

Project Title
Barnsley FRA - Carrington Avenue

Job Number CS/071060
Version Version 1
File Path [S:\ZWET\Sheffield Based Jobs\CSXXXXX_Barnsley_FRA\Surface Water Calcs\CARR\Carrington Avenue SW Calculations \(existing v proposed\).xls](#)
Produced by JL **Date** 03/07/2014
Checked by **Date**

Rainfall Data NGR SE 34000 07000

Duration (mins)	Duration (hrs)	Return Period					
		1	2	10	30	100	100 + CC (+30%)
15	0.25	3.80	7.13	13.34	19.46	29.16	37.91
30	0.5	5.05	9.18	16.63	23.78	34.89	45.36
60	1	6.72	11.83	20.73	29.06	41.76	54.29
120	2	8.94	15.23	25.84	35.52	49.97	64.96
240	4	11.90	19.61	32.20	43.41	59.79	77.73
360	6	14.07	22.74	36.63	48.82	66.41	86.33
480	8	15.84	25.25	40.14	53.05	71.55	93.02
600	10	17.37	27.39	43.09	56.59	75.81	98.55
840	14	20.10	31.21	48.31	62.85	83.34	108.34
1440	24	25.77	39.00	58.87	75.43	98.39	127.91
2880	48	35.48	51.96	75.91	95.37	121.80	158.34

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Barnsley FRA - Carrington Avenue

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Version	Draft v1.0		
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Produced by	JL	Date	03/07/2014
Checked by		Date	00/01/1900

Calculation of Greenfield Runoff Rates - Institute of Hydrology Report 124 FSR 3-parameter equation

Site name	AREA (km)	SPRHOST (%)	SAAR (mm)	SOIL	QBAR (m ³ /s)
Carrington Avenue	0.5	35.88	679	0.3	0.08793218

S1	0
S2	100
S3	0
S4	0
S5	0

Greenfield runoff in m3/s	Return Period						
	QBAR	1	2	10	30	100	100 + CC
Region		0.09	0.08	0.08	0.13	0.18	0.23
4		0.00	0.88	0.89	1.49	2.06	2.57

Greenfield runoff in l/s for 50 ha Area	Return Period						
	QBAR	1	2	10	30	100	100 + CC
	87.93	77.38	78.26	131.02	181.14	225.99	293.78

Greenfield runoff in l/s/ha	Return Period						
	QBAR	1	2	10	30	100	100 + CC
	1.75864	1.55	1.57	2.62	3.62	4.52	5.88

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Calculation of Existing Peak Runoffs and Volumes from Impermeable Areas ONLY

Calculation of Runoff Coefficient (Cv)

Surface	Area (ha)	Cv	Weighted Cv
Greenfield Open Space	n/a	n/a	n/a
Roof	0	0.85	#DIV/0!
Hardstanding	0	0.8	#DIV/0!
Other	0	0	#DIV/0!
Total	0.00		#DIV/0!

Return Period	1 in 1	Year
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Duration (mins)	FEH rainfall Depth (mm)	Intensity (mm/hr)	Peak Flow Rate (m3/s)	Volume of Runoff (m3)
15	3.8	15.20	#DIV/0!	#DIV/0!
30	5.05	10.10	#DIV/0!	#DIV/0!
60	6.72	6.72	#DIV/0!	#DIV/0!
120	8.94	4.47	#DIV/0!	#DIV/0!
240	11.9	2.98	#DIV/0!	#DIV/0!
360	14.07	2.35	#DIV/0!	#DIV/0!
480	15.84	1.98	#DIV/0!	#DIV/0!
600	17.37	1.74	#DIV/0!	#DIV/0!
840	20.1	1.44	#DIV/0!	#DIV/0!
1440	25.77	1.07	#DIV/0!	#DIV/0!
2880	35.48	0.74	#DIV/0!	#DIV/0!

