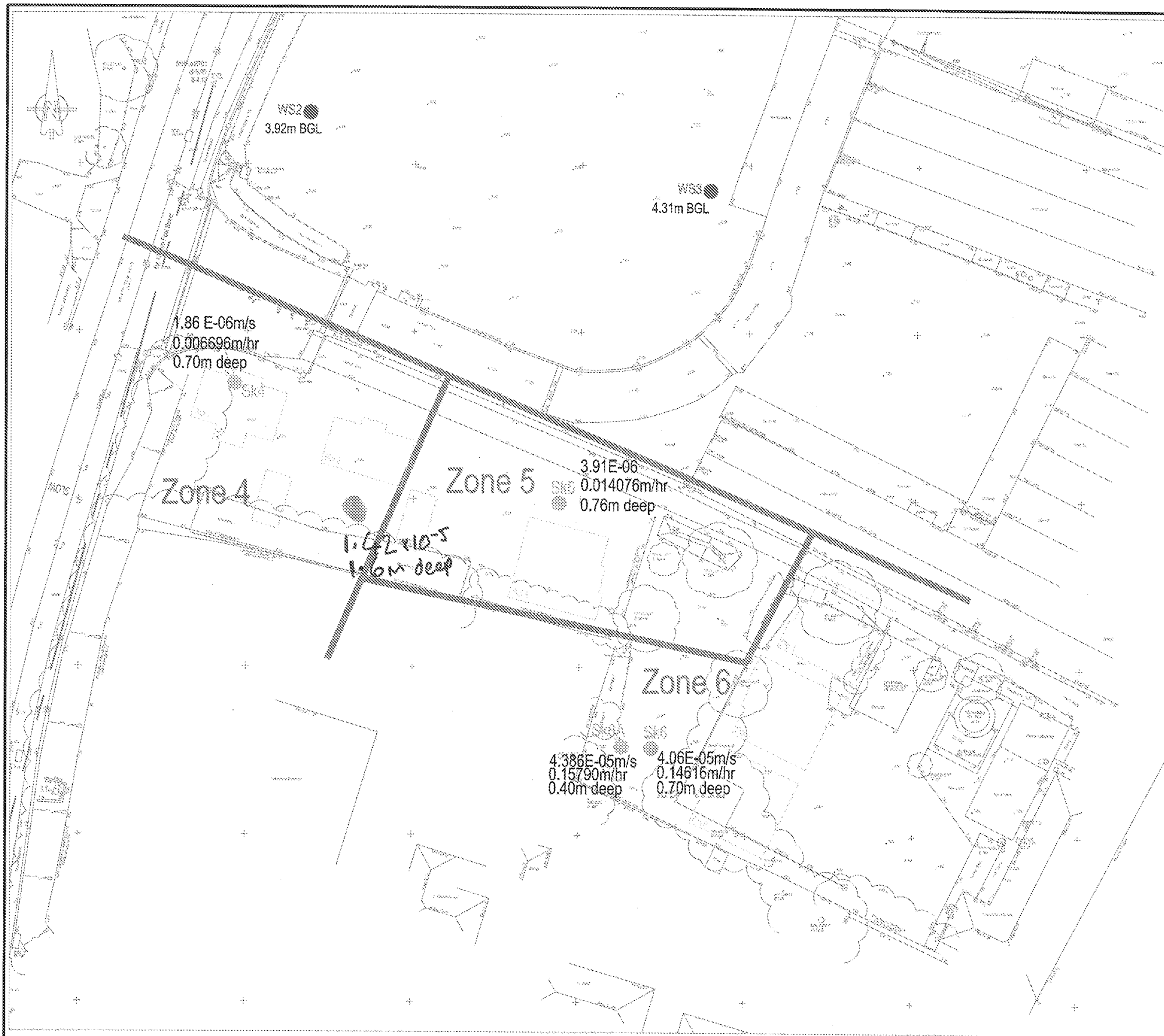




KEY	
	Location of soakaway tests Result & Depth shown
	Groundwater monitoring results depth of highest recorded level

Infiltration testing at shallow depths carried out on 30th and 31st January 2018.

Worst case rate used for permeable paving design = 1.86×10^{-6}

Infiltration testing at depth of proposed soakaways (marked thus ●) was carried out on 14th January 2021. This rate has had a FOS of 2 applied for the design of soakaways.

 KAZYS NARBUTAS CONSULTING <i>Civil Engineering Consultant</i> Unit 38, Tanners Court, Tanners Lane, East Welwyn, Herts. SG11 4DP	Project NORTH END ROAD, YAPTON: Phase 2	Drawing Status FOR INFORMATION		A 150120	First issue	Scales 1:500	Paper Size A3
	Drawing Title Engineering Details: Soakaway Tests & Groundwater Monitoring Locations	Client					
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		Rev.	Date	Details	Initials	Drawing No. 500-002	Rev A

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SOAKAGE TEST 1 600 wd x 1300 lg x 1600 dp		Depth from ground level (mm)
Time (mins)	Water Depth (mm)	
0	600	800
20	550	850
40	515	885
60	510	890
80	500	900
100	480	920
120	460	940
140	450	950
160	400	1000
180	290	1110
200	280	1120
220	250	1150
240	235	1165
260	213	1187
280	205	1195
300	195	1205
320	156	1244
340	117	1283
360	78	1322
400	39	1361
420	0	1400

NOTE: soakage results supplied by the Contractor

SOAKAGE TEST RESULTS

Site @ Orchard Business Park 2, North End Road, Yapton, BN18 0GA

CMW/424927/CMW

APPENDIX

SOAKAGE TEST 2 600 wd x 1300 lg x 1600 dp		Depth from ground level (mm)
Time (mins)	Water Depth (mm)	
0	545	800
20	515	830
40	485	860
60	475	870
80	460	885
100	445	900
120	425	920
140	405	940
160	355	990
180	295	1050
200	255	1090
220	209	1136
240	195	1150
260	175	1170
280	158	1187
300	150	1195
320	135	1210
340	115	1230
360	85	1260
400	50	1295
420	0	1345

NOTE: soakage results supplied by the Contractor

SOAKAGE TEST RESULTS

Site @ Orchard Business Park 2, North End Road, Yapton, BN18 0GA

CMW/424927/CMW

APPENDIX

SOAKAGE TEST 3 600 wd x 1300 lg x 1600 dp		Depth from ground level (mm)
Time (mins)	Water Depth (mm)	
0	500	800
20	480	820
40	450	850
60	440	860
80	430	870
100	410	890
120	400	900
140	370	930
160	320	980
180	300	1000
200	240	1060
220	220	1080
240	195	1105
260	185	1115
280	175	1125
300	156	1144
320	132	1168
340	110	1190
360	70	1230
400	45	1255
420	0	1300

