

**APPENDIX ES11.3**

**DETENTION BASIN CATCHMENT AREA CALCULATIONS**

Table A.ES.11.C.1

Calculation of attenuation storage during a 1 in 100 year storm event plus an allowance for climate change for the proposed Cooks Hole and Thornhaugh surface water management system using the Rational Method (reference 1)

Parameter	Value	Units	Reference
Catchment area	58	ha	Area draining to the proposed surface water management system shown on drawing reference AU/CH/12-23/24084
Net discharge rate	4364	m <sup>3</sup> /day	The 1 in 100yr greenfield runoff rate of 50.51 l/s calculated using the HR Wallingford greenfield runoff estimation tool.
Runoff coefficient	0.29	unitless	The runoff coefficient has been calculated using the nomogram presented on Figure 3 of Reference 1. In deriving the runoff coefficient a dominant vegetation type of cultivated land or short grass has been assumed and dominant soil type of gravelly sand has been assumed. The catchment slope of 1 vertical in 9.5 horizontal is derived from the proposed topography shown on drawing reference AU/CH/12-23/24084.
Climate change factor	40%	unitless	The recommended precautionary upper end increase in rainfall intensity to allow for climate change beyond 2100 from Reference <sup>3</sup>

Storm Duration (hr)	Rainfall for the site derived from Reference <sup>2</sup> (mm)	Rainfall Intensity corrected for climate change (mm/hr)	Volume of rainfall runoff in time period (m <sup>3</sup> )	Outflow in time period (m <sup>3</sup> )	Storage necessary in time period (m <sup>3</sup> )
0.25	25.72	144.03	6014.78	45.46	5969
0.5	33.62	94.14	7862.24	90.92	7771
0.75	38.52	71.90	9008.13	136.38	8872
1	42.02	58.83	9826.63	181.84	9645
1.5	47.35	44.19	11073.08	272.75	10800
2	51.43	36.00	12027.21	363.67	11664
3	57.7	26.93	13493.49	545.51	12948
4	62.44	21.85	14601.97	727.34	13875
5	66.22	18.54	15485.94	909.18	14577
6	69.37	16.19	16222.59	1091.02	15132
7	72.08	14.42	16856.34	1272.85	15583
8	74.43	13.03	17405.90	1454.69	15951
9	76.52	11.90	17894.66	1636.52	16258
10	78.38	10.97	18329.63	1818.36	16511
15	85.43	7.97	19978.32	2727.54	17251
20	90.25	6.32	21105.50	3636.72	17469
20.25	90.45	6.25	21152.28	3682.18	17470
20.5	90.65	6.19	21199.05	3727.64	17471
20.75	90.85	6.13	21245.82	3773.10	17473
21	91.05	6.07	21292.59	3818.56	17474
21.25	91.24	6.01	21337.02	3864.02	17473
21.5	91.43	5.95	21381.45	3909.47	17472
21.75	91.61	5.90	21423.55	3954.93	17469
22	91.8	5.84	21467.98	4000.39	17468
22.25	91.98	5.79	21510.07	4045.85	17464
22.5	92.16	5.73	21552.17	4091.31	17461
22.75	92.33	5.68	21591.92	4136.77	17455
23	92.51	5.63	21634.02	4182.23	17452
23.25	92.68	5.58	21673.77	4227.69	17446
23.5	92.85	5.53	21713.53	4273.15	17440
23.75	93.02	5.48	21753.29	4318.61	17435
24	93.18	5.44	21790.70	4364.06	17427
24.25	93.34	5.39	21828.12	4409.52	17419
24.5	93.49	5.34	21863.20	4454.98	17408
24.75	93.64	5.30	21898.28	4500.44	17398
25	93.79	5.25	21933.35	4545.90	17387
30	96.46	4.50	22557.75	5455.08	17103
40	100.61	3.52	23528.25	7273.44	16255
50	103.85	2.91	24285.95	9091.80	15194
60	106.54	2.49	24915.02	10910.16	14005
70	108.99	2.18	25487.97	12728.52	12759
80	111.28	1.95	26023.50	14546.88	11477
90	113.47	1.77	26535.64	16365.24	10170
96	114.75	1.67	26834.98	17456.26	9379

