

HALSWELL COMMONS

Stormwater Facility 1 Volume Calculations - Current Zoning

Date: 16-Sep-2023
 Completed by: Jamie Verstappen
 Revision: R1

Refer to Catchment Plan E18431 SC01.1

Assumptions:

1. Critical storm duration is 36hrs
2. Release of the storm is over four days
3. Average dewatering from site will be at 1 l/s/ha
4. Assumed 0.5l/s/ha already leaving site from spring flow

Stormwater flow and volume calculations using the requirements of Ecan consent CRC231955 and the Christchurch City Council Waterway, Wetlands & Drainage Guide (WWDG).

Zone	Area (Ha),A	FF Runoff Coefficients, Cff	Peak Flow Runoff Coefficients (50 year),C
Catchment A, Commercial (KAC) (CCC)	3.16	0.81	0.82
Catchment B, Commercial (KAC)	11.3	0.81	0.82
Catchment C, RNN Equivalent	18.4	0.63	0.65
Catchment D, RNN Equivalent	7.7	0.63	0.65
Catchment E, Stormwater facility	9.8	0	0.9
Catchment F, MRZ, RNN Equivalent (CCC)	12.6	0.63	0.65
Catchment G, MRZ, RNN Equivalent (CCC)	18.1	0.63	0.65
Catchment H, MRZ, RNN Equivalent (CCC)	6.5	0.63	0.65
Total Area	87.56		

Christchurch Rainfall intensity for 36hr event: 4.95 mm/hr HIRDS RCP8.5 2081 -2100

First flush Volume (WWDG,Eqn 6-2), $V = 10CA_d$, $d = 25\text{mm}$ as per consent condition

Commercial (KAC):	$V = 10 * 25 * 0.81 * 14.46$	2928.15 m ³
Residential (RNN Equiv):	$V = 10 * 25 * 0.63 * 63.3$	9969.75 m ³
Residential (HRZ)	$V = 10 * 25 * 0.81 * 0$	0 m ³

Halswell Commons Facility FF volume required 12898 m³
With 5% sediment retention added. **13543 m³**
Constructed FF Basin Volume **18010 m³**

This fits into the existing FF basin by raising the spillway to RL19.4

FF Volume Split

Spreydon Lodge	$V = 10 * 25 * (B * C_{ffB} + C * C_{ffC} + D * C_{ffD})$	6399 m ³
CCC	$V = 10 * 25 * (A * C_{ffA} + F * C_{ffF} + F * C_{ffF})$	6499 m ³

FF Outflow Rate based on volume discharging over 4 days 39.2 l/s

Full Flood Volume calculation = 2.78CiA

		%	m ³
Catchment A, Commercial (KAC) (CCC)	35.7 l/s	4.19	2321
Catchment B, Commercial (KAC)	127.5 l/s	14.99	8298
Catchment C, RNN Equivalent	164.6 l/s	19.35	10711
Catchment D, RNN Equivalent	68.9 l/s	8.10	4482
Catchment E, Stormwater facility	121.4 l/s	14.27	7899
Catchment F, MRZ, RNN Equivalent (CCC)	112.7 l/s	13.25	7335
Catchment G, MRZ, RNN Equivalent (CCC)	161.9 l/s	19.03	10537
Catchment H, MRZ, RNN Equivalent (CCC)	58.1 l/s	6.83	3784
CCC Portion		17.44	
Spreydon Lodge Portion		56.70	

Storm water detention volume required 850.7 l/s
 110255.3 m³ for 36hrs

Discharge rate of storm volume over a 4 day time frame, $110255.3 / 4 / 24 / 60 / 60$
 0.319 m³/s

Discharge rate over the 36hrs storm event, $0.319 * 60 * 60 * 36 =$ 41345.7 m³

Volume of detention basin required, less discharge over storm event and FF volumes,
 $V = 110255.3 - 41345.7 - 13543$ 55367 m³