Calculation of Existing Peak Runoffs and Volumes from Greenfield Areas ONLY

Existing Greenfield Area	2.6022 ha	
	QBAR	Return Period
		1
Greenfield Runoff Rate (l/s/ha)	1.76	1.55
Greenfield Runoff from Open Space (l/s)	4.58	4.03

Refer greenfield runoff calcs

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Calculation of Post Development Peak Runoffs and Volumes from Impermeable Areas ONLY

Calculation of Runoff Coefficient (Cv)

Surface	Area (ha)	Cv	Weighted Cv
Greenfield Open Space	n/a	n/a	n/a
Roof	0.5555	0.85	0.228379686
Hardstanding	1.512	0.8	0.585054414
Other			0
Total	2.07		0.813434099

Return Period 1 in 1 **Year**

Duration (mins)	FEH rainfall Depth (mm)	Intensity (mm/hr)	Peak Flow Rate (m3/s)	Volume of Runoff (m3)
15	3.8	15.20	0.0924	63.9
30	5.05	10.10	0.0614	84.9
60	6.72	6.72	0.0408	113.0
120	8.94	4.47	0.0272	150.4
240	11.9	2.98	0.0181	200.1
360	14.07	2.35	0.0143	236.6
480	15.84	1.98	0.0120	266.4
600	17.37	1.74	0.0106	292.1
840	20.1	1.44	0.0087	338.0
1440	25.77	1.07	0.0065	433.4
2880	35.48	0.74	0.0045	596.7

Calculation of Post Development Peak Runoffs and Volumes from Greenfield Areas ONLY

Post Development Greenfield Area	0.5347 ha	
	QBAR	Return Period
		1
Greenfield Runoff Rate (l/s/ha)	1.76	1.55
Greenfield Runoff from Open Space (l/s)	0.94	0.83

Refer greenfield runoff calcs

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Calculation of TOTAL Post Development Peak Runoffs and Volumes and Required Storage

Return Period 1 in 1 **Year**

Storm Duration (minutes)	Existing or Permitted Discharge Runoff Rate m³/s	Post-Development Runoff Rate m³/s	Existing or Permitted Outflow Volume m³	Post-Development Runoff Volume m³	Storage, Inflow - Outflow m³
15	0.0050	0.0932	4.50	64.65	60.15
30	0.0050	0.0622	9.00	86.42	77.42
60	0.0050	0.0417	18.00	115.99	97.99
120	0.0050	0.0280	36.00	156.31	120.31
240	0.0050	0.0189	72.00	212.05	140.05
360	0.0050	0.0151	108.00	254.50	146.50
480	0.0050	0.0129	144.00	290.23	146.23
600	0.0050	0.0114	180.00	321.91	141.91
840	0.0050	0.0096	252.00	379.74	127.74
1440	0.0050	0.0074	432.00	504.89	72.89
2880	0.0050	0.0053	864.00	739.69	-124.31

Required Storage 146.50 m³

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Calculation of Existing Peak Runoffs and Volumes from Impermeable Areas ONLY

Calculation of Runoff Coefficient (Cv)

Surface	Area (ha)	Cv	Weighted Cv
Greenfield Open Space	n/a	n/a	#VALUE!
Macadam	0	0.85	#DIV/0!
Hardstanding	0	0.8	#DIV/0!
Other	0	0	#DIV/0!
Total	0.00		#DIV/0!

Return Period 1 in 2 **Year**

Duration (mins)	FEH rainfall Depth (mm)	Intensity (mm/hr)	Peak Flow Rate (m3/s)	Volume of Runoff (m3)
15	7.13	28.52	#DIV/0!	#DIV/0!
30	9.18	18.36	#DIV/0!	#DIV/0!
60	11.83	11.83	#DIV/0!	#DIV/0!
120	15.23	7.62	#DIV/0!	#DIV/0!
240	19.61	4.90	#DIV/0!	#DIV/0!
360	22.74	3.79	#DIV/0!	#DIV/0!
480	25.25	3.16	#DIV/0!	#DIV/0!
600	27.39	2.74	#DIV/0!	#DIV/0!
840	31.21	2.23	#DIV/0!	#DIV/0!
1440	39	1.63	#DIV/0!	#DIV/0!
2880	51.96	1.08	#DIV/0!	#DIV/0!

