

Job No.	435358	Sheet	1	Date	Jun-21
Job	Land Adj Mistletoe	By	TB	Checked	EG

Permavoid Attenuation Storage for Roofs, Access Road & Parking

Total Surface Area

Area	286.000 m ²
Urban Creep	1.000 m ²
	286.000 m ²

10 year return period

		Storm duration (Min.)
R5	0.009 m	5
R10	0.012 m	10
R15	0.015 m	15
R30	0.020 m	30
R60	0.025 m	60
R120	0.030 m	120
R240	0.036 m	240
R360	0.041 m	360
R600	0.047 m	600
R1440	0.058 m	1440

Inflow to attenuation system

I5	2.49 m ³
I10	3.55 m ³
I15	4.38 m ³
I30	5.61 m ³
I60	7.09 m ³
I120	8.67 m ³
I240	10.38 m ³
I360	11.70 m ³
I600	13.33 m ³
I1440	16.53 m ³

Outflow from Tank

f	2.00E-03 m ³ /s
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Soakaway dims:

Length	7 m
Width	5 m
Depth	0.4 m

As50	1
Void ratio	95 %

Outflow from Tank:

O5	0.6000 m ³
O10	1.2000 m ³
O15	1.8000 m ³
O30	3.6000 m ³
O60	7.2000 m ³
O120	14.4000 m ³
O240	28.8000 m ³
O360	43.2000 m ³
O600	72.0000 m ³
O1440	172.8000 m ³

Storage required:

S5	1.89 m ³
S10	2.35 m ³
S15	2.58 m ³
S30	2.01 m ³
S60	-0.11 m ³
S120	-5.73 m ³
S240	-18.42 m ³
S360	-31.50 m ³
S600	-58.67 m ³
S1440	-156.27 m ³

Storage provided **13.3** m³

Time to drain:

ts50	0.13 hours
ts50	0.16 hours
ts50	0.18 hours
ts50	0.14 hours
ts50	-0.01 hours
ts50	-0.40 hours
ts50	-1.28 hours
ts50	-2.19 hours
ts50	-4.07 hours
ts50	-10.85 hours

Critical storm =	S15		
Storage required =	2.58		
Time to discharge =	0.18	Hours	0.01 Days

Tank size proposed is satisfactory

Allowance for extra rain during storage period (assume average rainfall)

Average daily rain	2.60 mm
Extra rain during storage	0.01 m ³

Proposed soakaway material requires a void ratio $\geq 95\%$.
The use of Polypipe Permavoid sub- base replacement system is recommended. Proposed design includes for 40% increase due to Climate Change.

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Total Surface Area

Area	286.000 m ²
Urban Creep	1.000 m ²
	286.000 m ²

30 year return period + 40%

		Storm duration (Min.)
R5	0.022 m	5
R10	0.028 m	10
R15	0.031 m	15
R30	0.039 m	30
R60	0.048 m	60
R120	0.059 m	120
R240	0.073 m	240
R360	0.082 m	360
R600	0.095 m	600
R1440	0.123 m	1440

Inflow to attenuation system

I5	6.31 m ³
I10	7.89 m ³
I15	8.97 m ³
I30	11.12 m ³
I60	13.74 m ³
I120	16.92 m ³
I240	20.79 m ³
I360	23.43 m ³
I600	27.21 m ³
I1440	35.11 m ³

Outflow from Tank

f 2.00E-03 m³/s

Soakaway dims:

L	7 m
W	5 m
Depth	0.4 m

As50 1
Void ratio 95 %

Outflow from Tank:

O5	0.6000 m ³
O10	1.2000 m ³
O15	1.8000 m ³
O30	3.6000 m ³
O60	7.2000 m ³
O120	14.4000 m ³
O240	28.8000 m ³
O360	43.2000 m ³
O600	72.0000 m ³
O1440	172.8000 m ³

Storage required:

S5	5.71 m ³
S10	6.69 m ³
S15	7.17 m ³
S30	7.52 m ³
S60	6.54 m ³
S120	2.52 m ³
S240	-8.01 m ³
S360	-19.77 m ³
S600	-44.79 m ³
S1440	-137.69 m ³