Total basin volume storage volume required **55367 m³**
Less spare FF capacity **4467 m³**
Total basin volume to be constructed **50900 m³**

HALSWELL COMMONS

Stormwater Facility 1 Volume Calculations - PC14 Notified Zoning

Date: 16-Sep-2023
 Completed by: Jamie Verstappen
 Revision: R1

Refer to Catchment Plan E18431 SC01.2

Assumptions:

1. Critical storm duration is 36hrs
2. Release of the storm is over four days
3. Average dewatering from site will be at 1 l/s/ha
4. Assumed 0.5l/s/ha already leaving site from spring flow

Stormwater flow and volume calculations using the requirements of Ecan consent CRC231955 and the Christchurch City Council Waterway, Wetlands & Drainage Guide (WWDG).

Zone	Area (Ha),A	FF Runoff Coefficients, Cff	Peak Flow Runoff Coefficients (50 year),C
Catchment A, Commercial (KAC) (CCC)	3.16	0.81	0.82
Catchment B, Commercial (KAC)	11.3	0.81	0.82
Catchment C, HRZ	18.4	0.81	0.82
Catchment D, RNN Equivalent	7.7	0.63	0.65
Catchment E, Stormwater facility	9.8	0	0.9
Catchment F, HRZ	12.6	0.81	0.82
Catchment G, MRZ, RNN Equivalent (CCC)	18.1	0.63	0.65
Catchment H, MRZ, RNN Equivalent (CCC)	6.5	0.63	0.65
Total Area	87.56		

Christchurch Rainfall intensity for 36hr event: 4.95 mm/hr HIRDS RCP8.5 2081 -2100

First flush Volume (WWDG,Eqn 6-2), $V = 10CA_d$, $d = 25\text{mm}$ as per consent condition

Commercial (KAC):	$V = 10 * 25 * 0.81 * 14.46$	2928.15 m ³
Residential (RNN Equiv):	$V = 10 * 25 * 0.63 * 32.3$	5087.25 m ³
Residential (HRZ)	$V = 10 * 25 * 0.81 * 31$	4882.5 m ³

Halswell Commons Facility FF volume required 12898 m³
With 5% sediment retention added. **13543 m³**
FF capacity provided **18010 m³**

This fits into the existing FF basin by raising the spillway to RL19.4

FF Volume Split

Spreydon Lodge	$V = 10 * 25 * (B * C_{ffB} + C * C_{ffC} + D * C_{ffD})$	7227 m ³
CCC	$V = 10 * 25 * (A * C_{ffA} + F * C_{ffF} + F * C_{ffF})$	7066 m ³

FF Outflow Rate based on volume discharging over 4 days 39.2 l/s

Full Flood Volume calculation = 2.78CiA

		%	m ³
Catchment A, Commercial (KAC) (CCC)	35.7 l/s	3.86	2365
Catchment B, Commercial (KAC)	127.5 l/s	13.81	8458
Catchment C, HRZ	207.6 l/s	22.49	13772
Catchment D, RNN Equivalent	68.9 l/s	7.46	4569
Catchment E, Stormwater facility	121.4 l/s	13.15	8051
Catchment F, HRZ	142.2 l/s	15.40	9431
Catchment G, MRZ, RNN Equivalent (CCC)	161.9 l/s	17.54	10739
Catchment H, MRZ, RNN Equivalent (CCC)	58.1 l/s	6.30	3857
CCC Portion		19.26	
Spreydon Lodge Portion		56.91	

Storm water detention volume required 923.3 l/s
 119653.9 m³ for 36hrs

Discharge rate of storm volume over a 4 day time frame, $119653.9 / 4 / 24 / 60 / 60$
 0.346 m³/s

Discharge rate over the 36hrs storm event, $0.346 * 60 * 60 * 36 =$ 44870.2 m³

Volume of detention basin required, less discharge over storm event and FF volumes,
 $V = 119653.9 - 44870.2 - 13543$ 61241 m³

