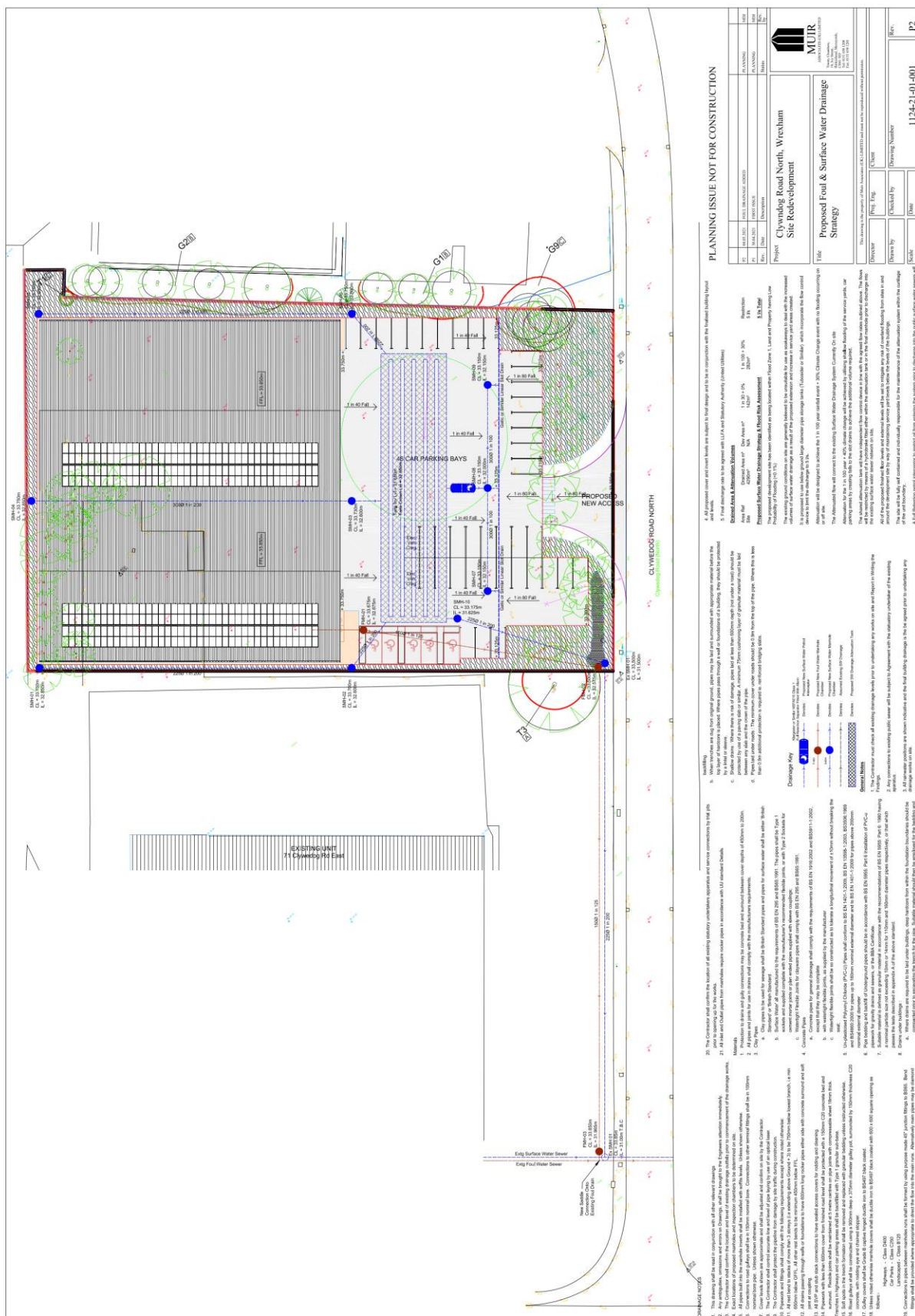
Appendix A – Flood Risk Map



Appendix B – Sewer Records Extract



Appendix C – Proposed Site Drainage Layout



Appendix E – Drainage Calculations



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Project Clywedog Road North, Wrexham		Sheet no. 1		Date 04/05/21
Title Hydrograph Storage1 in 30 + 0% Winter Profile		By MJ	Checked	Reviewed

Data:-

Location = WREXHAM
 M5-60 (mm) = 18
 Soil index = 0.45
 Return period = 30
 UCWI = 0.0
 Grid reference = SJ3349
 r = 0.32
 SAAR (mm/yr) = 800
 WRAP = 4
 Climate change = +0%