Time to half drain:

ts50	0.40 hours
ts50	0.46 hours
ts50	0.50 hours
ts50	0.52 hours
ts50	0.45 hours
ts50	0.18 hours
ts50	-0.56 hours
ts50	-1.37 hours
ts50	-3.11 hours
ts50	-9.56 hours

Storage provided 13.3 m³

Critical storm = S30

Storage required = 7.52

Time to half discharge = 0.52 Hours (Acceptable time as 1/30 year storm)

Tank size proposed is satisfactory

For increase from 10 year storm to 30 year storm use,

Bilham's formula $r \text{ (mm)} = (((1.25T)/N)^{(1/3.55)}) \times 25.4$

T = storm duration in hours

N = No. of storms in 10 years

T	N	r	0.4 10 year return period
0.083333	0.333333	0.015764	0.022069124 R5
0.166667	0.333333	0.01971	0.027594367 R10
0.25	0.333333	0.022402	0.031363365 R15
0.5	0.333333	0.02778	0.038892614 R30
1	0.333333	0.034318	0.048045307 R60
2	0.333333	0.042265	0.059171486 R120
4	0.333333	0.051926	0.072696672 R240
6	0.333333	0.058516	0.081922764 R360
10	0.333333	0.07	0.095151657 R600
24	0.333333	0.087685	0.122758323 R1440

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Total Surface Area

Area	286.000 m ²
Urban Creep	1.000 m ²
	286.000 m ²

100 year return period + 40%

		Storm duration (Min.)
R5	0.032 m	5
R10	0.040 m	10
R15	0.045 m	15
R30	0.056 m	30
R60	0.069 m	60
R120	0.084 m	120
R240	0.103 m	240
R360	0.116 m	360
R600	0.135 m	600
R1440	0.174 m	1440

Inflow to attenuation system

I5	9.27 m ³
I10	11.49 m ³
I15	13.00 m ³
I30	16.02 m ³
I60	19.70 m ³
I120	24.17 m ³
I240	29.60 m ³
I360	33.30 m ³
I600	38.61 m ³
I1440	49.69 m ³

Outflow from Tank

f	2.00E-03 m ³ /s
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Soakaway dims:

L	7 m
W	5 m
Depth	0.4 m

As50	1
Void ratio	95 %

Outflow from Tank:

O5	0.6000 m ³
O10	1.2000 m ³
O15	1.8000 m ³
O30	3.6000 m ³
O60	7.2000 m ³
O120	14.4000 m ³
O240	28.8000 m ³
O360	43.2000 m ³
O600	72.0000 m ³
O1440	172.8000 m ³

Storage required:

S5	8.67 m ³
S10	10.29 m ³
S15	11.20 m ³
S30	12.42 m ³
S60	12.50 m ³
S120	9.77 m ³
S240	0.80 m ³
S360	-9.90 m ³
S600	-33.39 m ³
S1440	-123.11 m ³

Storage provided **13.3** m³

Critical storm = **S60**

Storage required = **12.50**

Time to half discharge = **0.87** Hours (Acceptable time as 1/100 year storm)

Tank size proposed is satisfactory

For increase from 10 year storm to 100 year storm use,

Bilham's formula $r \text{ (mm)} = (((1.25T)/N)^{(1/3.55)}) \times 25.4$

T = storm duration in hours

N = No. of storms in 10 years

T	N	r	0.4 10 year return period
0.083333	0.1	0.023154	0.03241527 R5
0.166667	0.1	0.028694	0.040171329 R10
0.25	0.1	0.032473	0.045462061 R15
0.5	0.1	0.040022	0.056031245 R30
1	0.1	0.0492	0.068879338 R60
2	0.1	0.060356	0.084497712 R120
4	0.1	0.073917	0.103483692 R240
6	0.1	0.083168	0.116434821 R360
10	0.1	0.10	0.135004879 R600
24	0.1	0.124113	0.173757739 R1440