NOTE: soakage results supplied by the Contractor

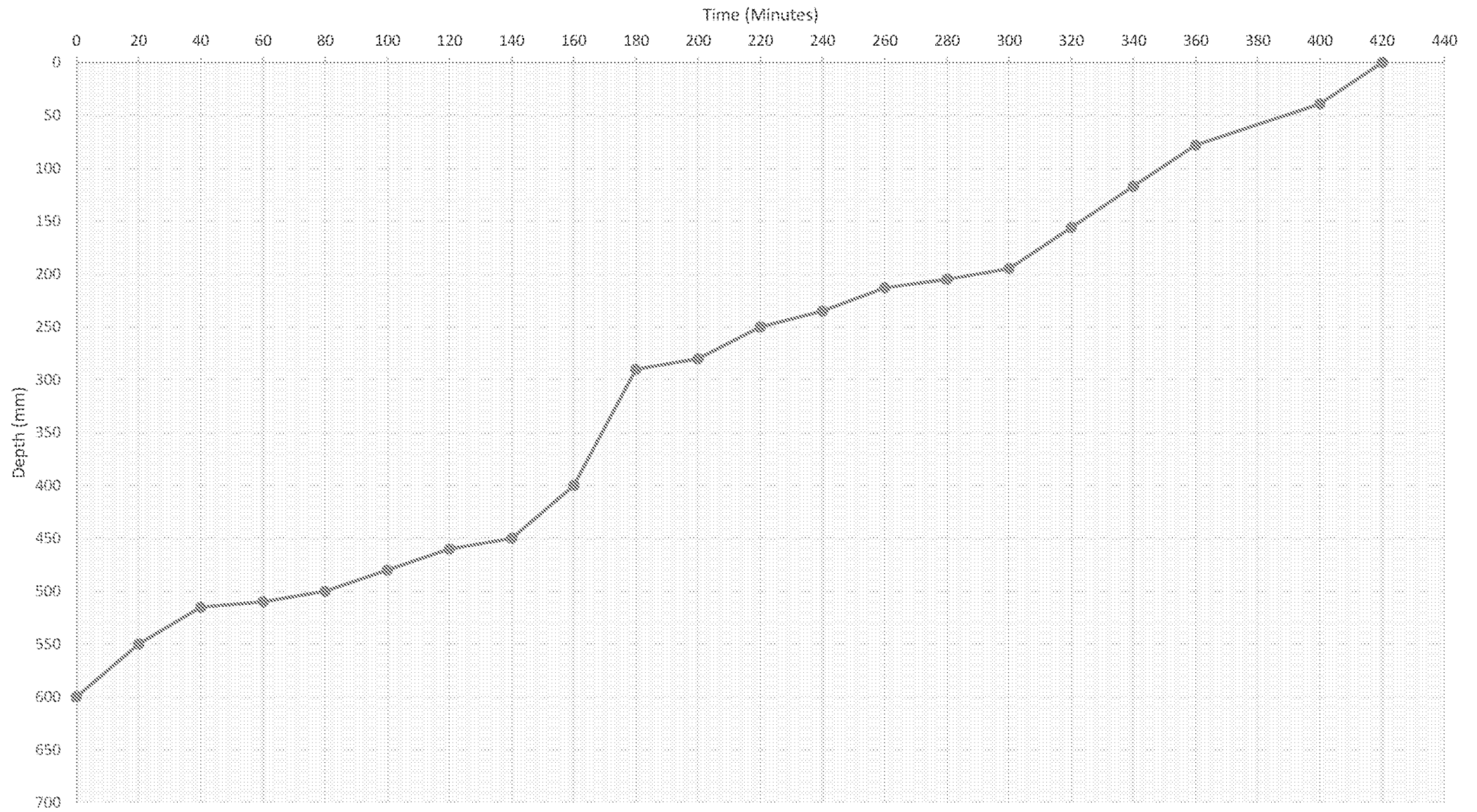
SOAKAGE TEST RESULTS

Site @ Orchard Business Park 2, North End Road, Yapton, BN18 0GA

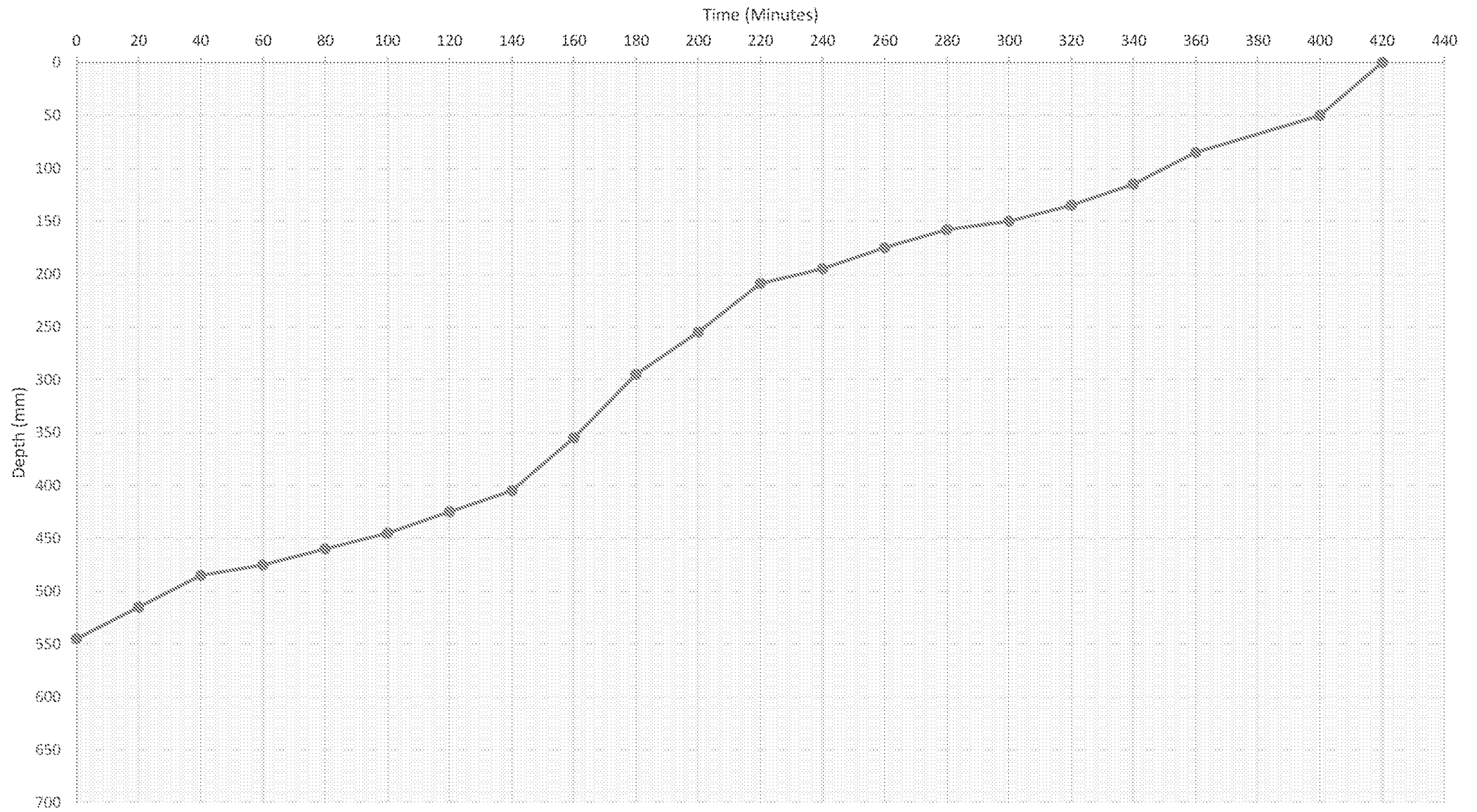
CMW/424927/CMW

APPENDIX

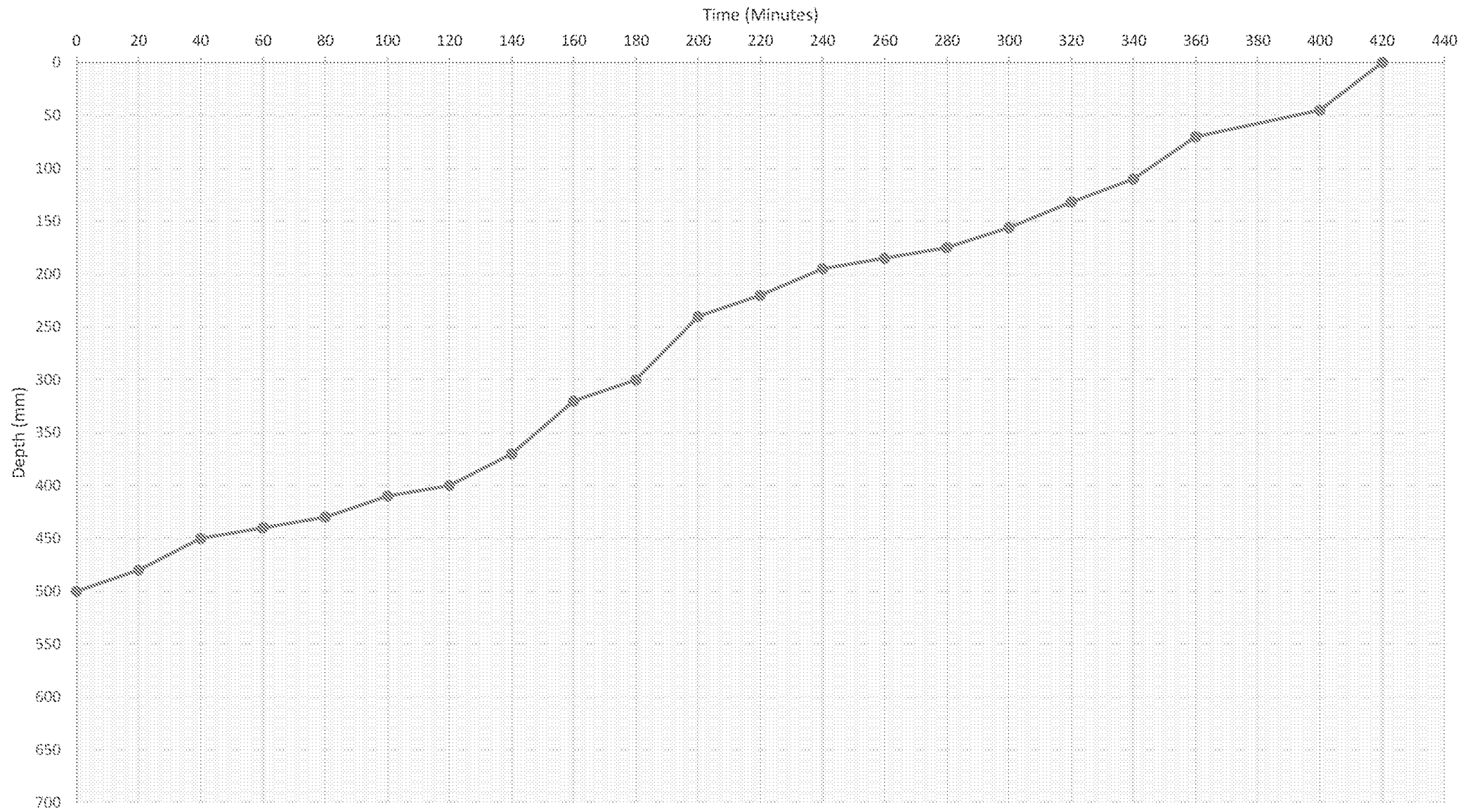
TEST 1



TEST 2



TEST 3



Soakage Pit Test 1	Storage volume 75% to 25%	0.60	wide	
		1.30	long	
		0.30	deep	
	Total	0.30	m3	
	Surface area 50% inc. base	0.60 x 1.30	0.780	
		0.60 x 0.30	0.180	
		0.60 x 0.30	0.180	
		1.30 x 0.30	0.390	
		1.30 x 0.30	0.390	
	Total	1.920	m2	
	Time for water to drop from	75%	139	
	75% to 25%	25%	322	
		Total	183	mins
			10980	secs
	Soil infiltration rate		1.42E-05	

NOTE: soakage results supplied by the Contractor

Soakage Pit Test 2	Storage volume 75% to 25%	0.60	wide	
		1.30	long	
		0.27	deep	
	Total	0.30	m3	
	Surface area 50% inc. base	0.60 x 1.30	0.780	
		0.60 x 0.27	0.164	
		0.60 x 0.27	0.164	
		1.30 x 0.27	0.354	
		1.30 x 0.27	0.354	
	Total	1.816	m2	
	Time for water to drop from 75% to 25%	75%	140	
		25%	325	
		Total	185	mins
			11100	secs
	Soil infiltration rate	1.49E-05		

NOTE: soakage results supplied by the Contractor

Soakage Pit Test 3	Storage volume 75% to 25%	0.60	wide	
		1.30	long	
		0.25	deep	
		Total	0.30	m3
	Surface area 50% inc. base	0.60 x 1.30	0.780	
		0.60 x 0.25	0.150	
		0.60 x 0.25	0.150	
		0.60 x 0.25	0.325	
		0.60 x 0.25	0.325	
		Total	1.730	m2
	Time for water to drop from 75% to 25%	75%	135	
		25%	330	
		Total	195	mins
		11700	secs	
Soil infiltration rate			1.48E-05	

NOTE: soakage results supplied by the Contractor

LOWEST =

1.42E-05

Job No.	424927	Sheet	Date	May-21