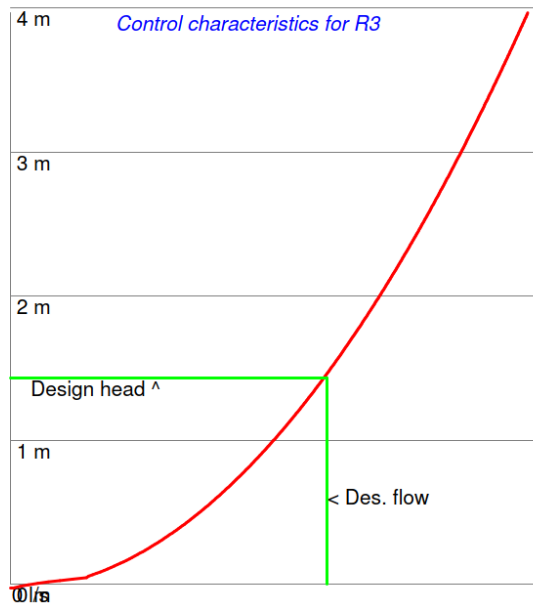
Clayey, or loamy over clayey soils with an impermeable layer at shallow depth.

Percentage runoff = 95.0% (manual setting)

Imperv. area = 4290 m²
 Total area = 4290 m²
 Total runoff = 212.1 m³
 Pervious area = 0 m²
 Equiv area = 4076 m² (Tot. area x % runoff).
 Discharge rate = 5.000 l/s

Design Head = 1.5m
 Control device = R3
 Max. calc. depth = 1.5 m
 Peak flow = 4.98 l/s
 Orifice diam = 56.5 mm
 Available depth = 0.0 m³

Pipeline storage = 0.0 m³
 Offline storage = 0.0 m³
 Total storage = 142.0 m³
 Available MH storage = 0.0 m³
 Peak input flow = 18.41 l/s



Head (m)	Flow (l/s)	Head (m)	Flow (l/s)
0.01	0.05	2.01	5.79
0.05	0.59	2.05	5.85
0.10	1.29	2.10	5.92
0.15	1.58	2.15	5.99
0.20	1.83	2.20	6.06
0.25	2.04	2.25	6.12
0.30	2.24	2.30	6.19
0.35	2.42	2.35	6.26
0.40	2.58	2.40	6.32
0.45	2.74	2.45	6.39
0.50	2.89	2.50	6.45
0.55	3.03	2.55	6.52
0.60	3.16	2.60	6.58
0.65	3.29	2.65	6.65
0.70	3.42	2.70	6.71
0.75	3.54	2.75	6.77
0.80	3.65	2.80	6.83
0.85	3.76	2.85	6.89
0.90	3.87	2.90	6.95
0.95	3.98	2.95	7.01
1.00	4.08	3.00	7.07
1.05	4.18	3.05	7.13
1.10	4.28	3.10	7.19
1.15	4.38	3.15	7.25
1.20	4.47	3.20	7.30
1.25	4.56	3.25	7.36
1.30	4.65	3.30	7.42
1.35	4.74	3.35	7.47
1.40	4.83	3.40	7.53
1.45	4.92	3.45	7.58
1.50	5.00	3.50	7.64
1.55	5.08	3.55	7.69
1.60	5.16	3.60	7.75
1.65	5.24	3.65	7.80
1.70	5.32	3.70	7.85
1.75	5.40	3.75	7.91
1.80	5.48	3.80	7.96
1.85	5.55	3.85	8.01
1.90	5.63	3.90	8.06
1.95	5.70	3.95	8.11
2.00	5.77	4.00	8.16