Total basin volume storage volume required **61241 m³**
Less spare FF capacity **4467 m³**
Total basin volume to be constructed **56774 m³**

HALSWELL COMMONS

Stormwater Facility 1 Volume Calculations - s42A Recommended

Date: 16-Sep-2023
 Completed by: Jamie Verstappen
 Revision: R1

Refer to Catchment Plan E18431 SC01.3

Assumptions:

1. Critical storm duration is 36hrs
2. Release of the storm is over four days
3. Average dewatering from site will be at 1 l/s/ha
4. Assumed 0.5l/s/ha already leaving site from spring flow

Stormwater flow and volume calculations using the requirements of Ecan consent CRC231955 and the Christchurch City Council Waterway, Wetlands & Drainage Guide (WWDG).

Zone	Area (Ha),A	FF Runoff Coefficients, Cff	Peak Flow Runoff Coefficients (50 year),C
Catchment A, Commercial (KAC) (CCC)	3.16	0.81	0.82
Catchment B, Commercial (KAC)	11.3	0.81	0.82
Catchment C, HRZ	18.4	0.81	0.82
Catchment D, HRZ	7.7	0.81	0.82
Catchment E, Stormwater facility	9.8	0	0.9
Catchment F, HRZ	12.6	0.81	0.82
Catchment G, MRZ, RNN Equivalent (CCC)	18.1	0.63	0.65
Catchment H, HRZ	6.5	0.81	0.82
Total Area	87.56		

Christchurch Rainfall intensity for 36hr event: 4.95 mm/hr HIRDS RCP8.5 2081 -2100

First flush Volume (WWDG,Eqn 6-2), $V = 10CA_d$, $d = 25\text{mm}$ as per consent condition

Commercial (KAC):	$V = 10 * 25 * 0.81 * 14.46$	2928.15 m ³
Residential (RNN Equiv):	$V = 10 * 25 * 0.63 * 63.3$	12818.25 m ³
Residential (HRZ)	$V = 10 * 25 * 0.81 * 0$	0 m ³

Halswell Commons Facility FF volume required 15746 m³
With 5% sediment retention added. **16534 m³**
FF capacity provided **18010 m³**

This fits into the existing FF basin by raising the spillway to RL19.4

FF Volume Split

Spreydon Lodge	$V = 10 * 25 * (B * C_{ffB} + C * C_{ffC} + D * C_{ffD})$	7574 m ³
CCC	$V = 10 * 25 * (A * C_{ffA} + F * C_{ffF} + F * C_{ffF})$	7358 m ³

FF Outflow Rate based on volume discharging over 4 days 47.8 l/s

Full Flood Volume calculation = 2.78CiA

		%	m ³
Catchment A, Commercial (KAC) (CCC)	35.7 l/s	3.73	2272
Catchment B, Commercial (KAC)	127.5 l/s	13.33	8124
Catchment C, HRZ	207.6 l/s	21.71	13229
Catchment D, HRZ	86.9 l/s	9.08	5536
Catchment E, Stormwater facility	121.4 l/s	12.69	7733
Catchment F, HRZ	142.2 l/s	14.86	9059
Catchment G, MRZ, RNN Equivalent (CCC)	161.9 l/s	16.93	10315
Catchment H, HRZ	73.3 l/s	7.67	4673
CCC Portion		18.59	
Spreydon Lodge Portion		56.81	

Storm water detention volume required 956.5 l/s
 123959.1 m³ for 36hrs

Discharge rate of storm volume over a 4 day time frame, $123959.1 / 4 / 24 / 60 / 60$
 0.359 m³/s

Discharge rate over the 36hrs storm event, $0.359 * 60 * 60 * 36 =$ 46484.7 m³

Volume of detention basin required, less discharge over storm event and FF volumes,
 $V = 123959.1 - 46484.7 - 16534$ 60941 m³