Job	ORCHARD	By TB	Checked	CMW

Soakaway Design for Proposed Building SO1

PLOT 1 (INCLUDING GARAGE)

Area	115.000 m ²
Climate change	1.400 m ²
	161.000 m ²

10 year return period

R5	0.009 m
R10	0.012 m
R15	0.015 m
R30	0.020 m
R60	0.025 m
R120	0.030 m
R240	0.036 m
R360	0.041 m
R600	0.047 m
R1440	0.058 m

Storm duration (Min.)

5
10
15
30
60
120
240
360
600
1440

Inflow to attenuation system

I5	1.40 m ³
I10	2.00 m ³
I15	2.46 m ³
I30	3.16 m ³
I60	3.99 m ³
I120	4.88 m ³
I240	5.84 m ³
I360	6.58 m ³
I600	7.50 m ³
I1440	9.31 m ³

Outflow from Tank

f	7.01E-06 m ³ /s
---	----------------------------

FOS of 2 applied

Soakaway dims:

Length	5 m
Width	2.5 m
Depth	1.2 m

As50	9
Void ratio	95 %

Outflow from Tank:

O5	0.0189 m ³
O10	0.0379 m ³
O15	0.0568 m ³
O30	0.1136 m ³
O60	0.2271 m ³
O120	0.4542 m ³
O240	0.9085 m ³
O360	1.3627 m ³
O600	2.2712 m ³
O1440	5.4510 m ³

Storage required:

S5	1.38 m ³
S10	1.96 m ³
S15	2.41 m ³
S30	3.04 m ³
S60	3.77 m ³
S120	4.42 m ³
S240	4.94 m ³
S360	5.22 m ³
S600	5.23 m ³
S1440	3.85 m ³

Time to drain:

ts50	3.04 hours
ts50	4.31 hours
ts50	5.30 hours
ts50	6.70 hours
ts50	8.29 hours
ts50	9.74 hours
ts50	10.87 hours
ts50	11.50 hours
ts50	11.52 hours
ts50	8.49 hours

Storage provided **14.3** m³

Critical storm = **S600**
Storage required = **5.37**
Time to discharge = **11.52** Hours **0.48** Days

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

Average daily rain	2.60 mm
Extra rain during storage	0.14 m ³

Proposed soakaway material requires a void ratio $\geq 95\%$.
Aquacell soakaway units is recommended. Proposed design includes for 40% increase due to Climate Change.