Calculation data provided by Crown Water Ltd, SL5 7NT



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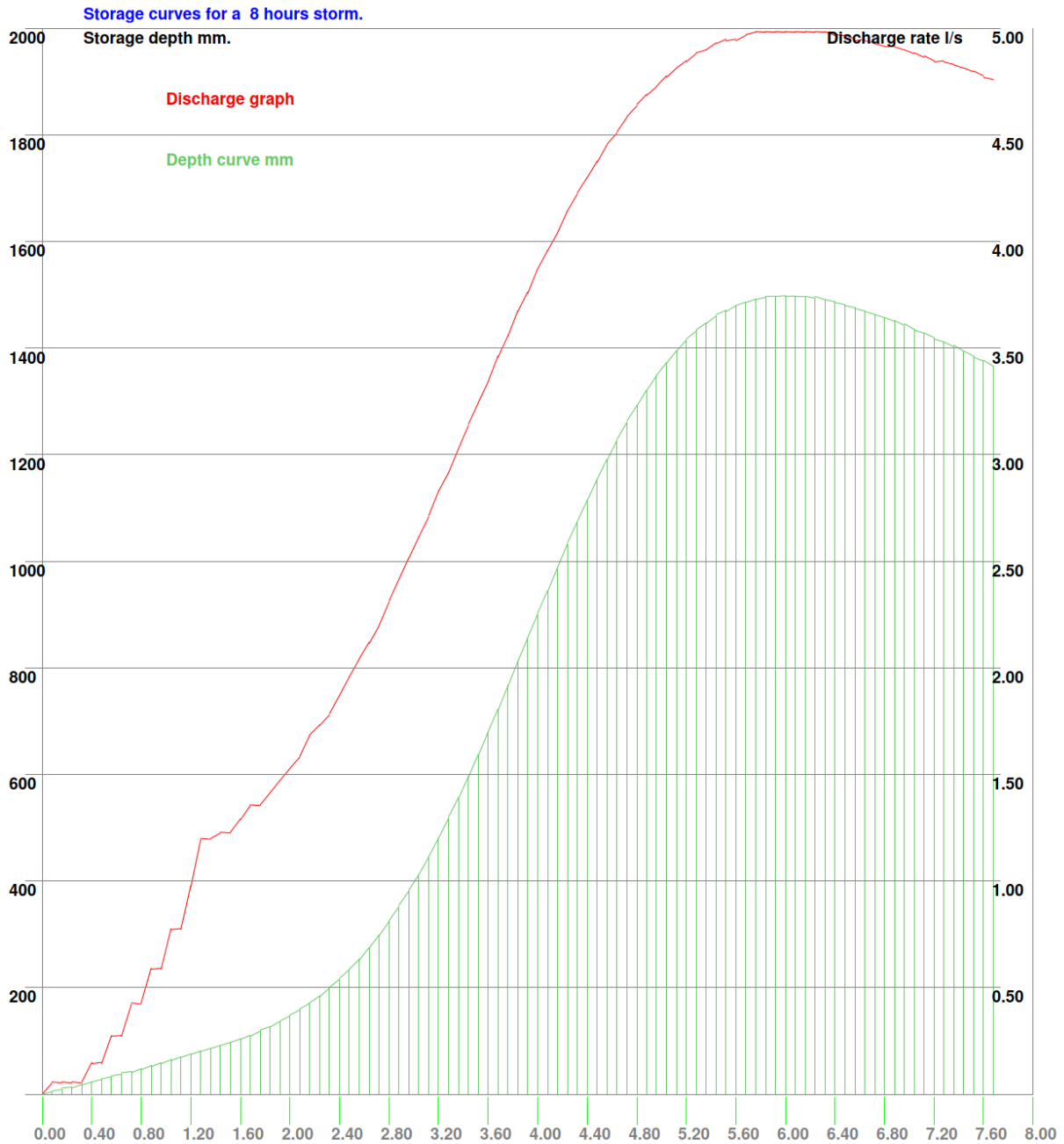
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Incremental rainfall figures.