Calculation of Existing Peak Runoffs and Volumes from Greenfield Areas ONLY

Existing Greenfield Area	2.6022 ha		
	QBAR	Return Period	
		2	
Greenfield Runoff Rate (l/s/ha)	1.76	1.57	
Greenfield Runoff from Open Space (l/s)	4.58	4.07	

Refer greenfield runoff calcs

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Calculation of Post Development Peak Runoffs and Volumes from Impermeable Areas ONLY

Calculation of Runoff Coefficient (Cv)

Surface	Area (ha)	Cv	Weighted Cv
Greenfield Open Space	N/A	N/A	N/A
Macadam	0.5555	0.85	0.228379686
Hardstanding	1.512	0.8	0.585054414
Other	0	0	0
Total	2.07		0.813434099

Return Period 1 in 2 **Year**

Duration (mins)	FEH rainfall Depth (mm)	Intensity (mm/hr)	Peak Flow Rate (m3/s)	Volume of Runoff (m3)
15	7.13	28.52	0.1733	119.9
30	9.18	18.36	0.1116	154.4
60	11.83	11.83	0.0719	199.0
120	15.23	7.62	0.0463	256.1
240	19.61	4.90	0.0298	329.8
360	22.74	3.79	0.0230	382.4
480	25.25	3.16	0.0192	424.6
600	27.39	2.74	0.0166	460.6
840	31.21	2.23	0.0135	524.9
1440	39	1.63	0.0099	655.9
2880	51.96	1.08	0.0066	873.9

Calculation of Post Development Peak Runoffs and Volumes from Greenfield Areas ONLY

Post Development Greenfield Area	0.53 ha	
	QBAR	Return Period
		2
Greenfield Runoff Rate (l/s/ha)	1.76	1.57
Greenfield Runoff from Open Space (l/s)	0.94	0.84

Refer greenfield runoff calcs

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Calculation of TOTAL Post Development Peak Runoffs and Volumes and Required Storage

Return Period 1 in 2 **Year**

Storm Duration (minutes)	Existing or Permitted Discharge Runoff Rate m³/s	Post-Development Runoff Rate m³/s	Existing or Permitted Outflow Volume m³	Post-Development Runoff Volume m³	Storage, Inflow - Outflow m³
15	0.0050	0.1742	4.50	120.66	116.16
30	0.0050	0.1124	9.00	155.89	146.89
60	0.0050	0.0727	18.00	201.97	183.97
120	0.0050	0.0471	36.00	262.16	226.16
240	0.0050	0.0306	72.00	341.85	269.85
360	0.0050	0.0239	108.00	400.51	292.51
480	0.0050	0.0200	144.00	448.75	304.75
600	0.0050	0.0175	180.00	490.77	310.77
840	0.0050	0.0144	252.00	567.06	315.06
1440	0.0050	0.0107	432.00	728.20	296.20
2880	0.0050	0.0074	864.00	1018.47	154.47

Required Storage 315.06 m³

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Calculation of Existing Peak Runoffs and Volumes from Impermeable Areas ONLY

Calculation of Runoff Coefficient (Cv)

Surface	Area (ha)	Cv	Weighted Cv
Greenfield Open Space	n/a	n/a	#VALUE!
Macadam	0	0.85	#DIV/0!
Hardstanding	0	0.8	#DIV/0!
Other	0	0	#DIV/0!
Total	0.00		#VALUE!

Return Period 1 in 10 **Year**

Duration (mins)	FEH rainfall Depth (mm)	Intensity (mm/hr)	Peak Flow Rate (m3/s)	Volume of Runoff (m3)
15	13.34	53.36	#VALUE!	#VALUE!
30	16.63	33.26	#VALUE!	#VALUE!
60	20.73	20.73	#VALUE!	#VALUE!
120	25.84	12.92	#VALUE!	#VALUE!
240	32.2	8.05	#VALUE!	#VALUE!
360	36.63	6.11	#VALUE!	#VALUE!
480	40.14	5.02	#VALUE!	#VALUE!
600	43.09	4.31	#VALUE!	#VALUE!
840	48.31	3.45	#VALUE!	#VALUE!
1440	58.87	2.45	#VALUE!	#VALUE!
2880	75.91	1.58	#VALUE!	#VALUE!