References

- Reference 1. National Coal Board, 1982. Technical Management of Water in the Coal Mining Industry.
- Reference 2. <https://fehweb.ceh.ac.uk/>
- Reference 3. <https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances>

Denotes parameters which are determined based on the restoration scheme, rainfall data or other constraints on discharge or water levels  
 Denotes parameters which are calculated based on other parameters

Table A.ES.11.C.2

Calculation of attenuation storage during a 1 in 100 year storm event plus an allowance for climate change for the Detention Basin 1 catchment using the Rational Method (reference 1)

Parameter	Value	Units	Reference
Catchment area	20	ha	Area of Catchment 1 shown on drawing reference AU/CH/12-23/24084
Net discharge rate	1543	m <sup>3</sup> /day	The 1 in 100yr greenfield runoff rate of 17.86 l/s calculated using the HR Wallingford greenfield runoff estimation tool.
Runoff coefficient	0.29	unitless	The runoff coefficient has been calculated using the nomogram presented on Figure 3 of Reference 1. In deriving the runoff coefficient a dominant vegetation type of cultivated land or short grass has been assumed and dominant soil type of gravelly sand has been assumed. The catchment slope of 1 vertical in 9.5 horizontal is derived from the proposed topography shown on drawing reference AU/CH/12-23/24084.
Climate change factor	40%	unitless	The recommended precautionary upper end increase in rainfall intensity to allow for climate change beyond 2100 from Reference <sup>3</sup>

Storm Duration (hr)	Rainfall for the site derived from Reference <sup>2</sup> (mm)	Rainfall Intensity corrected for climate change (mm/hr)	Volume of rainfall runoff in time period (m <sup>3</sup> )	Outflow in time period (m <sup>3</sup> )	Storage necessary in time period (m <sup>3</sup> )
0.25	25.72	144.03	2082.04	16.07	2066
0.5	33.62	94.14	2721.55	32.15	2689
0.75	38.52	71.90	3118.20	48.22	3070
1	42.02	58.83	3401.53	64.30	3337
1.5	47.35	44.19	3832.99	96.44	3737
2	51.43	36.00	4163.27	128.59	4035
3	57.7	26.93	4670.83	192.89	4478
4	62.44	21.85	5054.53	257.18	4797
5	66.22	18.54	5360.52	321.48	5039
6	69.37	16.19	5615.51	385.78	5230
7	72.08	14.42	5834.89	450.07	5385
8	74.43	13.03	6025.12	514.37	5511
9	76.52	11.90	6194.31	578.66	5616
10	78.38	10.97	6344.88	642.96	5702
15	85.43	7.97	6915.57	964.44	5951
20	90.25	6.32	7305.75	1285.92	6020
20.25	90.45	6.25	7321.94	1301.99	6020
20.5	90.65	6.19	7338.13	1318.07	6020
20.75	90.85	6.13	7354.32	1334.14	6020
21	91.05	6.07	7370.51	1350.22	6020
21.25	91.24	6.01	7385.89	1366.29	6020
21.5	91.43	5.95	7401.28	1382.36	6019
21.75	91.61	5.90	7415.85	1398.44	6017
22	91.8	5.84	7431.23	1414.51	6017
22.25	91.98	5.79	7445.80	1430.59	6015
22.5	92.16	5.73	7460.37	1446.66	6014
22.75	92.33	5.68	7474.13	1462.73	6011
23	92.51	5.63	7488.70	1478.81	6010
23.25	92.68	5.58	7502.46	1494.88	6008
23.5	92.85	5.53	7516.22	1510.96	6005
23.75	93.02	5.48	7529.99	1527.03	6003
24	93.18	5.44	7542.94	1543.10	6000
24.25	93.34	5.39	7555.89	1559.18	5997
24.5	93.49	5.34	7568.03	1575.25	5993
24.75	93.64	5.30	7580.18	1591.33	5989
25	93.79	5.25	7592.32	1607.40	5985
30	96.46	4.50	7808.45	1928.88	5880
40	100.61	3.52	8144.40	2571.84	5573
50	103.85	2.91	8406.68	3214.80	5192
60	106.54	2.49	8624.43	3857.76	4767
70	108.99	2.18	8822.76	4500.72	4322
80	111.28	1.95	9008.14	5143.68	3864
90	113.47	1.77	9185.42	5786.64	3399
96	114.75	1.67	9289.03	6172.42	3117

References

Reference 1. National Coal Board, 1982. Technical Management of Water in the Coal Mining Industry.