Storm Mins	Storage Depth mm	Control Flow l/s	Storm Mins	Storage Depth mm	Control Flow l/s
4.8	4.5	0.05	244.8	945.0	3.96
9.6	8.8	0.05	249.6	988.8	4.04
14.4	13.3	0.05	254.4	1032.1	4.14
19.2	17.9	0.05	259.2	1074.1	4.22
24.0	22.7	0.15	264.0	1114.8	4.30
28.8	27.4	0.15	268.8	1153.9	4.38
33.6	32.3	0.27	273.6	1191.3	4.45
38.4	37.3	0.27	278.4	1226.8	4.51
43.2	42.5	0.42	283.2	1260.6	4.58
48.0	47.7	0.42	288.0	1292.3	4.64
52.8	53.4	0.59	292.8	1321.7	4.69
57.6	58.7	0.59	297.6	1348.4	4.73
62.4	64.3	0.78	302.4	1372.8	4.78
67.2	69.6	0.78	307.2	1395.0	4.81
72.0	75.3	0.98	312.0	1414.9	4.85
76.8	80.8	1.20	316.8	1432.2	4.88
81.6	85.9	1.20	321.6	1447.6	4.90
86.4	91.3	1.22	326.4	1460.7	4.93
91.2	96.9	1.22	331.2	1471.2	4.95
96.0	103.3	1.29	336.0	1479.7	4.95
100.8	110.3	1.35	340.8	1486.6	4.97
105.6	118.1	1.35	345.6	1491.8	4.98
110.4	126.8	1.41	350.4	1495.5	4.98
115.2	136.3	1.47	355.2	1497.6	4.98
120.0	146.7	1.53	360.0	1498.3	4.98
124.8	157.9	1.58	364.8	1498.0	4.98
129.6	170.4	1.68	369.6	1496.7	4.98
134.4	184.1	1.73	374.4	1494.3	4.98
139.2	199.2	1.78	379.2	1491.0	4.98
144.0	215.7	1.87	384.0	1486.8	4.97
148.8	233.6	1.96	388.8	1481.8	4.97
153.6	253.1	2.04	393.6	1476.1	4.95
158.4	274.9	2.12	398.4	1470.0	4.95
163.2	298.7	2.20	403.2	1463.7	4.93
168.0	324.1	2.31	408.0	1457.2	4.92
172.8	351.6	2.42	412.8	1450.3	4.92
177.6	381.0	2.52	417.6	1443.0	4.90
182.4	412.1	2.61	422.4	1435.5	4.88
187.2	445.1	2.71	427.2	1427.8	4.86
192.0	480.3	2.83	432.0	1419.9	4.85
196.8	517.4	2.92	436.8	1411.7	4.85
201.6	556.1	3.03	441.6	1403.0	4.83
206.4	595.9	3.14	446.4	1394.1	4.81
211.2	637.0	3.24	451.2	1384.9	4.80
216.0	679.4	3.34	456.0	1375.4	4.78
220.8	722.8	3.46	460.8	1365.8	4.76
225.6	766.9	3.56	465.6	1356.0	4.74
230.4	811.6	3.67	470.4	1346.3	4.73
235.2	856.2	3.76	475.2	1336.4	4.71
240.0	900.8	3.87	480.0	1326.6	4.69

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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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 = +30%

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

Percentage runoff = 95.0% (manual setting)

Imperv. area = 4290 m²
Total area = 4290 m²
Total runoff = 355.8 m³

Pervious area = 0 m²
Equiv area = 4076 m² (Tot. area x % runoff).
Discharge rate = 5.000 l/s

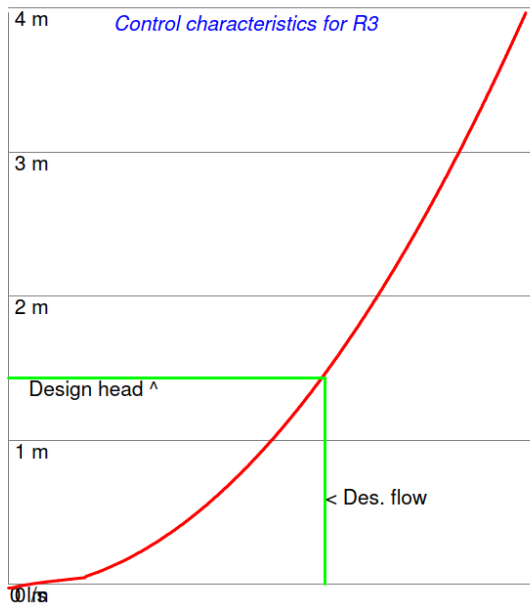
Design Head = 1.5m
Control device = R3
Max. calc. depth = 1.5 m

Peak flow = 4.98 l/s
Orifice diam = 56.5 mm
Available depth = 0.0 m³

Pipeline storage = 0.0 m³
Offline storage = 0.0 m³
Total storage = 282.0 m³

Available MH storage = 0.0 m³

Peak input flow = 30.89 l/s



Head (m)	Flow (l/s)	Head (m)	Flow (l/s)
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0.05	0.59	2.05	5.85
0.10	1.29	2.10	5.92
0.15	1.58	2.15	5.99
0.20	1.83	2.20	6.06
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1.70	5.32	3.70	7.85
1.75	5.40	3.75	7.91
1.80	5.48	3.80	7.96
1.85	5.55	3.85	8.01
1.90	5.63	3.90	8.06
1.95	5.70	3.95	8.11
2.00	5.77	4.00	8.16