Total basin volume storage volume required **60941 m³**
Less spare FF capacity **1476 m³**
Total basin volume to be constructed **59464 m³**

HALSWELL COMMONS

Stormwater Facility 2 Volume Calculations - Current Zoning

Date: 16-Sep-2023
 Completed by: Jamie Verstappen
 Revision: R1

Refer to Catchment Plan E18431 SC01.1

Assumptions:

1. Critical storm duration is 36hrs
2. Release of the storm is over four days
3. Average dewatering from site will be at 1 l/s/ha
4. Assumed 0.5l/s/ha already leaving site from spring flow

Stormwater flow and volume calculations using the requirements of Ecan consent CRC231955 and the Christchurch City Council Waterway, Wetlands & Drainage Guide (WWDG).

Zone	Area (Ha),A	FF Runoff Coefficients, Cff	Peak Flow Runoff Coefficients (50 year),C
Catchment A, Commercial (KAC)	2.9	0.81	0.82
Catchment B, L2 Equivalent	14.2	0.53	0.56
Catchment C, L2 Equivalent	9.8	0.53	0.56
Catchment D, L2 Equivalent	5.3	0.53	0.56
Catchment E, Completed L2 Equivalent	10	0.53	0.56
Catchment F, Completed L2 Equivalent	10.2	0.53	0.56
Catchment G, L2 Equivalent	4	0.53	0.56
Catchment H, Partially completed L2 Equivalent	16.7	0.53	0.56
Catchment I, Partially completed L3 Res	3.5	0.63	0.65
Catchment J, Stormwater Facility	5.2	0	0.9
Total Area	81.8		

Christchurch Rainfall intensity for 36hr event: 4.95 mm/hr HIRDS RCP8.5 2081 -2100

First flush Volume (WWDG, Eqn 6-2), $V = 10CA_d$, $d = 25\text{mm}$ as per consent condition

Residential (RNN/L3): $V = 10*25 * 0.63 * 3.5$ 463.75 m3
 Residential (L2 Equiv): $V = 10*25 * 0.53 * 16.7$ 2212.75 m3

SW Facility 2 FF volume required 2677 m3
Constructed FF Basin Volume 2810 m3

FF Outflow Rate based on volume discharging over 4 days 8.1 l/s

Volume of FF required upstream of site

Commercial (KAC): $V = 10*25 * 0.81 * 2.9$ 587.25 m3
 Residential (RNN/L3): $V = 10*25 * 0.63 * 18.2$ 2411.5 m3
 Residential (L2 Equiv): $V = 10*25 * 0.53 * 35.3$ 4677.25 m3

Total FF Volume within catchment 10494 m3

Full Flood Volume calculation = 2.78CIA

		%	m ³
Catchment A, Commercial (KAC)	32.7 l/s	4.89	2138
Catchment B, L2 Equivalent	109.4 l/s	16.35	7148
Catchment C, L2 Equivalent	75.5 l/s	11.28	4933
Catchment D, L2 Equivalent	40.8 l/s	6.10	2668
Catchment E, Completed L2 Equivalent	77.1 l/s	11.51	5034
Catchment F, Completed L2 Equivalent	78.6 l/s	11.74	5135
Catchment G, L2 Equivalent	30.8 l/s	4.60	2014
Catchment H, Partially completed L2 Equivalent	128.7 l/s	19.22	8407
Catchment I, Partially completed L3 Res	31.3 l/s	4.68	2045
Catchment J, Stormwater Facility	64.4 l/s	9.62	4207

Storm water detention volume required 669.4 l/s
 86754.7 m3 for 36hrs

Discharge rate of storm volume over a 4 day time frame, $86754.7 / 4 / 24 / 60 / 60$
 0.251 m3/s

Discharge rate over the 36hrs storm event, $0.251 * 60 * 60 * 36 =$ 32533.0 m3

Volume of detention basin required, less discharge over storm event and FF volumes,
 $V = 86754.7 - 32533.0 - 10494$ 43728 m3