Reference 2. <https://fehweb.ceh.ac.uk/>

Reference 3. <https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances>

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Table A.ES.11.C.3

Calculation of attenuation storage during a 1 in 100 year storm event plus an allowance for climate change for the Detention Basin 2 catchment using the Rational Method (reference 1)

Parameter	Value	Units	Reference
Catchment area	9	ha	Area of Catchment 2 shown on drawing reference AU/CH/12-23/24084
Net discharge rate	698	m <sup>3</sup> /day	The 1 in 100yr greenfield runoff rate of 8.08 l/s calculated using the HR Wallingford greenfield runoff estimation tool.
Runoff coefficient	0.29	unitless	The runoff coefficient has been calculated using the nomogram presented on Figure 3 of Reference 1. In deriving the runoff coefficient a dominant vegetation type of cultivated land or short grass has been assumed and dominant soil type of gravelly sand has been assumed. The catchment slope of 1 vertical in 9.5 horizontal is derived from the proposed topography shown on drawing reference AU/CH/12-23/24084.
Climate change factor	40%	unitless	The recommended precautionary upper end increase in rainfall intensity to allow for climate change beyond 2100 from Reference <sup>3</sup>

Storm Duration (hr)	Rainfall for the site derived from Reference <sup>2</sup> (mm)	Rainfall Intensity corrected for climate change (mm/hr)	Volume of rainfall runoff in time period (m <sup>3</sup> )	Outflow in time period (m <sup>3</sup> )	Storage necessary in time period (m <sup>3</sup> )
0.25	25.72	144.03	942.24	7.27	935
0.5	33.62	94.14	1231.65	14.54	1217
0.75	38.52	71.90	1411.16	21.82	1389
1	42.02	58.83	1539.38	29.09	1510
1.5	47.35	44.19	1734.64	43.63	1691
2	51.43	36.00	1884.11	58.18	1826
3	57.7	26.93	2113.80	87.26	2027
4	62.44	21.85	2287.45	116.35	2171
5	66.22	18.54	2425.93	145.44	2280
6	69.37	16.19	2541.33	174.53	2367
7	72.08	14.42	2640.61	203.62	2437
8	74.43	13.03	2726.70	232.70	2494
9	76.52	11.90	2803.26	261.79	2541
10	78.38	10.97	2871.40	290.88	2581
15	85.43	7.97	3129.67	436.32	2693
20	90.25	6.32	3306.25	581.76	2724
20.25	90.45	6.25	3313.58	589.03	2725
20.5	90.65	6.19	3320.91	596.30	2725
20.75	90.85	6.13	3328.23	603.58	2725
21	91.05	6.07	3335.56	610.85	2725
21.25	91.24	6.01	3342.52	618.12	2724
21.5	91.43	5.95	3349.48	625.39	2724
21.75	91.61	5.90	3356.07	632.66	2723
22	91.8	5.84	3363.04	639.94	2723
22.25	91.98	5.79	3369.63	647.21	2722
22.5	92.16	5.73	3376.22	654.48	2722
22.75	92.33	5.68	3382.45	661.75	2721
23	92.51	5.63	3389.05	669.02	2720
23.25	92.68	5.58	3395.27	676.30	2719
23.5	92.85	5.53	3401.50	683.57	2718
23.75	93.02	5.48	3407.73	690.84	2717
24	93.18	5.44	3413.59	698.11	2715
24.25	93.34	5.39	3419.45	705.38	2714
24.5	93.49	5.34	3424.95	712.66	2712
24.75	93.64	5.30	3430.44	719.93	2711
25	93.79	5.25	3435.94	727.20	2709
30	96.46	4.50	3533.75	872.64	2661
40	100.61	3.52	3685.78	1163.52	2522
50	103.85	2.91	3804.48	1454.40	2350
60	106.54	2.49	3903.03	1745.28	2158
70	108.99	2.18	3992.78	2036.16	1957
80	111.28	1.95	4076.67	2327.04	1750
90	113.47	1.77	4156.90	2617.92	1539
96	114.75	1.67	4203.79	2792.45	1411

References

Reference 1. National Coal Board, 1982. Technical Management of Water in the Coal Mining Industry.