Calculation of Existing Peak Runoffs and Volumes from Greenfield Areas ONLY

Existing Greenfield Area	2.6022 ha	
	QBAR	Return Period
		10
Greenfield Runoff Rate (l/s/ha)	1.76	2.62
Greenfield Runoff from Open Space (l/s)	4.58	6.82

Refer greenfield runoff calcs

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Calculation of Post Development Peak Runoffs and Volumes from Impermeable Areas ONLY

Calculation of Runoff Coefficient (Cv)

Surface	Area (ha)	Cv	Weighted Cv
Greenfield Open Space	N/A	N/A	N/A
Roof	0.5555	0.85	0.228379686
Hardstanding	1.512	0.8	0.585054414
Other	0	0	0
Total	2.07		0.813434099

Return Period 1 in 10 **Year**

Duration (mins)	FEH rainfall Depth (mm)	Intensity (mm/hr)	Peak Flow Rate (m3/s)	Volume of Runoff (m3)
15	13.34	53.36	0.3243	224.3
30	16.63	33.26	0.2022	279.7
60	20.73	20.73	0.1260	348.6
120	25.84	12.92	0.0785	434.6
240	32.2	8.05	0.0489	541.5
360	36.63	6.11	0.0371	616.0
480	40.14	5.02	0.0305	675.1
600	43.09	4.31	0.0262	724.7
840	48.31	3.45	0.0210	812.5
1440	58.87	2.45	0.0149	990.1
2880	75.91	1.58	0.0096	1276.6

Calculation of Post Development Peak Runoffs and Volumes from Greenfield Areas ONLY

Post Development Greenfield Area	0.53 ha	
	QBAR	Return Period
		10
Greenfield Runoff Rate (l/s/ha)	1.76	2.62
Greenfield Runoff from Open Space (l/s)	0.94	1.40

Refer greenfield runoff calcs

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Calculation of TOTAL Post Development Peak Runoffs and Volumes and Required Storage

Return Period 1 in 10 **Year**

Storm Duration (minutes)	Existing or Permitted Discharge Runoff Rate m³/s	Post-Development Runoff Rate m³/s	Existing or Permitted Outflow Volume m³	Post-Development Runoff Volume m³	Storage, Inflow - Outflow m³
15	0.0050	0.3257	4.50	225.61	221.11
30	0.0050	0.2036	9.00	282.20	273.20
60	0.0050	0.1274	18.00	353.68	335.68
120	0.0050	0.0799	36.00	444.66	408.66
240	0.0050	0.0503	72.00	561.71	489.71
360	0.0050	0.0385	108.00	646.30	538.30
480	0.0050	0.0319	144.00	715.42	571.42
600	0.0050	0.0276	180.00	775.12	595.12
840	0.0050	0.0224	252.00	883.08	631.08
1440	0.0050	0.0163	432.00	1111.12	679.12
2880	0.0050	0.0110	864.00	1518.75	654.75

Required Storage 679.12 m³

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Calculation of Existing Peak Runoffs and Volumes from Impermeable Areas ONLY

Calculation of Runoff Coefficient (Cv)

Surface	Area (ha)	Cv	Weighted Cv
Greenfield Open Space	n/a	n/a	#VALUE!
Roof	0	0.85	#DIV/0!
Hardstanding	0	0.8	#DIV/0!
Other	0	0	#DIV/0!
Total	0.00		#VALUE!

Return Period 1 in 30 **Year**

Duration (mins)	FEH rainfall Depth (mm)	Intensity (mm/hr)	Peak Flow Rate (m3/s)	Volume of Runoff (m3)
15	19.46	77.84	#VALUE!	#VALUE!
30	23.78	47.56	#VALUE!	#VALUE!
60	29.06	29.06	#VALUE!	#VALUE!
120	35.52	17.76	#VALUE!	#VALUE!
240	43.41	10.85	#VALUE!	#VALUE!
360	48.82	8.14	#VALUE!	#VALUE!
480	53.05	6.63	#VALUE!	#VALUE!
600	56.59	5.66	#VALUE!	#VALUE!
840	62.85	4.49	#VALUE!	#VALUE!
1440	75.43	3.14	#VALUE!	#VALUE!
2880	95.37	1.99	#VALUE!	#VALUE!