Soakaway size proposed is satisfactory

Job No.	424927	Sheet	Date	May-21
Job	ORCHARD	By TB	Checked	CMW

Soakaway Design for Proposed Building SO1

PLOT 1 (INCLUDING GARAGE)

Area 115.000 m²

m²

115.000 m²

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	2.54 m ³
I10	3.17 m ³
I15	3.61 m ³
I30	4.47 m ³
I60	5.53 m ³
I120	6.80 m ³
I240	8.36 m ³
I360	9.42 m ³
I600	10.94 m ³
I1440	14.12 m ³

Outflow from Tank

f 7.01E-06 m³/s

Soakaway dims:

L	5 m
W	2.5 m
Depth	1.2 m

As50 9
Void ratio 95 %

Outflow from Tank:

O5	0.0189 m ³
O10	0.0379 m ³
O15	0.0568 m ³
O30	0.1136 m ³
O60	0.2271 m ³
O120	0.4542 m ³
O240	0.9085 m ³
O360	1.3627 m ³
O600	2.2712 m ³
O1440	5.4510 m ³

Storage required:

S5	2.52 m ³
S10	3.14 m ³
S15	3.55 m ³
S30	4.36 m ³
S60	5.30 m ³
S120	6.35 m ³
S240	7.45 m ³
S360	8.06 m ³
S600	8.67 m ³
S1440	8.67 m ³

Time to half drain:

ts50	5.55 hours
ts50	6.90 hours
ts50	7.82 hours
ts50	9.60 hours
ts50	11.66 hours
ts50	13.98 hours
ts50	16.40 hours
ts50	17.74 hours
ts50	19.09 hours
ts50	19.08 hours

Storage provided 14.3 m³

Critical storm = S600

Storage required = 8.67

Time to half discharge= 19.09 Hours (Acceptable time as 1/30 year storm)

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
0.08333	0.33333	0.01576	0.022069124 R5 0.0087 m
0.16667	0.33333	0.01971	0.027594367 R10 0.0124 m
0.25	0.33333	0.0224	0.031363365 R15 0.0153 m
0.5	0.33333	0.02778	0.038892614 R30 0.0196 m
1	0.33333	0.03432	0.048045307 R60 0.0248 m
2	0.33333	0.04227	0.059171486 R120 0.0303 m
4	0.33333	0.05193	0.072696672 R240 0.0363 m
6	0.33333	0.05852	0.081922764 R360 0.0409 m
10	0.33333	0.07	0.095151657 R600 0.0466 m
24	0.33333	0.08768	0.122758323 R1440 0.0578 m

Job No.	424927	Sheet	Date	May-21
Job	ORCHARD	By TB	Checked	CMW

Soakaway Design for Proposed Building SO1

PLOT 1 (INCLUDING GARAGE)

Area 115.000 m²

115.000 m²

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	3.73 m ³
I10	4.62 m ³
I15	5.23 m ³
I30	6.44 m ³
I60	7.92 m ³
I120	9.72 m ³
I240	11.90 m ³
I360	13.39 m ³
I600	15.53 m ³
I1440	19.98 m ³

Outflow from Tank

f 7.01E-06 m³/s

Soakaway dims:

L	5 m
W	2.5 m
Depth	1.2 m

As50 9
Void ratio 95 %

Outflow from Tank:

O5	0.0189 m ³
O10	0.0379 m ³
O15	0.0568 m ³
O30	0.1136 m ³
O60	0.2271 m ³
O120	0.4542 m ³
O240	0.9085 m ³
O360	1.3627 m ³
O600	2.2712 m ³
O1440	5.4510 m ³

Storage required:

S5	3.71 m ³
S10	4.58 m ³
S15	5.17 m ³
S30	6.33 m ³
S60	7.69 m ³
S120	9.26 m ³
S240	10.99 m ³
S360	12.03 m ³
S600	13.25 m ³
S1440	14.53 m ³

Time to half drain:

ts50	8.16 hours
ts50	10.09 hours
ts50	11.38 hours
ts50	13.94 hours
ts50	16.94 hours
ts50	20.39 hours
ts50	24.20 hours
ts50	26.48 hours
ts50	29.18 hours
ts50	31.99 hours

Storage provided 15.3 m³

Critical storm = S1440

Storage required = 14.53

Time to half discharge = 31.99 Hours (Acceptable time as 1/100 year storm)

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
0.08333	0.1	0.02315	0.03241527 R5 0.0087 m
0.16667	0.1	0.02869	0.040171329 R10 0.0124 m
0.25	0.1	0.03247	0.045462061 R15 0.0153 m
0.5	0.1	0.04002	0.056031245 R30 0.0196 m
1	0.1	0.0492	0.068879338 R60 0.0248 m
2	0.1	0.06036	0.084497712 R120 0.0303 m
4	0.1	0.07392	0.103483692 R240 0.0363 m
6	0.1	0.08317	0.116434821 R360 0.0409 m
10	0.1	0.10	0.135004879 R600 0.0466 m
24	0.1	0.12411	0.173757739 R1440 0.0578 m

MH Storage (5No)450mm Ø

5No 0.450 m

$V = \pi r^2 h = 0.3578 \text{ m}^3$

Pipes @ 100mm Ø

Pipe length = 90 m

$V = \pi r^2 h = 0.7069 \text{ m}^3$

1.065 m³

Job No.	424927	Sheet	Date	May-21
Job	ORCHARD	By TB	Checked	CMW

Soakaway Design for Proposed Building SO2A

PLOT 2 (EXCLUDING GARAGE)

Area 71.000 m²
Climate change 1.400 m²
99.400 m²

10 year return period

R5 0.009 m
R10 0.012 m
R15 0.015 m
R30 0.020 m
R60 0.025 m
R120 0.030 m
R240 0.036 m
R360 0.041 m
R600 0.047 m
R1440 0.058 m

Storm duration (Min.)

5
10
15
30
60
120
240
360
600
1440

Inflow to attenuation system

I5 0.86 m³
I10 1.23 m³
I15 1.52 m³
I30 1.95 m³
I60 2.47 m³
I120 3.01 m³
I240 3.61 m³
I360 4.07 m³
I600 4.63 m³
I1440 5.75 m³

Outflow from Tank

f 7.01E-06 m³/s

FOS of 2 applied

Soakaway dims:

Length 3 m
Width 2.5 m
Depth 1.2 m

As50 6.6
Void ratio 95 %

Outflow from Tank:

O5 0.0139 m³
O10 0.0278 m³
O15 0.0416 m³
O30 0.0833 m³
O60 0.1666 m³
O120 0.3331 m³
O240 0.6662 m³
O360 0.9993 m³
O600 1.6656 m³
O1440 3.9974 m³

Storage required:

S5 0.85 m³
S10 1.20 m³
S15 1.48 m³
S30 1.86 m³
S60 2.30 m³
S120 2.68 m³
S240 2.94 m³
S360 3.07 m³
S600 2.97 m³
S1440 1.75 m³

Time to drain:

ts50 2.55 hours
ts50 3.62 hours
ts50 4.44 hours
ts50 5.60 hours
ts50 6.90 hours
ts50 8.04 hours
ts50 8.83 hours
ts50 9.20 hours
ts50 8.91 hours
ts50 5.25 hours

Storage provided 8.6 m³

Critical storm = S360
Storage required = 3.14
Time to discharge = 9.20 Hours 0.38 Days

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

Average daily rain 2.60 mm
Extra rain during storage 0.07 m³

Proposed soakaway material requires a void ratio $\geq 95\%$.
Aquacell soakaway units is recommended. Proposed design includes for 40% increase due to Climate Change.