Reference 2. <https://fehweb.ceh.ac.uk/>

Reference 3. <https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances>

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Table A.ES.11.C.4

Calculation of attenuation storage during a 1 in 100 year storm event plus an allowance for climate change for the Detention Basin 3 catchment using the Rational Method (reference 1)

Parameter	Value	Units	Reference
Catchment area	4	ha	Area of Catchment 3 shown on drawing reference AU/CH/12-23/24084
Net discharge rate	337	m <sup>3</sup> /day	The 1 in 100yr greenfield runoff rate of 3.90 l/s calculated using the HR Wallingford greenfield runoff estimation tool.
Runoff coefficient	0.29	unitless	The runoff coefficient has been calculated using the nomogram presented on Figure 3 of Reference 1. In deriving the runoff coefficient a dominant vegetation type of cultivated land or short grass has been assumed and dominant soil type of gravelly sand has been assumed. The catchment slope of 1 vertical in 9.5 horizontal is derived from the proposed topography shown on drawing reference AU/CH/12-23/24084.
Climate change factor	40%	unitless	The recommended precautionary upper end increase in rainfall intensity to allow for climate change beyond 2100 from Reference <sup>3</sup>

Storm Duration (hr)	Rainfall for the site derived from Reference <sup>2</sup> (mm)	Rainfall Intensity corrected for climate change (mm/hr)	Volume of rainfall runoff in time period (m <sup>3</sup> )	Outflow in time period (m <sup>3</sup> )	Storage necessary in time period (m <sup>3</sup> )
0.25	25.72	144.03	454.74	3.51	451
0.5	33.62	94.14	594.42	7.02	587
0.75	38.52	71.90	681.05	10.53	671
1	42.02	58.83	742.93	14.04	729
1.5	47.35	44.19	837.17	21.06	816
2	51.43	36.00	909.31	28.08	881
3	57.7	26.93	1020.16	42.12	978
4	62.44	21.85	1103.97	56.16	1048
5	66.22	18.54	1170.80	70.20	1101
6	69.37	16.19	1226.49	84.24	1142
7	72.08	14.42	1274.41	98.28	1176
8	74.43	13.03	1315.96	112.32	1204
9	76.52	11.90	1352.91	126.36	1227
10	78.38	10.97	1385.79	140.40	1245
15	85.43	7.97	1510.44	210.60	1300
20	90.25	6.32	1595.66	280.80	1315
20.25	90.45	6.25	1599.20	284.31	1315
20.5	90.65	6.19	1602.73	287.82	1315
20.75	90.85	6.13	1606.27	291.33	1315
21	91.05	6.07	1609.81	294.84	1315
21.25	91.24	6.01	1613.16	298.35	1315
21.5	91.43	5.95	1616.52	301.86	1315
21.75	91.61	5.90	1619.71	305.37	1314
22	91.8	5.84	1623.07	308.88	1314
22.25	91.98	5.79	1626.25	312.39	1314
22.5	92.16	5.73	1629.43	315.90	1314
22.75	92.33	5.68	1632.44	319.41	1313
23	92.51	5.63	1635.62	322.92	1313
23.25	92.68	5.58	1638.62	326.43	1312
23.5	92.85	5.53	1641.63	329.94	1312
23.75	93.02	5.48	1644.64	333.45	1311
24	93.18	5.44	1647.47	336.96	1311
24.25	93.34	5.39	1650.29	340.47	1310
24.5	93.49	5.34	1652.95	343.98	1309
24.75	93.64	5.30	1655.60	347.49	1308
25	93.79	5.25	1658.25	351.00	1307
30	96.46	4.50	1705.46	421.20	1284
40	100.61	3.52	1778.83	561.60	1217
50	103.85	2.91	1836.12	702.00	1134
60	106.54	2.49	1883.68	842.40	1041
70	108.99	2.18	1926.99	982.80	944
80	111.28	1.95	1967.48	1123.20	844
90	113.47	1.77	2006.20	1263.60	743
96	114.75	1.67	2028.83	1347.84	681

References

Reference 1. National Coal Board, 1982. Technical Management of Water in the Coal Mining Industry.