Calculation of Existing Peak Runoffs and Volumes from Greenfield Areas ONLY

Existing Greenfield Area	2.6022 ha		
	QBAR	Return Period	
		30	
Greenfield Runoff Rate (l/s/ha)	1.76	3.62	
Greenfield Runoff from Open Space (l/s)	4.58	9.43	Refer greenfield runoff calcs

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Calculation of Post Development Peak Runoffs and Volumes from Impermeable Areas ONLY

Calculation of Runoff Coefficient (Cv)

Surface	Area (ha)	Cv	Weighted Cv
Greenfield Open Space	N/A	N/A	N/A
Macadam	0.5555	0.85	0.228379686
Hardstanding	1.512	0.8	0.585054414
Other	0	0	0
Total	2.07		0.813434099

Return Period 1 in 30 **Year**

Duration (mins)	FEH rainfall Depth (mm)	Intensity (mm/hr)	Peak Flow Rate (m3/s)	Volume of Runoff (m3)
15	19.46	77.84	0.4731	327.3
30	23.78	47.56	0.2891	399.9
60	29.06	29.06	0.1766	488.7
120	35.52	17.76	0.1079	597.4
240	43.41	10.85	0.0660	730.1
360	48.82	8.14	0.0495	821.0
480	53.05	6.63	0.0403	892.2
600	56.59	5.66	0.0344	951.7
840	62.85	4.49	0.0273	1057.0
1440	75.43	3.14	0.0191	1268.6
2880	95.37	1.99	0.0121	1603.9

Calculation of Post Development Peak Runoffs and Volumes from Greenfield Areas ONLY

Post Development Greenfield Area	0.5347 ha	
	QBAR	Return Period
		30
Greenfield Runoff Rate (l/s/ha)	1.76	3.62
Greenfield Runoff from Open Space (l/s)	0.94	1.94

Refer greenfield runoff calcs

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Calculation of TOTAL Post Development Peak Runoffs and Volumes and Required Storage

Return Period 1 in 30 **Year**

Storm Duration (minutes)	Existing or Permitted Discharge Runoff Rate m³/s	Post-Development Runoff Rate m³/s	Existing or Permitted Outflow Volume (Greenfield) m³	Post-Development Runoff Volume m³	Storage, Inflow - Outflow m³
15	0.0050	0.4750	4.50	329.02	324.52
30	0.0050	0.2910	9.00	403.41	394.41
60	0.0050	0.1786	18.00	495.70	477.70
120	0.0050	0.1099	36.00	611.31	575.31
240	0.0050	0.0679	72.00	757.95	685.95
360	0.0050	0.0514	108.00	862.88	754.88
480	0.0050	0.0422	144.00	947.97	803.97
600	0.0050	0.0363	180.00	1021.45	841.45
840	0.0050	0.0292	252.00	1154.63	902.63
1440	0.0050	0.0210	432.00	1435.93	1003.93
2880	0.0050	0.0140	864.00	1938.64	1074.64

Required Storage 1074.64 m³

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Calculation of Existing Peak Runoffs and Volumes from Impermeable Areas ONLY

Calculation of Runoff Coefficient (Cv)

Surface	Area (ha)	Cv	Weighted Cv
Greenfield Open Space	n/a	n/a	#VALUE!
Macadam	0	0.85	#DIV/0!
Hardstanding	0	0.8	#DIV/0!
Other	0	0	#DIV/0!
Total	0.00		#VALUE!

Return Period 1 in 100 Year

Duration (mins)	FEH rainfall Depth (mm)	Intensity (mm/hr)	Peak Flow Rate (m3/s)	Volume of Runoff (m3)
15	29.16	116.64	#VALUE!	#VALUE!
30	34.89	69.78	#VALUE!	#VALUE!
60	41.76	41.76	#VALUE!	#VALUE!
120	49.97	24.99	#VALUE!	#VALUE!
240	59.79	14.95	#VALUE!	#VALUE!
360	66.41	11.07	#VALUE!	#VALUE!
480	71.55	8.94	#VALUE!	#VALUE!
600	75.81	7.58	#VALUE!	#VALUE!
840	83.34	5.95	#VALUE!	#VALUE!
1440	98.39	4.10	#VALUE!	#VALUE!
2880	121.8	2.54	#VALUE!	#VALUE!