Soakaway size proposed is satisfactory

Job No.	424927	Sheet	Date	May-21
Job	ORCHARD	By TB	Checked	CMW

Soakaway Design for Proposed Building SO2A

PLOT 2 (EXCLUDING GARAGE)

Area 71.000 m²
71.000 m²

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	1.57 m ³
I10	1.96 m ³
I15	2.23 m ³
I30	2.76 m ³
I60	3.41 m ³
I120	4.20 m ³
I240	5.16 m ³
I360	5.82 m ³
I600	6.76 m ³
I1440	8.72 m ³

Outflow from Tank

f 7.01E-06 m³/s

Soakaway dims:

L	3 m
W	2.5 m
Depth	1.2 m

As50 6.6

Void ratio 95 %

Outflow from Tank:

O5	0.0139 m ³
O10	0.0278 m ³
O15	0.0416 m ³
O30	0.0833 m ³
O60	0.1666 m ³
O120	0.3331 m ³
O240	0.6662 m ³
O360	0.9993 m ³
O600	1.6656 m ³
O1440	3.9974 m ³

Storage required:

S5	1.55 m ³
S10	1.93 m ³
S15	2.19 m ³
S30	2.68 m ³
S60	3.24 m ³
S120	3.87 m ³
S240	4.50 m ³
S360	4.82 m ³
S600	5.09 m ³
S1440	4.72 m ³

Time to half drain:

ts50	4.66 hours
ts50	5.80 hours
ts50	6.56 hours
ts50	8.04 hours
ts50	9.74 hours
ts50	11.61 hours
ts50	13.49 hours
ts50	14.46 hours
ts50	15.28 hours
ts50	14.16 hours

Storage provided 8.6 m³

Critical storm = S600

Storage required = 5.09

Time to half discharge= 15.28 Hours (Acceptable time as 1/30 year storm)

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
0.08333	0.33333	0.01576	0.022069124 R5 0.0087 m
0.16667	0.33333	0.01971	0.027594367 R10 0.0124 m
0.25	0.33333	0.0224	0.031363365 R15 0.0153 m
0.5	0.33333	0.02778	0.038892614 R30 0.0196 m
1	0.33333	0.03432	0.048045307 R60 0.0248 m
2	0.33333	0.04227	0.059171486 R120 0.0303 m
4	0.33333	0.05193	0.072696672 R240 0.0363 m
6	0.33333	0.05852	0.081922764 R360 0.0409 m
10	0.33333	0.07	0.095151657 R600 0.0466 m
24	0.33333	0.08768	0.122758323 R1440 0.0578 m

Job No.	424927	Sheet	Date	May-21
Job	ORCHARD	By TB	Checked	CMW

Soakaway Design for Proposed Building SO2A

PLOT 2 (EXCLUDING GARAGE)

Area 71.000 m²
71.000 m²

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	2.30 m ³
I10	2.85 m ³
I15	3.23 m ³
I30	3.98 m ³
I60	4.89 m ³
I120	6.00 m ³
I240	7.35 m ³
I360	8.27 m ³
I600	9.59 m ³
I1440	12.34 m ³

Outflow from Tank

f 7.01E-06 m³/s

Soakaway dims:

L	3 m
W	2.5 m
Depth	1.2 m

As50 6.6

Void ratio 95 %

Outflow from Tank:

O5	0.0139 m ³
O10	0.0278 m ³
O15	0.0416 m ³
O30	0.0833 m ³
O60	0.1666 m ³
O120	0.3331 m ³
O240	0.6662 m ³
O360	0.9993 m ³
O600	1.6656 m ³
O1440	3.9974 m ³

Storage required:

S5	2.29 m ³
S10	2.82 m ³
S15	3.19 m ³
S30	3.89 m ³
S60	4.72 m ³
S120	5.67 m ³
S240	6.68 m ³
S360	7.27 m ³
S600	7.92 m ³
S1440	8.34 m ³

Time to half drain:

ts50	6.87 hours
ts50	8.48 hours
ts50	9.56 hours
ts50	11.69 hours
ts50	14.18 hours
ts50	17.01 hours
ts50	20.06 hours
ts50	21.82 hours
ts50	23.77 hours
ts50	25.03 hours

Storage provided 9.1 m³

Critical storm = S1440

Storage required = 8.34

Time to half discharge = 25.03 Hours (Acceptable time as 1/100 year storm)

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
0.08333	0.1	0.02315	0.03241527 R5 0.0087 m
0.16667	0.1	0.02869	0.040171329 R10 0.0124 m
0.25	0.1	0.03247	0.045462061 R15 0.0153 m
0.5	0.1	0.04002	0.056031245 R30 0.0196 m
1	0.1	0.0492	0.068879338 R60 0.0248 m
2	0.1	0.06036	0.084497712 R120 0.0303 m
4	0.1	0.07392	0.103483692 R240 0.0363 m
6	0.1	0.08317	0.116434821 R360 0.0409 m
10	0.1	0.10	0.135004879 R600 0.0466 m
24	0.1	0.12411	0.173757739 R1440 0.0578 m

MH Storage (5No)450mm Ø

5No 0.450 m

$V = \pi r^2 h = 0.3578 \text{ m}^3$

Pipes @ 100mm Ø

Pipe length = 25 m

$V = \pi r^2 h = 0.1963 \text{ m}^3$

0.554 m³

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Soakaway Design for Proposed Building SO2B

PLOT 2 GARAGE

Area	28.000 m ²
Climate change	1.400 m ²
	39.200 m ²

10 year return period

R5	0.009 m
R10	0.012 m
R15	0.015 m
R30	0.020 m
R60	0.025 m
R120	0.030 m
R240	0.036 m
R360	0.041 m
R600	0.047 m
R1440	0.058 m

Storm duration (Min.)

5
10
15
30
60
120
240
360
600
1440

Inflow to attenuation system

I5	0.34 m ³
I10	0.49 m ³
I15	0.60 m ³
I30	0.77 m ³
I60	0.97 m ³
I120	1.19 m ³
I240	1.42 m ³
I360	1.60 m ³
I600	1.83 m ³
I1440	2.27 m ³

Outflow from Tank

f	7.01E-06 m ³ /s
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FOS of 2 applied

Soakaway dims:

Length	2 m
Width	1.5 m
Depth	1.2 m

As50	4.2
Void ratio	95 %

Outflow from Tank:

O5	0.0088 m ³
O10	0.0177 m ³
O15	0.0265 m ³
O30	0.0530 m ³
O60	0.1060 m ³
O120	0.2120 m ³
O240	0.4240 m ³
O360	0.6359 m ³
O600	1.0599 m ³
O1440	2.5438 m ³

Storage required:

S5	0.33 m ³
S10	0.47 m ³
S15	0.57 m ³
S30	0.72 m ³
S60	0.87 m ³
S120	0.98 m ³
S240	1.00 m ³
S360	0.97 m ³
S600	0.77 m ³
S1440	-0.28 m ³

Time to drain:

ts50	1.57 hours
ts50	2.21 hours
ts50	2.70 hours
ts50	3.37 hours
ts50	4.09 hours
ts50	4.60 hours
ts50	4.71 hours
ts50	4.56 hours
ts50	3.62 hours
ts50	-1.31 hours

Storage provided **3.4** m³

Critical storm = **S240**

Storage required = **1.01**

Time to discharge = **4.71** Hours

0.20 Days

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 $\geq 95\%$.
Aquacell soakaway units is recommended. Proposed design includes for 40% increase due to Climate Change.

Soakaway size proposed is satisfactory

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Soakaway Design for Proposed Building SO2B

PLOT 2 GARAGE

Area 28.000 m²

28.000 m²

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	0.62 m ³
I10	0.77 m ³
I15	0.88 m ³
I30	1.09 m ³
I60	1.35 m ³
I120	1.66 m ³
I240	2.04 m ³
I360	2.29 m ³
I600	2.66 m ³
I1440	3.44 m ³

Outflow from Tank

f 7.01E-06 m³/s

Soakaway dims:

L	2 m
W	1.5 m
Depth	1.2 m

As50 4.2

Void ratio 95 %

Outflow from Tank:

O5	0.0088 m ³
O10	0.0177 m ³
O15	0.0265 m ³
O30	0.0530 m ³
O60	0.1060 m ³
O120	0.2120 m ³
O240	0.4240 m ³
O360	0.6359 m ³
O600	1.0599 m ³
O1440	2.5438 m ³

Storage required:

S5	0.61 m ³
S10	0.75 m ³
S15	0.85 m ³
S30	1.04 m ³
S60	1.24 m ³
S120	1.44 m ³
S240	1.61 m ³
S360	1.66 m ³
S600	1.60 m ³
S1440	0.89 m ³

Time to half drain:

ts50	2.87 hours
ts50	3.56 hours
ts50	4.02 hours
ts50	4.89 hours
ts50	5.85 hours
ts50	6.82 hours
ts50	7.60 hours
ts50	7.82 hours
ts50	7.57 hours
ts50	4.21 hours