Reference 2. <https://fehweb.ceh.ac.uk/>

Reference 3. <https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances>

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Denotes parameters which are calculated based on other parameters

Table A.ES.11.C.5

Calculation of attenuation storage during a 1 in 100 year storm event plus an allowance for climate change for the Detention Basin 4 catchment using the Rational Method (reference 1)

Parameter	Value	Units	Reference
Catchment area	1	ha	Area of Catchment 4 shown on drawing reference AU/CH/12-23/24084
Net discharge rate	73	m <sup>3</sup> /day	The 1 in 100yr greenfield runoff rate of 0.85 l/s calculated using the HR Wallingford greenfield runoff estimation tool.
Runoff coefficient	0.29	unitless	The runoff coefficient has been calculated using the nomogram presented on Figure 3 of Reference 1. In deriving the runoff coefficient a dominant vegetation type of cultivated land or short grass has been assumed and dominant soil type of gravelly sand has been assumed. The catchment slope of 1 vertical in 9.5 horizontal is derived from the proposed topography shown on drawing reference AU/CH/12-23/24084.
Climate change factor	40%	unitless	The recommended precautionary upper end increase in rainfall intensity to allow for climate change beyond 2100 from Reference <sup>3</sup>

Storm Duration (hr)	Rainfall for the site derived from Reference <sup>2</sup> (mm)	Rainfall Intensity corrected for climate change (mm/hr)	Volume of rainfall runoff in time period (m <sup>3</sup> )	Outflow in time period (m <sup>3</sup> )	Storage necessary in time period (m <sup>3</sup> )
0.25	25.72	144.03	98.72	0.77	98
0.5	33.62	94.14	129.05	1.53	128
0.75	38.52	71.90	147.85	2.30	146
1	42.02	58.83	161.29	3.06	158
1.5	47.35	44.19	181.75	4.59	177
2	51.43	36.00	197.41	6.12	191
3	57.7	26.93	221.48	9.18	212
4	62.44	21.85	239.67	12.24	227
5	66.22	18.54	254.18	15.30	239
6	69.37	16.19	266.27	18.36	248
7	72.08	14.42	276.67	21.42	255
8	74.43	13.03	285.69	24.48	261
9	76.52	11.90	293.71	27.54	266
10	78.38	10.97	300.85	30.60	270
15	85.43	7.97	327.91	45.90	282
20	90.25	6.32	346.42	61.20	285
20.25	90.45	6.25	347.18	61.97	285
20.5	90.65	6.19	347.95	62.73	285
20.75	90.85	6.13	348.72	63.50	285
21	91.05	6.07	349.49	64.26	285
21.25	91.24	6.01	350.22	65.03	285
21.5	91.43	5.95	350.94	65.79	285
21.75	91.61	5.90	351.64	66.56	285
22	91.8	5.84	352.36	67.32	285
22.25	91.98	5.79	353.06	68.09	285
22.5	92.16	5.73	353.75	68.85	285
22.75	92.33	5.68	354.40	69.62	285
23	92.51	5.63	355.09	70.38	285
23.25	92.68	5.58	355.74	71.15	285
23.5	92.85	5.53	356.39	71.91	284
23.75	93.02	5.48	357.05	72.68	284
24	93.18	5.44	357.66	73.44	284
24.25	93.34	5.39	358.28	74.21	284
24.5	93.49	5.34	358.85	74.97	284
24.75	93.64	5.30	359.43	75.74	284
25	93.79	5.25	360.00	76.50	284
30	96.46	4.50	370.25	91.80	278
40	100.61	3.52	386.18	122.40	264
50	103.85	2.91	398.62	153.00	246
60	106.54	2.49	408.94	183.60	225
70	108.99	2.18	418.35	214.20	204
80	111.28	1.95	427.14	244.80	182
90	113.47	1.77	435.54	275.40	160
96	114.75	1.67	440.46	293.76	147

References

Reference 1. National Coal Board, 1982. Technical Management of Water in the Coal Mining Industry.