Calculation data provided by Crown Water Ltd, SLS 7NT



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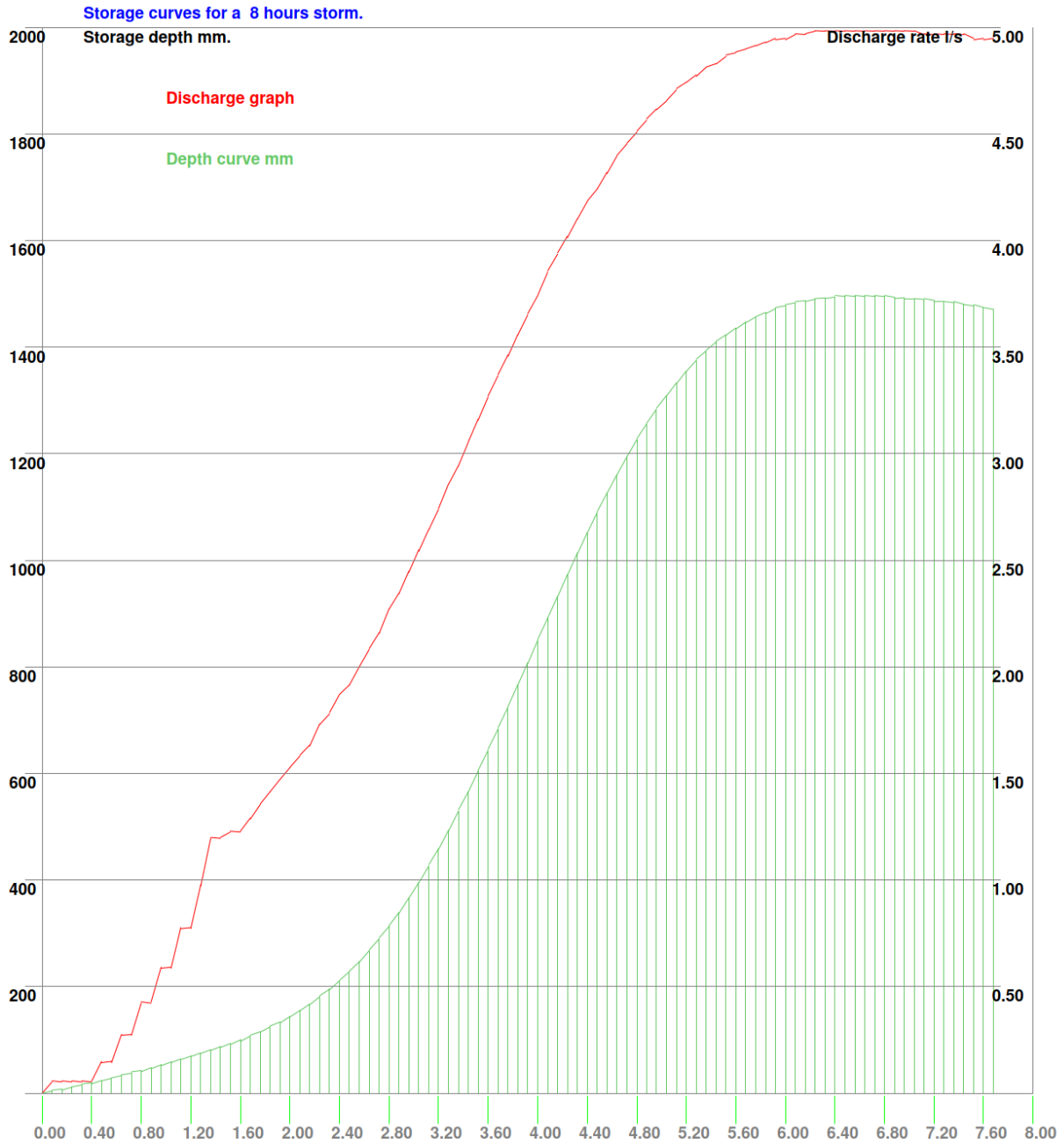
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43.2	37.3	0.27	283.2	1194.4	4.45
48.0	42.4	0.42	288.0	1226.2	4.51
52.8	47.6	0.42	292.8	1256.0	4.56
57.6	53.0	0.59	297.6	1283.7	4.62
62.4	58.4	0.59	302.4	1309.4	4.65
67.2	63.9	0.78	307.2	1333.3	4.71
72.0	69.5	0.78	312.0	1355.2	4.74
76.8	75.5	0.98	316.8	1375.0	4.78
81.6	81.4	1.20	321.6	1393.2	4.81
86.4	87.1	1.20	326.4	1409.5	4.83
91.2	93.3	1.22	331.2	1423.7	4.86
96.0	99.9	1.22	336.0	1436.1	4.88
100.8	107.3	1.29	340.8	1447.2	4.90
105.6	115.4	1.35	345.6	1456.9	4.92
110.4	124.1	1.41	350.4	1465.3	4.93
115.2	133.6	1.47	355.2	1472.3	4.95
120.0	143.9	1.53	360.0	1478.2	4.95
124.8	155.0	1.58	364.8	1483.1	4.97
129.6	167.1	1.63	369.6	1487.2	4.97
134.4	180.5	1.73	374.4	1490.4	4.98
139.2	195.1	1.78	379.2	1492.8	4.98
144.0	210.9	1.87	384.0	1494.4	4.98
148.8	227.9	1.91	388.8	1495.3	4.98
153.6	246.6	2.00	393.6	1495.6	4.98
158.4	267.2	2.08	398.4	1495.5	4.98
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172.8	339.0	2.35	412.8	1494.0	4.98
177.6	366.4	2.45	417.6	1492.8	4.98
182.4	395.4	2.55	422.4	1491.4	4.98
187.2	426.1	2.65	427.2	1489.9	4.97
192.0	458.8	2.74	432.0	1488.1	4.97
196.8	493.2	2.86	436.8	1486.0	4.97
201.6	529.0	2.94	441.6	1483.5	4.97
206.4	565.9	3.06	446.4	1480.8	4.97
211.2	604.0	3.16	451.2	1477.8	4.95
216.0	643.3	3.27	456.0	1474.5	4.95
220.8	683.5	3.37	460.8	1471.1	4.95
225.6	724.5	3.46	465.6	1467.5	4.93
230.4	766.1	3.56	470.4	1463.9	4.93
235.2	807.8	3.65	475.2	1460.1	4.93
240.0	849.6	3.74	480.0	1456.4	4.92