Storage provided 3.4 m³

Critical storm = S360

Storage required = 1.66

Time to half discharge= 7.82 Hours (Acceptable time as 1/30 year storm)

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
0.08333	0.33333	0.01576	0.022069124 R5 0.0087 m
0.16667	0.33333	0.01971	0.027594367 R10 0.0124 m
0.25	0.33333	0.0224	0.031363365 R15 0.0153 m
0.5	0.33333	0.02778	0.038892614 R30 0.0196 m
1	0.33333	0.03432	0.048045307 R60 0.0248 m
2	0.33333	0.04227	0.059171486 R120 0.0303 m
4	0.33333	0.05193	0.072696672 R240 0.0363 m
6	0.33333	0.05852	0.081922764 R360 0.0409 m
10	0.33333	0.07	0.095151657 R600 0.0466 m
24	0.33333	0.08768	0.122758323 R1440 0.0578 m

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Soakaway Design for Proposed Building SO2B

PLOT 2 GARAGE

Area 28.000 m²
28.000 m²

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	0.91 m ³
I10	1.12 m ³
I15	1.27 m ³
I30	1.57 m ³
I60	1.93 m ³
I120	2.37 m ³
I240	2.90 m ³
I360	3.26 m ³
I600	3.78 m ³
I1440	4.87 m ³

Outflow from Tank

f 7.01E-06 m³/s

Soakaway dims:

L	2 m
W	1.5 m
Depth	1.2 m

As50 4.2

Void ratio 95 %

Outflow from Tank:

O5	0.0088 m ³
O10	0.0177 m ³
O15	0.0265 m ³
O30	0.0530 m ³
O60	0.1060 m ³
O120	0.2120 m ³
O240	0.4240 m ³
O360	0.6359 m ³
O600	1.0599 m ³
O1440	2.5438 m ³

Storage required:

S5	0.90 m ³
S10	1.11 m ³
S15	1.25 m ³
S30	1.52 m ³
S60	1.82 m ³
S120	2.15 m ³
S240	2.47 m ³
S360	2.62 m ³
S600	2.72 m ³
S1440	2.32 m ³

Time to half drain:

ts50	4.24 hours
ts50	5.22 hours
ts50	5.88 hours
ts50	7.15 hours
ts50	8.60 hours
ts50	10.16 hours
ts50	11.67 hours
ts50	12.38 hours
ts50	12.83 hours
ts50	10.95 hours

Storage provided 3.9 m³

Critical storm = S600

Storage required = 2.72

Time to half discharge = 12.83 Hours (Acceptable time as 1/100 year storm)

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
0.08333	0.1	0.02315	0.03241527 R5
0.16667	0.1	0.02869	0.040171329 R10
0.25	0.1	0.03247	0.045462061 R15
0.5	0.1	0.04002	0.056031245 R30
1	0.1	0.0492	0.068879338 R60
2	0.1	0.06036	0.084497712 R120
4	0.1	0.07392	0.103483692 R240
6	0.1	0.08317	0.116434821 R360
10	0.1	0.10	0.135004879 R600
24	0.1	0.12411	0.173757739 R1440

MH Storage (5No)450mm Ø

5No 0.450 m

$V = \pi r^2 h = 0.3578 \text{ m}^3$

Pipes @ 100mm Ø

Pipe length = 10 m

$V = \pi r^2 h = 0.0785 \text{ m}^3$

0.436 m³

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Soakaway Design for Proposed Building SO3

PLOT 3

Area	117.000 m ²
Climate change	1.400 m ²
	163.800 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	1.43 m ³
I10	2.03 m ³
I15	2.51 m ³
I30	3.21 m ³
I60	4.06 m ³
I120	4.96 m ³
I240	5.95 m ³
I360	6.70 m ³
I600	7.63 m ³
I1440	9.47 m ³

Outflow from Tank

f	7.01E-06 m ³ /s	FOS of 2 applied
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Soakaway dims:

Length	5 m
Width	2.5 m
Depth	1.2 m

As50	9
Void ratio	95 %

Outflow from Tank:

O5	0.0189 m ³
O10	0.0379 m ³
O15	0.0568 m ³
O30	0.1136 m ³
O60	0.2271 m ³
O120	0.4542 m ³
O240	0.9085 m ³
O360	1.3627 m ³
O600	2.2712 m ³
O1440	5.4510 m ³

Storage required:

S5	1.41 m ³
S10	1.99 m ³
S15	2.45 m ³
S30	3.10 m ³
S60	3.84 m ³
S120	4.51 m ³
S240	5.04 m ³
S360	5.34 m ³
S600	5.36 m ³
S1440	4.02 m ³

Time to drain:

ts50	3.10 hours
ts50	4.39 hours
ts50	5.39 hours
ts50	6.82 hours
ts50	8.44 hours
ts50	9.93 hours
ts50	11.09 hours
ts50	11.75 hours
ts50	11.80 hours
ts50	8.84 hours

Storage provided **14.3** m³

Critical storm = **S600**
Storage required = **5.51**
Time to discharge = **11.80** Hours **0.49** Days

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

Average daily rain	2.60 mm
Extra rain during storage	0.15 m ³

Proposed soakaway material requires a void ratio ≥95%.
The use Aquacell soakaway units is recommended.
Proposed design includes for 40% increase due to Climate Change.

Soakaway size proposed is satisfactory

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Soakaway Design for Proposed Building SO3

PLOT 3

Area 117.000 m²

117.000 m²

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	2.58 m ³
I10	3.23 m ³
I15	3.67 m ³
I30	4.55 m ³
I60	5.62 m ³
I120	6.92 m ³
I240	8.51 m ³
I360	9.58 m ³
I600	11.13 m ³
I1440	14.36 m ³

Outflow from Tank

f 7.01E-06 m³/s

Soakaway dims:

L	5 m
W	2.5 m
Depth	1.2 m

As50 9
Void ratio 95 %

Outflow from Tank:

O5	0.0189 m ³
O10	0.0379 m ³
O15	0.0568 m ³
O30	0.1136 m ³
O60	0.2271 m ³
O120	0.4542 m ³
O240	0.9085 m ³
O360	1.3627 m ³
O600	2.2712 m ³
O1440	5.4510 m ³

Storage required:

S5	2.56 m ³	ts50	5.64 hours
S10	3.19 m ³	ts50	7.02 hours
S15	3.61 m ³	ts50	7.95 hours
S30	4.44 m ³	ts50	9.77 hours
S60	5.39 m ³	ts50	11.87 hours
S120	6.47 m ³	ts50	14.24 hours
S240	7.60 m ³	ts50	16.72 hours
S360	8.22 m ³	ts50	18.10 hours
S600	8.86 m ³	ts50	19.51 hours
S1440	8.91 m ³	ts50	19.62 hours

Storage provided 14.3 m³

Critical storm = S1440
Storage required = 8.91
Time to half discharge = 19.62 Hours (Acceptable time as 1/30 year storm)

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
0.08333	0.33333	0.01576	0.022069124 R5 0.0087 m
0.16667	0.33333	0.01971	0.027594367 R10 0.0124 m
0.25	0.33333	0.0224	0.031363365 R15 0.0153 m
0.5	0.33333	0.02778	0.038892614 R30 0.0196 m
1	0.33333	0.03432	0.048045307 R60 0.0248 m
2	0.33333	0.04227	0.059171486 R120 0.0303 m
4	0.33333	0.05193	0.072696672 R240 0.0363 m
6	0.33333	0.05852	0.081922764 R360 0.0409 m
10	0.33333	0.07	0.095151657 R600 0.0466 m
24	0.33333	0.08768	0.122758323 R1440 0.0578 m

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Soakaway Design for Proposed Building SO3

PLOT 3

Area 117.000 m²

117.000 m²

100 year return period + 40%

R5	0.032 m
R10	0.040 m
R15	0.045 m
R30	0.056 m
R60	0.069 m
R120	0.084 m
R240	0.103 m
R360	0.116 m
R600	0.135 m
R1440	0.174 m

Storm duration (Min.)