Reference 2. <https://fehweb.ceh.ac.uk/>

Reference 3. <https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances>

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Denotes parameters which are calculated based on other parameters

Table A.ES.11.C.6

Calculation of attenuation storage during a 1 in 100 year storm event plus an allowance for climate change for the Detention Basin 5 catchment using the Rational Method (reference 1)

Parameter	Value	Units	Reference
Catchment area	6	ha	Area of Catchment 5 shown on drawing reference AU/CH/12-23/24084
Net discharge rate	357	m <sup>3</sup> /day	The 1 in 100yr greenfield runoff rate of 4.98 l/s calculated using the HR Wallingford greenfield runoff estimation tool adjusted to allow for the inflow of 0.85l/s from Basin 4
Runoff coefficient	0.29	unitless	The runoff coefficient has been calculated using the nomogram presented on Figure 3 of Reference 1. In deriving the runoff coefficient a dominant vegetation type of cultivated land or short grass has been assumed and dominant soil type of gravelly sand has been assumed. The catchment slope of 1 vertical in 9.5 horizontal is derived from the proposed topography shown on drawing reference AU/CH/12-23/24084.
Climate change factor	40%	unitless	The recommended precautionary upper end increase in rainfall intensity to allow for climate change beyond 2100 from Reference <sup>3</sup>

Storm Duration (hr)	Rainfall for the site derived from Reference <sup>2</sup> (mm)	Rainfall Intensity corrected for climate change (mm/hr)	Volume of rainfall runoff in time period (m <sup>3</sup> )	Outflow in time period (m <sup>3</sup> )	Storage necessary in time period (m <sup>3</sup> )
0.25	25.72	144.03	580.36	3.72	577
0.5	33.62	94.14	758.62	7.43	751
0.75	38.52	71.90	869.19	11.15	858
1	42.02	58.83	948.16	14.87	933
1.5	47.35	44.19	1068.43	22.30	1046
2	51.43	36.00	1160.49	29.74	1131
3	57.7	26.93	1301.97	44.60	1257
4	62.44	21.85	1408.93	59.47	1349
5	66.22	18.54	1494.22	74.34	1420
6	69.37	16.19	1565.30	89.21	1476
7	72.08	14.42	1626.45	104.08	1522
8	74.43	13.03	1679.48	118.94	1561
9	76.52	11.90	1726.64	133.81	1593
10	78.38	10.97	1768.61	148.68	1620
15	85.43	7.97	1927.69	223.02	1705
20	90.25	6.32	2036.45	297.36	1739
20.25	90.45	6.25	2040.96	301.08	1740
20.5	90.65	6.19	2045.48	304.79	1741
20.75	90.85	6.13	2049.99	308.51	1741
21	91.05	6.07	2054.50	312.23	1742
21.25	91.24	6.01	2058.79	315.95	1743
21.5	91.43	5.95	2063.08	319.66	1743
21.75	91.61	5.90	2067.14	323.38	1744
22	91.8	5.84	2071.43	327.10	1744
22.25	91.98	5.79	2075.49	330.81	1745
22.5	92.16	5.73	2079.55	334.53	1745
22.75	92.33	5.68	2083.39	338.25	1745
23	92.51	5.63	2087.45	341.96	1745
23.25	92.68	5.58	2091.28	345.68	1746
23.5	92.85	5.53	2095.12	349.40	1746
23.75	93.02	5.48	2098.95	353.12	1746
24	93.18	5.44	2102.57	356.83	1746
24.25	93.34	5.39	2106.18	360.55	1746
24.5	93.49	5.34	2109.56	364.27	1745
24.75	93.64	5.30	2112.94	367.98	1745
25	93.79	5.25	2116.33	371.70	1745
30	96.46	4.50	2176.58	446.04	1731
40	100.61	3.52	2270.22	594.72	1675
50	103.85	2.91	2343.33	743.40	1600
60	106.54	2.49	2404.03	892.08	1512
70	108.99	2.18	2459.31	1040.76	1419
80	111.28	1.95	2510.98	1189.44	1322
90	113.47	1.77	2560.40	1338.12	1222
96	114.75	1.67	2589.28	1427.33	1162

References

Reference 1. National Coal Board, 1982. Technical Management of Water in the Coal Mining Industry.