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

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WRAP = 4
Climate change = +30%

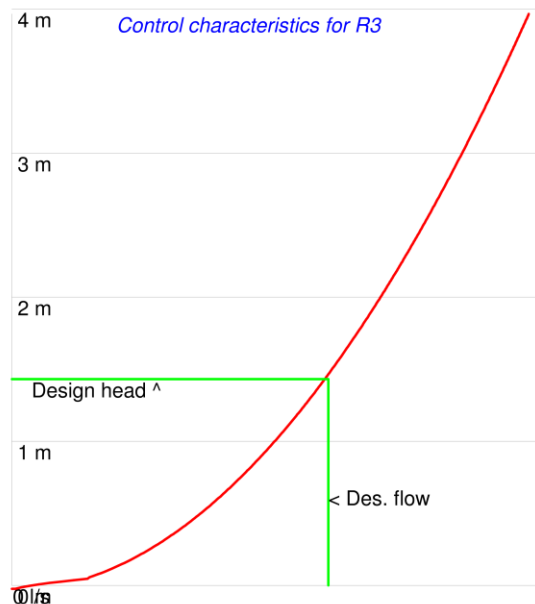
Clayey, or loamy over clayey soils with an impermeable layer at shallow depth.

Percentage runoff = 95.0% (manual setting)

Imperv. area = 4290 m²
Total area = 4290 m²
Total runoff = 355.8 m³
Pervious area = 0 m²
Equiv area = 4076 m² (Tot. area x % runoff).
Discharge rate = 5.000 l/s

Design Head = 1.5m
Control device = R3
Max. calc. depth = 1.42 m
Peak flow = 4.86 l/s
Orifice diam = 56.5 mm
Available depth = 0.0 m³

Pipeline storage = 0.0 m³
Offline storage = 0.0 m³
Total storage = 282.0 m³
Available MH storage = 0.0 m³
Peak input flow = 48.43 l/s