Total basin volume storage volume required 43728 m3

HALSWELL COMMONS

Stormwater Facility 2 Volume Calculations - PC14 Zoning

Date: 16-Sep-2023
 Completed by: Jamie Verstappen
 Revision: R1

Refer to Catchment Plan E18431 SC01.2

Assumptions:

1. Critical storm duration is 36hrs
2. Release of the storm is over four days
3. Average dewatering from site will be at 1 l/s/ha
4. Assumed 0.5l/s/ha already leaving site from spring flow

Stormwater flow and volume calculations using the requirements of Ecan consent CRC231955 and the Christchurch City Council Waterway, Wetlands & Drainage Guide (WWDG).

Zone	Area (Ha),A	FF Runoff Coefficients, Cff	Peak Flow Runoff Coefficients (50 year),C
Catchment A, Commercial (KAC)	2.9	0.81	0.82
Catchment B, Progressive HRZ	14.2	0.81	0.82
Catchment C, L2 Equivalent	9.8	0.53	0.56
Catchment D, L2 Equivalent	5.3	0.53	0.56
Catchment E, Completed L2 Equivalent	10	0.53	0.56
Catchment F, Completed L2 Equivalent	10.2	0.53	0.56
Catchment G, Progressive RNN	4	0.63	0.65
Catchment H, Partially completed L2 Equivalent	16.7	0.53	0.56
Catchment I, Partially completed L3 Res	3.5	0.63	0.65
Catchment J, Stormwater Facility	5.2	0	0.9
Total Area	81.8		

Christchurch Rainfall intensity for 36hr event: 4.95 mm/hr HIRDS RCP8.5 2081 -2100

First flush Volume (WWDG, Eqn 6-2), $V = 10CA_d$, $d = 25\text{mm}$ as per consent condition

Residential (RNN/L3): $V = 10*25 * 0.63 * 3.5$ 463.75 m3
 Residential (L2 Equiv): $V = 10*25 * 0.53 * 16.7$ 2212.75 m3

SW Facility 2 FF volume required 2677 m3
Constructed FF Basin Volume 2810 m3

FF Outflow Rate based on volume discharging over 4 days 8.1 l/s

Volume of FF required upstream of site

Commercial (KAC): $V = 10*25 * 0.81 * 2.9$ 587.25 m3
 Residential (RNN/L3): $V = 10*25 * 0.63 * 18.2$ 3685.5 m3
 Residential (L2 Equiv): $V = 10*25 * 0.53 * 35.3$ 4677.25 m3

Total FF Volume within catchment 11768 m3

Full Flood Volume calculation = 2.78CIA

		%	m ³
Catchment A, Commercial (KAC)	32.7 l/s	4.51	2120
Catchment B, Progressive HRZ	160.2 l/s	22.10	10379
Catchment C, L2 Equivalent	75.5 l/s	10.41	4892
Catchment D, L2 Equivalent	40.8 l/s	5.63	2645
Catchment E, Completed L2 Equivalent	77.1 l/s	10.63	4991
Catchment F, Completed L2 Equivalent	78.6 l/s	10.84	5091
Catchment G, Progressive RNN	35.8 l/s	4.93	2317
Catchment H, Partially completed L2 Equivalent	128.7 l/s	17.75	8336
Catchment I, Partially completed L3 Res	31.3 l/s	4.32	2028
Catchment J, Stormwater Facility	64.4 l/s	8.88	4171

Storm water detention volume required 725.2 l/s
 93981.2 m3 for 36hrs

Discharge rate of storm volume over a 4 day time frame, $93981.2 / 4 / 24 / 60 / 60$
 0.272 m3/s

Discharge rate over the 36hrs storm event, $0.272 * 60 * 60 * 36 =$ 35242.9 m3

Volume of detention basin required, less discharge over storm event and FF volumes,
 $V = 93981.2 - 35242.9 - 11768$ 46970 m3