5
10
15
30
60
120
240
360
600
1440

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
0.08333	0.1	0.02315	0.03241527 R5
0.16667	0.1	0.02869	0.040171329 R10
0.25	0.1	0.03247	0.045462061 R15
0.5	0.1	0.04002	0.056031245 R30
1	0.1	0.0492	0.068879338 R60
2	0.1	0.06036	0.084497712 R120
4	0.1	0.07392	0.103483692 R240
6	0.1	0.08317	0.116434821 R360
10	0.1	0.10	0.135004879 R600
24	0.1	0.12411	0.173757739 R1440

Inflow to attenuation system

I5	3.79 m ³
I10	4.70 m ³
I15	5.32 m ³
I30	6.56 m ³
I60	8.06 m ³
I120	9.89 m ³
I240	12.11 m ³
I360	13.62 m ³
I600	15.80 m ³
I1440	20.33 m ³

Outflow from Tank

f 7.01E-06 m³/s

Soakaway dims:

L	5 m
W	2.5 m
Depth	1.2 m

As50 9
Void ratio 95 %

Outflow from Tank:

O5	0.0189 m ³
O10	0.0379 m ³
O15	0.0568 m ³
O30	0.1136 m ³
O60	0.2271 m ³
O120	0.4542 m ³
O240	0.9085 m ³
O360	1.3627 m ³
O600	2.2712 m ³
O1440	5.4510 m ³

Storage required:

S5	3.77 m ³
S10	4.66 m ³
S15	5.26 m ³
S30	6.44 m ³
S60	7.83 m ³
S120	9.43 m ³
S240	11.20 m ³
S360	12.26 m ³
S600	13.52 m ³
S1440	14.88 m ³

Time to half drain:

ts50	8.31 hours
ts50	10.26 hours
ts50	11.58 hours
ts50	14.18 hours
ts50	17.24 hours
ts50	20.76 hours
ts50	24.65 hours
ts50	26.99 hours
ts50	29.77 hours
ts50	32.75 hours

Storage provided 14.9 m³

Critical storm = S1440

Storage required = 14.88

Time to half discharge = 32.75 Hours (Acceptable time as 1/100 year storm)

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Soakaway Design for Proposed Building SO4, SO5 & SO6

PLOTS 4, 5 & 6 (SOAKAWAY SIZE PER PLOT)

Area	113.000 m ²
Climate change	1.400 m ²
	158.200 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	1.38 m ³
I10	1.96 m ³
I15	2.42 m ³
I30	3.10 m ³
I60	3.92 m ³
I120	4.79 m ³
I240	5.74 m ³
I360	6.47 m ³
I600	7.37 m ³
I1440	9.14 m ³

Outflow from Tank

f	7.01E-06 m ³ /s	FOS of 2 applied
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Soakaway dims:

Length	5 m
Width	2.5 m
Depth	1.2 m

As50	9
Void ratio	95 %

Outflow from Tank:

O5	0.0189 m ³
O10	0.0379 m ³
O15	0.0568 m ³
O30	0.1136 m ³
O60	0.2271 m ³
O120	0.4542 m ³
O240	0.9085 m ³
O360	1.3627 m ³
O600	2.2712 m ³
O1440	5.4510 m ³

Storage required:

S5	1.36 m ³
S10	1.92 m ³
S15	2.36 m ³
S30	2.99 m ³
S60	3.70 m ³
S120	4.34 m ³
S240	4.83 m ³
S360	5.11 m ³
S600	5.10 m ³
S1440	3.69 m ³

Time to drain:

ts50	2.99 hours
ts50	4.24 hours
ts50	5.20 hours
ts50	6.58 hours
ts50	8.14 hours
ts50	9.55 hours
ts50	10.64 hours
ts50	11.24 hours
ts50	11.23 hours
ts50	8.13 hours

Storage provided **14.3** m³

Critical storm = **S360**
Storage required = **5.25**
Time to discharge = **11.24** Hours **0.47** Days

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

Average daily rain	2.60 mm
Extra rain during storage	0.14 m ³

Proposed soakaway material requires a void ratio ≥95%.
The use of Aquacell soakaway units is recommended.
Proposed design includes for 40% increase due to Climate Change.

Soakaway size proposed is satisfactory

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Soakaway Design for Proposed Building SO4, SO5 & SO6

PLOTS 4, 5 & 6 (SOAKAWAY SIZE PER PLOT)

Area 113.000 m²

113.000 m²

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	2.49 m ³
I10	3.12 m ³
I15	3.54 m ³
I30	4.39 m ³
I60	5.43 m ³
I120	6.69 m ³
I240	8.21 m ³
I360	9.26 m ³
I600	10.75 m ³
I1440	13.87 m ³

Outflow from Tank

f 7.01E-06 m³/s

Soakaway dims:

L	5 m
W	2.5 m
Depth	1.2 m

As50 9
Void ratio 95 %

Outflow from Tank:

O5	0.0189 m ³
O10	0.0379 m ³
O15	0.0568 m ³
O30	0.1136 m ³
O60	0.2271 m ³
O120	0.4542 m ³
O240	0.9085 m ³
O360	1.3627 m ³
O600	2.2712 m ³
O1440	5.4510 m ³

Storage required:

S5	2.47 m ³	ts50	5.45 hours
S10	3.08 m ³	ts50	6.78 hours
S15	3.49 m ³	ts50	7.68 hours
S30	4.28 m ³	ts50	9.43 hours
S60	5.20 m ³	ts50	11.45 hours
S120	6.23 m ³	ts50	13.72 hours
S240	7.31 m ³	ts50	16.08 hours
S360	7.89 m ³	ts50	17.38 hours
S600	8.48 m ³	ts50	18.67 hours
S1440	8.42 m ³	ts50	18.54 hours

Storage provided 14.3 m³

Critical storm = S600

Storage required = 8.48

Time to half discharge = 18.67 Hours (Acceptable time as 1/30 year storm)

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
0.08333	0.33333	0.01576	0.022069124 R5 0.0087 m
0.16667	0.33333	0.01971	0.027594367 R10 0.0124 m
0.25	0.33333	0.0224	0.031363365 R15 0.0153 m
0.5	0.33333	0.02778	0.038892614 R30 0.0196 m
1	0.33333	0.03432	0.048045307 R60 0.0248 m
2	0.33333	0.04227	0.059171486 R120 0.0303 m
4	0.33333	0.05193	0.072696672 R240 0.0363 m
6	0.33333	0.05852	0.081922764 R360 0.0409 m
10	0.33333	0.07	0.095151657 R600 0.0466 m
24	0.33333	0.08768	0.122758323 R1440 0.0578 m

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Soakaway Design for Proposed Building SO4, SO5 & SO6

PLOTS 4, 5 & 6 (SOAKAWAY SIZE PER PLOT)

Area 114.000 m²

114.000 m²

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	3.70 m ³
I10	4.58 m ³
I15	5.18 m ³
I30	6.39 m ³
I60	7.85 m ³
I120	9.63 m ³
I240	11.80 m ³
I360	13.27 m ³
I600	15.39 m ³
I1440	19.81 m ³

Outflow from Tank

f 7.01E-06 m³/s

Soakaway dims:

L	5 m
W	2.5 m
Depth	1.2 m

As50 9
Void ratio 95 %

Outflow from Tank:

O5	0.0189 m ³
O10	0.0379 m ³
O15	0.0568 m ³
O30	0.1136 m ³
O60	0.2271 m ³
O120	0.4542 m ³
O240	0.9085 m ³
O360	1.3627 m ³
O600	2.2712 m ³
O1440	5.4510 m ³

Storage required:

S5	3.68 m ³
S10	4.54 m ³
S15	5.13 m ³
S30	6.27 m ³
S60	7.63 m ³
S120	9.18 m ³
S240	10.89 m ³
S360	11.91 m ³
S600	13.12 m ³
S1440	14.36 m ³