Calculation of Existing Peak Runoffs and Volumes from Greenfield Areas ONLY

Existing Greenfield Area	2.6022 ha	
	QBAR	Return Period 100
Greenfield Runoff Rate (l/s/ha)	1.76	4.52
Greenfield Runoff from Open Space (l/s)	4.58	11.76

Refer greenfield runoff calcs

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Barnsley FRA - Carrington Avenue

Job Number CS/071060
Version Draft v1.0
File Path S:\ZWET\Sheffield Based Jobs\CSXXXXX Barnsley FRA\Surface
Produced by JL Date 03/07/2014
Checked by 0 Date 00/01/1900

Calculation of Post Development Peak Runoffs and Volumes from Impermeable Areas ONLY

Calculation of Runoff Coefficient (Cv)

Surface	Area (ha)	Cv	Weighted Cv
Greenfield Open Space	N/A	N/A	N/A
Roof	0.5555	0.85	0.228379686
Hardstanding	1.512	0.8	0.585054414
Other	0	0	0
Total	2.07		0.813434099

Return Period 1 in 100 Year

Duration (mins)	FEH rainfall Depth (mm)	Intensity (mm/hr)	Peak Flow Rate (m3/s)	Volume of Runoff (m3)
15	29.16	116.64	0.7089	490.4
30	34.89	69.78	0.4241	586.8
60	41.76	41.76	0.2538	702.3
120	49.97	24.99	0.1519	840.4
240	59.79	14.95	0.0908	1005.5
360	66.41	11.07	0.0673	1116.9
480	71.55	8.94	0.0544	1203.3
600	75.81	7.58	0.0461	1275.0
840	83.34	5.95	0.0362	1401.6
1440	98.39	4.10	0.0249	1654.7
2880	121.8	2.54	0.0154	2048.4

Calculation of Post Development Peak Runoffs and Volumes from Greenfield Areas ONLY

Post Development Greenfield Area	0.5347	ha
	QBAR	Return Period 100
Greenfield Runoff Rate (l/s/ha)	1.76	4.52
Greenfield Runoff from Open Space (l/s)	0.94	2.42

Refer greenfield runoff calcs

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Calculation of TOTAL Post Development Peak Runoffs and Volumes and Required Storage

Return Period 1 in 100 **Year**

Storm Duration (minutes)	Existing or Permitted Discharge Runoff Rate m ³ /s	Post-Development Runoff Rate m ³ /s	Existing or Permitted Outflow Volume (Greenfield) m ³	Post-Development Runoff Volume m ³	Storage, Inflow - Outflow m ³
15	0.0050	0.7113	4.50	492.58	488.08
30	0.0050	0.4265	9.00	591.12	582.12
60	0.0050	0.2562	18.00	711.01	693.01
120	0.0050	0.1543	36.00	857.78	821.78
240	0.0050	0.0933	72.00	1040.33	968.33
360	0.0050	0.0697	108.00	1169.07	1061.07
480	0.0050	0.0568	144.00	1272.91	1128.91
600	0.0050	0.0485	180.00	1361.95	1181.95
840	0.0050	0.0386	252.00	1523.39	1271.39
1440	0.0050	0.0273	432.00	1863.50	1431.50
2880	0.0050	0.0178	864.00	2466.01	1602.01

Required Storage 1602.01 m³

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Calculation of Existing Peak Runoffs and Volumes from Impermeable Areas ONLY

Calculation of Runoff Coefficient (Cv)

Surface	Area (ha)	Cv	Weighted Cv
Greenfield Open Space	n/a	n/a	#VALUE!
Macadam	0	0.85	#DIV/0!
Hardstanding	0	0.8	#DIV/0!
Other	0	0	#DIV/0!
Total	0.00		#VALUE!