Total basin volume storage volume required 46970 m3

HALSWELL COMMONS

Stormwater Facility 2 Volume Calculations - PC14 Zoning

Date: 16-Sep-2023
 Completed by: Jamie Verstappen
 Revision: R1

Refer to Catchment Plan E18431 SC01.3

Assumptions:

1. Critical storm duration is 36hrs
2. Release of the storm is over four days
3. Average dewatering from site will be at 1 l/s/ha
4. Assumed 0.5l/s/ha already leaving site from spring flow

Stormwater flow and volume calculations using the requirements of Ecan consent CRC231955 and the Christchurch City Council Waterway, Wetlands & Drainage Guide (WWDG).

Zone	Area (Ha),A	FF Runoff Coefficients, Cff	Peak Flow Runoff Coefficients (50 year),C
Catchment A, Commercial (KAC)	2.9	0.81	0.82
Catchment B, Progressive HRZ	14.2	0.81	0.82
Catchment C, L2 Equivalent	9.8	0.53	0.56
Catchment D, HRZ	5.3	0.81	0.82
Catchment E, Completed L2 Equivalent	10	0.53	0.56
Catchment F, HRZ	10.2	0.81	0.82
Catchment G, HRZ	4	0.81	0.82
Catchment H, Partially completed L2 Equivalent	16.7	0.53	0.56
Catchment I, Partially completed L3 Res	3.5	0.63	0.65
Catchment J, Stormwater Facility	5.2	0	0.9
Total Area	81.8		

Christchurch Rainfall intensity for 36hr event: 4.95 mm/hr HIRDS RCP8.5 2081 -2100

First flush Volume (WWDG, Eqn 6-2), $V = 10CA_d$, $d = 25\text{mm}$ as per consent condition

Residential (RNN/L3): $V = 10*25 * 0.63 *$ 3.5 708.75 m3
 Residential (L2 Equiv): $V = 10*25 * 0.53 *$ 16.7 2212.75 m3

SW Facility 2 FF volume required 2922 m3
Constructed FF Basin Volume **2810 m3**

FF Outflow Rate based on volume discharging over 4 days 8.1 l/s

Volume of FF required upstream of site
 Commercial (KAC): $V = 10*25 * 0.81 *$ 2.9 587.25 m3
 Residential (RNN/L3): $V = 10*25 * 0.63 *$ 18.2 3685.5 m3
 Residential (L2 Equiv): $V = 10*25 * 0.53 *$ 35.3 4677.25 m3

Total FF Volume within catchment **11768 m3**

Full Flood Volume calculation = 2.78CIA

		%	m ³
Catchment A, Commercial (KAC)	32.7 l/s	4.14	2163
Catchment B, Progressive HRZ	160.2 l/s	20.28	10592
Catchment C, L2 Equivalent	75.5 l/s	9.56	4992
Catchment D, HRZ	59.8 l/s	7.57	3953
Catchment E, Completed L2 Equivalent	77.1 l/s	9.75	5094
Catchment F, HRZ	115.1 l/s	14.57	7608
Catchment G, HRZ	45.1 l/s	5.71	2984
Catchment H, Partially completed L2 Equivalent	128.7 l/s	16.29	8507
Catchment I, Partially completed L3 Res	31.3 l/s	3.96	2069
Catchment J, Stormwater Facility	64.4 l/s	8.15	4257

Storm water detention volume required 790.0 l/s
 102381.1 m3 for 36hrs

Discharge rate of storm volume over a 4 day time frame, $102381.1 / 4 / 24 / 60 / 60$
 0.296 m3/s

Discharge rate over the 36hrs storm event, $0.296 * 60 * 60 * 36 =$ 38392.9 m3

Volume of detention basin required, less discharge over storm event and FF volumes,
 $V = 102381.1 - 38392.9 - 11768$ 52220 m3

Total basin volume storage volume required **52220 m3**