Reference 2. <https://fehweb.ceh.ac.uk/>

Reference 3. <https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances>

Denotes parameters which are determined based on the restoration scheme, rainfall data or other constraints on discharge or water levels

Denotes parameters which are calculated based on other parameters

Table A.ES.11.C.7

Calculation of attenuation storage during a 1 in 100 year storm event plus an allowance for climate change for the Detention Basin 6 catchment using the Rational Method (reference 1)

Parameter	Value	Units	Reference
Catchment area	3	ha	Area of Catchment 6 shown on drawing reference AU/CH/12-23/24084
Net discharge rate	269	m <sup>3</sup> /day	The 1 in 100yr greenfield runoff rate of 3.11 l/s calculated using the HR Wallingford greenfield runoff estimation tool.
Runoff coefficient	0.29	unitless	The runoff coefficient has been calculated using the nomogram presented on Figure 3 of Reference 1. In deriving the runoff coefficient a dominant vegetation type of cultivated land or short grass has been assumed and dominant soil type of gravelly sand has been assumed. The catchment slope of 1 vertical in 9.5 horizontal is derived from the proposed topography shown on drawing reference AU/CH/12-23/24084.
Climate change factor	40%	unitless	The recommended precautionary upper end increase in rainfall intensity to allow for climate change beyond 2100 from Reference <sup>3</sup>

Storm Duration (hr)	Rainfall for the site derived from Reference <sup>2</sup> (mm)	Rainfall Intensity corrected for climate change (mm/hr)	Volume of rainfall runoff in time period (m <sup>3</sup> )	Outflow in time period (m <sup>3</sup> )	Storage necessary in time period (m <sup>3</sup> )
0.25	25.72	144.03	362.65	2.80	360
0.5	33.62	94.14	474.04	5.60	468
0.75	38.52	71.90	543.12	8.40	535
1	42.02	58.83	592.47	11.20	581
1.5	47.35	44.19	667.63	16.79	651
2	51.43	36.00	725.15	22.39	703
3	57.7	26.93	813.56	33.59	780
4	62.44	21.85	880.39	44.78	836
5	66.22	18.54	933.69	55.98	878
6	69.37	16.19	978.10	67.18	911
7	72.08	14.42	1016.31	78.37	938
8	74.43	13.03	1049.45	89.57	960
9	76.52	11.90	1078.92	100.76	978
10	78.38	10.97	1105.14	111.96	993
15	85.43	7.97	1204.55	167.94	1037
20	90.25	6.32	1272.51	223.92	1049
20.25	90.45	6.25	1275.33	226.72	1049
20.5	90.65	6.19	1278.15	229.52	1049
20.75	90.85	6.13	1280.97	232.32	1049
21	91.05	6.07	1283.79	235.12	1049
21.25	91.24	6.01	1286.47	237.92	1049
21.5	91.43	5.95	1289.15	240.71	1048
21.75	91.61	5.90	1291.68	243.51	1048
22	91.8	5.84	1294.36	246.31	1048
22.25	91.98	5.79	1296.90	249.11	1048
22.5	92.16	5.73	1299.44	251.91	1048
22.75	92.33	5.68	1301.84	254.71	1047
23	92.51	5.63	1304.37	257.51	1047
23.25	92.68	5.58	1306.77	260.31	1046
23.5	92.85	5.53	1309.17	263.11	1046
23.75	93.02	5.48	1311.56	265.91	1046
24	93.18	5.44	1313.82	268.70	1045
24.25	93.34	5.39	1316.08	271.50	1045
24.5	93.49	5.34	1318.19	274.30	1044
24.75	93.64	5.30	1320.31	277.10	1043
25	93.79	5.25	1322.42	279.90	1043
30	96.46	4.50	1360.07	335.88	1024
40	100.61	3.52	1418.58	447.84	971
50	103.85	2.91	1464.27	559.80	904
60	106.54	2.49	1502.19	671.76	830
70	108.99	2.18	1536.74	783.72	753
80	111.28	1.95	1569.03	895.68	673
90	113.47	1.77	1599.91	1007.64	592
96	114.75	1.67	1617.95	1074.82	543

References

Reference 1. National Coal Board, 1982. Technical Management of Water in the Coal Mining Industry.