Return Period 1 in 100 + CC **Year**

Duration (mins)	FEH rainfall Depth (mm)	Intensity (mm/hr)	Peak Flow Rate (m3/s)	Volume of Runoff (m3)
15	37.908	151.63	#VALUE!	#VALUE!
30	45.357	90.71	#VALUE!	#VALUE!
60	54.288	54.29	#VALUE!	#VALUE!
120	64.961	32.48	#VALUE!	#VALUE!
240	77.727	19.43	#VALUE!	#VALUE!
360	86.333	14.39	#VALUE!	#VALUE!
480	93.015	11.63	#VALUE!	#VALUE!
600	98.553	9.86	#VALUE!	#VALUE!
840	108.342	7.74	#VALUE!	#VALUE!
1440	127.907	5.33	#VALUE!	#VALUE!
2880	158.34	3.30	#VALUE!	#VALUE!

Calculation of Existing Peak Runoffs and Volumes from Greenfield Areas ONLY

Existing Greenfield Area	2.6022	ha
	QBAR	Return Period 100 + CC
Greenfield Runoff Rate (l/s/ha)	1.76	5.88
Greenfield Runoff from Open Space (l/s)	4.58	15.29

Refer greenfield runoff calcs

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Calculation of Post Development Peak Runoffs and Volumes from Impermeable Areas ONLY

Calculation of Runoff Coefficient (Cv)

Surface	Area (ha)	Cv	Weighted Cv
Greenfield Open Space	N/A	N/A	N/A
Macadam	0.5555	0.85	0.228379686
Hardstanding	1.512	0.8	0.585054414
Other	0	0	0
Total	2.07		0.813434099

Return Period 1 in 100 + CC **Year**

Duration (mins)	FEH rainfall Depth (mm)	Intensity (mm/hr)	Peak Flow Rate (m3/s)	Volume of Runoff (m3)
15	37.908	151.63	0.9216	637.5
30	45.357	90.71	0.5514	762.8
60	54.288	54.29	0.3300	913.0
120	64.961	32.48	0.1974	1092.5
240	77.727	19.43	0.1181	1307.2
360	86.333	14.39	0.0875	1451.9
480	93.015	11.63	0.0707	1564.3
600	98.553	9.86	0.0599	1657.4
840	108.342	7.74	0.0470	1822.1
1440	127.907	5.33	0.0324	2151.1
2880	158.34	3.30	0.0200	2662.9

Calculation of Post Development Peak Runoffs and Volumes from Greenfield Areas ONLY

Post Development Greenfield Area	0.5347	ha
	QBAR	Return Period 100 + CC
Greenfield Runoff Rate (l/s/ha)	1.76	5.88
Greenfield Runoff from Open Space (l/s)	0.94	3.14

Refer greenfield runoff calcs

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Calculation of TOTAL Post Development Peak Runoffs and Volumes and Required Storage

Return Period 1 in 100 + CC **Year**

Storm Duration (minutes)	Existing or Permitted Discharge Runoff Rate m³/s	Post-Development Runoff Rate m³/s	Existing or Permitted Outflow Volume (Greenfield) m³	Post-Development Runoff Volume m³	Storage, Inflow - Outflow m³
15	0.0050	0.9248	4.50	640.35	635.85
30	0.0050	0.5545	9.00	768.46	759.46
60	0.0050	0.3331	18.00	924.31	906.31
120	0.0050	0.2006	36.00	1115.12	1079.12
240	0.0050	0.1212	72.00	1352.43	1280.43
360	0.0050	0.0906	108.00	1519.79	1411.79
480	0.0050	0.0738	144.00	1654.78	1510.78
600	0.0050	0.0630	180.00	1770.54	1590.54
840	0.0050	0.0502	252.00	1980.41	1728.41
1440	0.0050	0.0355	432.00	2422.55	1990.55
2880	0.0050	0.0232	864.00	3205.81	2341.81

Required Storage 2341.81 m³

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Area (ha)	Site		
	Permeable area	Impermeable area	Total
Existing	2.60	0.00	2.60
Proposed Development	0.53	1.27	1.80

Greenfield Runoff Rate	l/s/ha
1	1.5
2	1.6
10	2.6
30	3.6
100	4.5
100+CC	5.9

Post Development Storage	m3
1	146.5
2	315.1
10	679.1
30	1074.6
100	1602.0
100+CC	2341.8