Time to half drain:

ts50	8.09 hours
ts50	10.00 hours
ts50	11.28 hours
ts50	13.81 hours
ts50	16.79 hours
ts50	20.21 hours
ts50	23.97 hours
ts50	26.22 hours
ts50	28.88 hours
ts50	31.61 hours

Storage provided 14.8 m³

Critical storm = S1440

Storage required = 14.36

Time to half discharge= 31.61 Hours (Acceptable time as 1/100 year storm)

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
0.08333	0.1	0.02315	0.03241527 R5
0.16667	0.1	0.02869	0.040171329 R10
0.25	0.1	0.03247	0.045462061 R15
0.5	0.1	0.04002	0.056031245 R30
1	0.1	0.0492	0.068879338 R60
2	0.1	0.06036	0.084497712 R120
4	0.1	0.07392	0.103483692 R240
6	0.1	0.08317	0.116434821 R360
10	0.1	0.10	0.135004879 R600
24	0.1	0.12411	0.173757739 R1440

MH Storage (5No)450mm Ø

3No 0.450 m

$V = \pi r^2 h = 0.2147 \text{ m}^3$

Pipes @ 100mm Ø

Pipe length = 44 m

$V = \pi r^2 h = 0.3456 \text{ m}^3$

0.560 m³

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PERMEABLE PAVING - ACCESS ROADS & PARKING

Area 795.000 m²
Climate change 1.400 m²
1113.000 m²

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	9.68 m ³
I10	13.80 m ³
I15	17.03 m ³
I30	21.81 m ³
I60	27.60 m ³
I120	33.72 m ³
I240	40.40 m ³
I360	45.52 m ³
I600	51.87 m ³
I1440	64.33 m ³

Outflow from Tank

f 1.86E-06 m³/s

Soakaway dims:

Length	795 m
Width	1 m
Depth	0.4 m

As50 318.4
Void ratio 30. %

Outflow from Tank:

O5	0.1777 m ³
O10	0.3553 m ³
O15	0.5330 m ³
O30	1.0660 m ³
O60	2.1320 m ³
O120	4.2640 m ³
O240	8.5280 m ³
O360	12.7920 m ³
O600	21.3201 m ³
O1440	51.1682 m ³

Storage required:

S5	9.51 m ³
S10	13.45 m ³
S15	16.50 m ³
S30	20.75 m ³
S60	25.47 m ³
S120	29.46 m ³
S240	31.87 m ³
S360	32.73 m ³
S600	30.55 m ³
S1440	13.16 m ³

Time to drain:

ts50	2.23 hours
ts50	3.15 hours
ts50	3.87 hours
ts50	4.87 hours
ts50	5.97 hours
ts50	6.91 hours
ts50	7.48 hours
ts50	7.68 hours
ts50	7.16 hours
ts50	3.09 hours

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

Average daily rain	2.60 mm
Extra rain during storage	0.66 m ³

Storage provided 95.4 m³

Critical storm = S360
Storage required = 33.39
Time to discharge = 7.68 Hours

0.32 Days

Proposed access roads sub surface granular material requires a void ratio ≥30%. . Proposed design includes for 40% increase due to Climate Change.

Soakaway size proposed is satisfactory

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PERMEABLE PAVING - ACCESS ROADS & PARKING

Area 795.000 m²
795.000 m²

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	17.54 m ³
I10	21.94 m ³
I15	24.93 m ³
I30	30.92 m ³
I60	38.20 m ³
I120	47.04 m ³
I240	57.79 m ³
I360	65.13 m ³
I600	75.65 m ³
I1440	97.59 m ³

Outflow from Tank

f 1.86E-06 m³/s

Soakaway dims:

L	795 m
W	1 m
Depth	0.4 m

As50 318.4

Void ratio 30 %

Outflow from Tank:

O5	0.1777 m ³
O10	0.3553 m ³
O15	0.5330 m ³
O30	1.0660 m ³
O60	2.1320 m ³
O120	4.2640 m ³
O240	8.5280 m ³
O360	12.7920 m ³
O600	21.3201 m ³
O1440	51.1682 m ³

Storage required:

S5	17.37 m ³
S10	21.58 m ³
S15	24.40 m ³
S30	29.85 m ³
S60	36.06 m ³
S120	42.78 m ³
S240	49.27 m ³
S360	52.34 m ³
S600	54.33 m ³
S1440	46.42 m ³

Time to half drain:

ts50	4.07 hours
ts50	5.06 hours
ts50	5.72 hours
ts50	7.00 hours
ts50	8.46 hours
ts50	10.03 hours
ts50	11.55 hours
ts50	12.27 hours
ts50	12.74 hours
ts50	10.89 hours

Storage provided 95.4 m³

Critical storm = S600

Storage required = 54.33

Time to half discharge = 12.74 Hours (Acceptable time as 1/30 year storm)

Soakaway 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 0.0087 m
0.166667	0.333333	0.01971	0.027594367 R10 0.0124 m
0.25	0.333333	0.022402	0.031363365 R15 0.0153 m
0.5	0.333333	0.02778	0.038892614 R30 0.0196 m
1	0.333333	0.034318	0.048045307 R60 0.0248 m
2	0.333333	0.042265	0.059171486 R120 0.0303 m
4	0.333333	0.051926	0.072696672 R240 0.0363 m
6	0.333333	0.058516	0.081922764 R360 0.0409 m
10	0.333333	0.07	0.095151657 R600 0.0466 m
24	0.333333	0.087685	0.122758323 R1440 0.0578 m

Job No.	424927	Sheet	Date	Jun-21
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PERMEABLE PAVING - ACCESS ROADS & PARKING

Area 795.000 m²
795.000 m²

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	25.77 m ³
I10	31.94 m ³
I15	36.14 m ³
I30	44.54 m ³
I60	54.76 m ³
I120	67.18 m ³
I240	82.27 m ³
I360	92.57 m ³
I600	107.33 m ³
I1440	138.14 m ³

Outflow from Tank

f 1.86E-06 m³/s

Soakaway dims:

L	795 m
W	1 m
Depth	0.4 m

As50 318.4

Void ratio 30 %

Outflow from Tank:

O5	0.1777 m ³
O10	0.3553 m ³
O15	0.5330 m ³
O30	1.0660 m ³
O60	2.1320 m ³
O120	4.2640 m ³
O240	8.5280 m ³
O360	12.7920 m ³
O600	21.3201 m ³
O1440	51.1682 m ³

Storage required:

S5	25.59 m ³
S10	31.58 m ³
S15	35.61 m ³
S30	43.48 m ³
S60	52.63 m ³
S120	62.91 m ³
S240	73.74 m ³
S360	79.77 m ³
S600	86.01 m ³
S1440	86.97 m ³

Time to half drain:

ts50	6.00 hours
ts50	7.41 hours
ts50	8.35 hours
ts50	10.20 hours
ts50	12.34 hours
ts50	14.75 hours
ts50	17.29 hours
ts50	18.71 hours
ts50	20.17 hours
ts50	20.40 hours

Storage provided 95.4 m³

Critical storm = S1440

Storage required = 86.97

Time to half discharge = 20.40 Hours (Acceptable time as 1/100 year storm)

Soakaway 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 0.0087 m
0.166667	0.1	0.028694	0.040171329 R10 0.0124 m
0.25	0.1	0.032473	0.045462061 R15 0.0153 m
0.5	0.1	0.040022	0.056031245 R30 0.0196 m
1	0.1	0.0492	0.068879338 R60 0.0248 m
2	0.1	0.060356	0.084497712 R120 0.0303 m
4	0.1	0.073917	0.103483692 R240 0.0363 m
6	0.1	0.083168	0.116434821 R360 0.0409 m
10	0.1	0.10	0.135004879 R600 0.0466 m
24	0.1	0.124113	0.173757739 R1440 0.0578 m