Head (m)	Flow (l/s)	Head (m)	Flow (l/s)
0.01	0.05	2.01	5.79
0.05	0.59	2.05	5.85
0.10	1.29	2.10	5.92
0.15	1.58	2.15	5.99
0.20	1.83	2.20	6.06
0.25	2.04	2.25	6.12
0.30	2.24	2.30	6.19
0.35	2.42	2.35	6.26
0.40	2.58	2.40	6.32
0.45	2.74	2.45	6.39
0.50	2.89	2.50	6.45
0.55	3.03	2.55	6.52
0.60	3.16	2.60	6.58
0.65	3.29	2.65	6.65
0.70	3.42	2.70	6.71
0.75	3.54	2.75	6.77
0.80	3.65	2.80	6.83
0.85	3.76	2.85	6.89
0.90	3.87	2.90	6.95
0.95	3.98	2.95	7.01
1.00	4.08	3.00	7.07
1.05	4.18	3.05	7.13
1.10	4.28	3.10	7.19
1.15	4.38	3.15	7.25
1.20	4.47	3.20	7.30
1.25	4.56	3.25	7.36
1.30	4.65	3.30	7.42
1.35	4.74	3.35	7.47
1.40	4.83	3.40	7.53
1.45	4.92	3.45	7.58
1.50	5.00	3.50	7.64
1.55	5.08	3.55	7.69
1.60	5.16	3.60	7.75
1.65	5.24	3.65	7.80
1.70	5.32	3.70	7.85
1.75	5.40	3.75	7.91
1.80	5.48	3.80	7.96
1.85	5.55	3.85	8.01
1.90	5.63	3.90	8.06
1.95	5.70	3.95	8.11
2.00	5.77	4.00	8.16

Calculation data provided by Crown Water Ltd, SL5 7NT



MasterDrain
SW

Muir Associates (UK) Limited

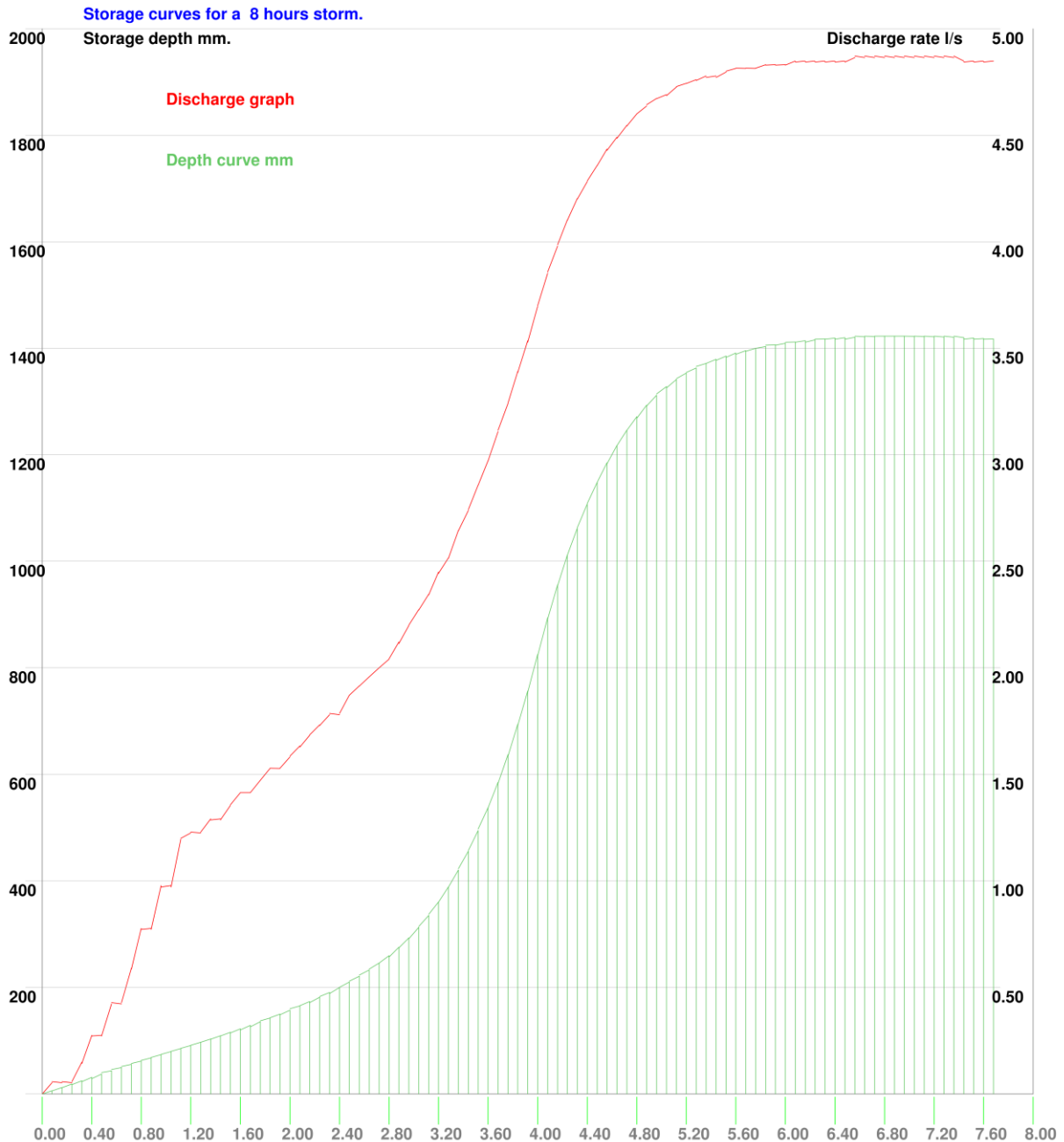
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Job No.	21-1124		
Sheet no.	2		
Date	04/05/21		
By	Checked	Reviewed	
MJ			