Reference 2. <https://fehweb.ceh.ac.uk/>

Reference 3. <https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances>

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Denotes parameters which are calculated based on other parameters



Table A.ES.11.C.8

Calculation of attenuation storage during a 1 in 100 year storm event plus an allowance for climate change for the Detention Basin 7 catchment using the Rational Method (reference 1)

Parameter	Value	Units	Reference
Catchment area	7	ha	Area of Catchment 7 shown on drawing reference AU/CH/12-23/24084
Net discharge rate	539	m <sup>3</sup> /day	The 1 in 100yr greenfield runoff rate of 6.24l/s calculated using the HR Wallingford greenfield runoff estimation tool.
Runoff coefficient	0.29	unitless	The runoff coefficient has been calculated using the nomogram presented on Figure 3 of Reference 1. In deriving the runoff coefficient a dominant vegetation type of cultivated land or short grass has been assumed and dominant soil type of gravelly sand has been assumed. The catchment slope of 1 vertical in 9.5 horizontal is derived from the proposed topography shown on drawing reference AU/CH/12-23/24084.
Climate change factor	40%	unitless	The recommended precautionary upper end increase in rainfall intensity to allow for climate change beyond 2100 from Reference <sup>3</sup>

Storm Duration (hr)	Rainfall for the site derived from Reference <sup>2</sup> (mm)	Rainfall Intensity corrected for climate change (mm/hr)	Volume of rainfall runoff in time period (m <sup>3</sup> )	Outflow in time period (m <sup>3</sup> )	Storage necessary in time period (m <sup>3</sup> )
0.25	25.72	144.03	728.09	5.62	722
0.5	33.62	94.14	951.73	11.23	940
0.75	38.52	71.90	1090.44	16.85	1074
1	42.02	58.83	1189.52	22.46	1167
1.5	47.35	44.19	1340.41	33.70	1307
2	51.43	36.00	1455.90	44.93	1411
3	57.7	26.93	1633.40	67.39	1566
4	62.44	21.85	1767.58	89.86	1678
5	66.22	18.54	1874.59	112.32	1762
6	69.37	16.19	1963.76	134.78	1829
7	72.08	14.42	2040.47	157.25	1883
8	74.43	13.03	2107.00	179.71	1927
9	76.52	11.90	2166.16	202.18	1964
10	78.38	10.97	2218.82	224.64	1994
15	85.43	7.97	2418.39	336.96	2081
20	90.25	6.32	2554.84	449.28	2106
20.25	90.45	6.25	2560.50	454.90	2106
20.5	90.65	6.19	2566.16	460.51	2106
20.75	90.85	6.13	2571.82	466.13	2106
21	91.05	6.07	2577.49	471.74	2106
21.25	91.24	6.01	2582.86	477.36	2106
21.5	91.43	5.95	2588.24	482.98	2105
21.75	91.61	5.90	2593.34	488.59	2105
22	91.8	5.84	2598.72	494.21	2105
22.25	91.98	5.79	2603.81	499.82	2104
22.5	92.16	5.73	2608.91	505.44	2103
22.75	92.33	5.68	2613.72	511.06	2103
23	92.51	5.63	2618.82	516.67	2102
23.25	92.68	5.58	2623.63	522.29	2101
23.5	92.85	5.53	2628.44	527.90	2101
23.75	93.02	5.48	2633.25	533.52	2100
24	93.18	5.44	2637.78	539.14	2099
24.25	93.34	5.39	2642.31	544.75	2098
24.5	93.49	5.34	2646.56	550.37	2096
24.75	93.64	5.30	2650.80	555.98	2095
25	93.79	5.25	2655.05	561.60	2093
30	96.46	4.50	2730.63	673.92	2057
40	100.61	3.52	2848.11	898.56	1950
50	103.85	2.91	2939.83	1123.20	1817
60	106.54	2.49	3015.98	1347.84	1668
70	108.99	2.18	3085.34	1572.48	1513
80	111.28	1.95	3150.17	1797.12	1353
90	113.47	1.77	3212.16	2021.76	1190
96	114.75	1.67	3248.40	2156.54	1092

References

Reference 1. National Coal Board, 1982. Technical Management of Water in the Coal Mining Industry.

Reference 2. <https://fehweb.ceh.ac.uk/>

Reference 3. <https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances>

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