Project **Clywendog Road North, Wrexham**

Title **Hydrograph Storage 1 in 100 + 30% Summer Profile**





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Job No.	21-1124		
Sheet no.	3		
Date	04/05/21		
By	MJ	Checked	Reviewed

Project **Clywendog Road North, Wrexham**
Title **Hydrograph Storage 1 in 100 + 30% Summer Profile**

Incremental rainfall figures.

Storm Mins	Storage Depth mm	Control Flow l/s	Storm Mins	Storage Depth mm	Control Flow l/s
4.8	6.1	0.05	244.8	893.9	3.85
9.6	12.2	0.05	249.6	955.8	3.98
14.4	18.4	0.05	254.4	1011.8	4.10
19.2	24.7	0.15	259.2	1062.3	4.20
24.0	30.9	0.27	264.0	1107.7	4.28
28.8	37.2	0.27	268.8	1148.4	4.36
33.6	43.4	0.42	273.6	1184.9	4.43
38.4	49.5	0.42	278.4	1217.5	4.49
43.2	55.7	0.59	283.2	1246.2	4.55
48.0	61.8	0.78	288.0	1271.4	4.60
52.8	67.6	0.78	292.8	1293.1	4.64
57.6	73.6	0.98	297.6	1311.8	4.67
62.4	79.3	0.98	302.4	1327.9	4.69
67.2	85.2	1.20	307.2	1341.5	4.73
72.0	90.9	1.22	312.0	1353.0	4.74
76.8	97.0	1.22	316.8	1363.0	4.76
81.6	103.1	1.29	321.6	1371.6	4.78
86.4	109.2	1.29	326.4	1379.0	4.78
91.2	115.6	1.35	331.2	1385.3	4.80
96.0	122.0	1.41	336.0	1390.9	4.81
100.8	128.6	1.41	340.8	1395.6	4.81
105.6	135.5	1.47	345.6	1399.8	4.81
110.4	142.5	1.53	350.4	1403.4	4.83
115.2	149.8	1.53	355.2	1406.6	4.83
120.0	157.3	1.58	360.0	1409.4	4.83
124.8	165.1	1.63	364.8	1411.8	4.85
129.6	173.2	1.68	369.6	1414.1	4.85
134.4	181.6	1.73	374.4	1415.9	4.85
139.2	190.5	1.78	379.2	1417.6	4.85
144.0	199.9	1.78	384.0	1418.9	4.85
148.8	210.0	1.87	388.8	1419.9	4.85
153.6	220.8	1.91	393.6	1420.9	4.86
158.4	232.6	1.96	398.4	1421.5	4.86
163.2	245.5	2.00	403.2	1422.0	4.86
168.0	259.7	2.04	408.0	1422.5	4.86
172.8	275.3	2.12	412.8	1422.7	4.86
177.6	292.9	2.20	417.6	1422.6	4.86
182.4	312.8	2.27	422.4	1422.3	4.86
187.2	335.0	2.35	427.2	1422.1	4.86
192.0	360.2	2.45	432.0	1421.6	4.86
196.8	388.6	2.52	436.8	1421.2	4.86
201.6	420.4	2.65	441.6	1420.5	4.86
206.4	455.7	2.74	446.4	1419.9	4.85
211.2	494.6	2.86	451.2	1419.1	4.85
216.0	537.6	2.97	456.0	1418.3	4.85
220.8	584.9	3.11	460.8	1417.3	4.85
225.6	636.9	3.24	465.6	1416.3	4.85
230.4	694.0	3.39	470.4	1415.1	4.85
235.2	756.6	3.54	475.2	1413.9	4.85
240.0	825.4	3.70	480.0	1412.6	4.85

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.