

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

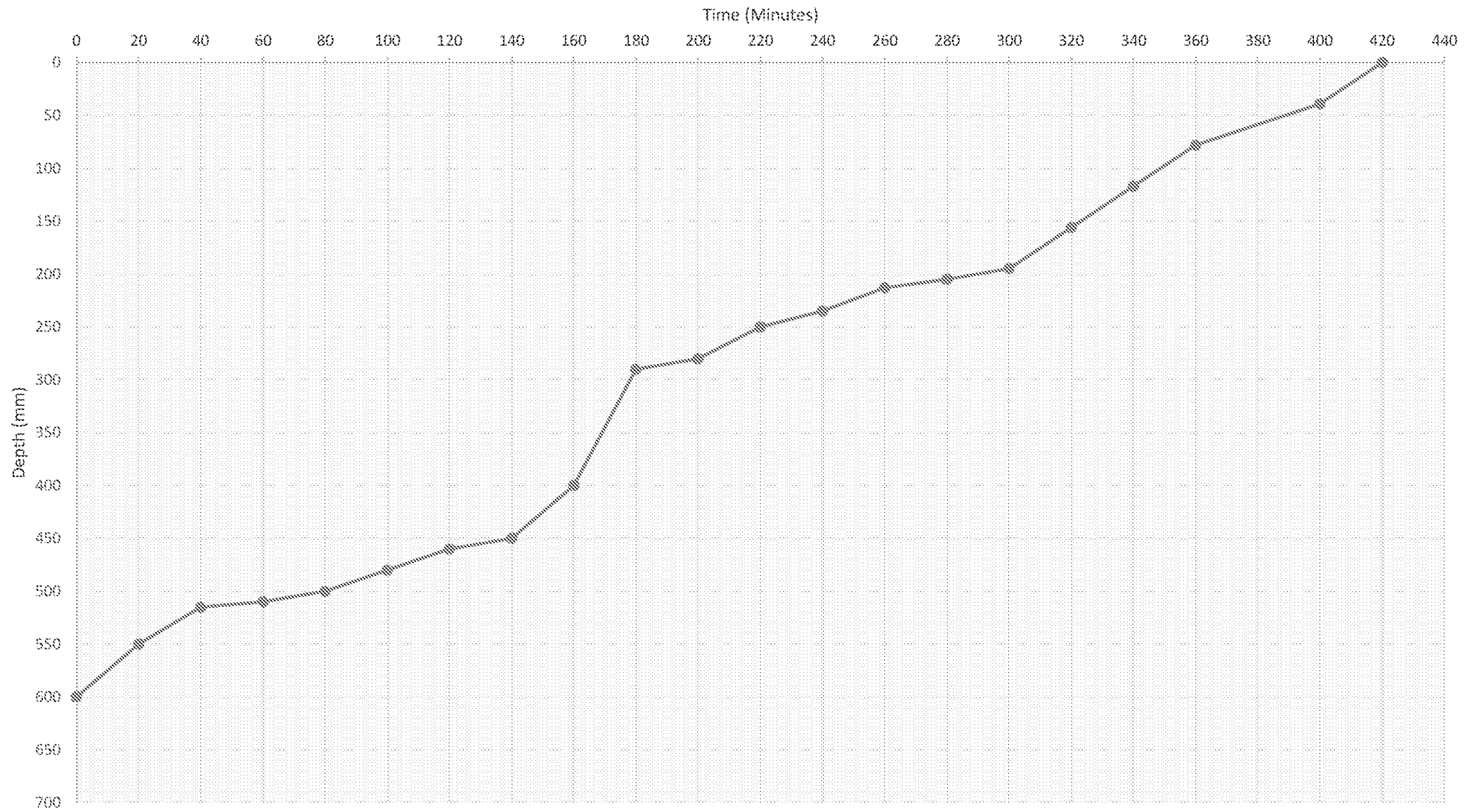
SOAKAGE TEST RESULTS

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

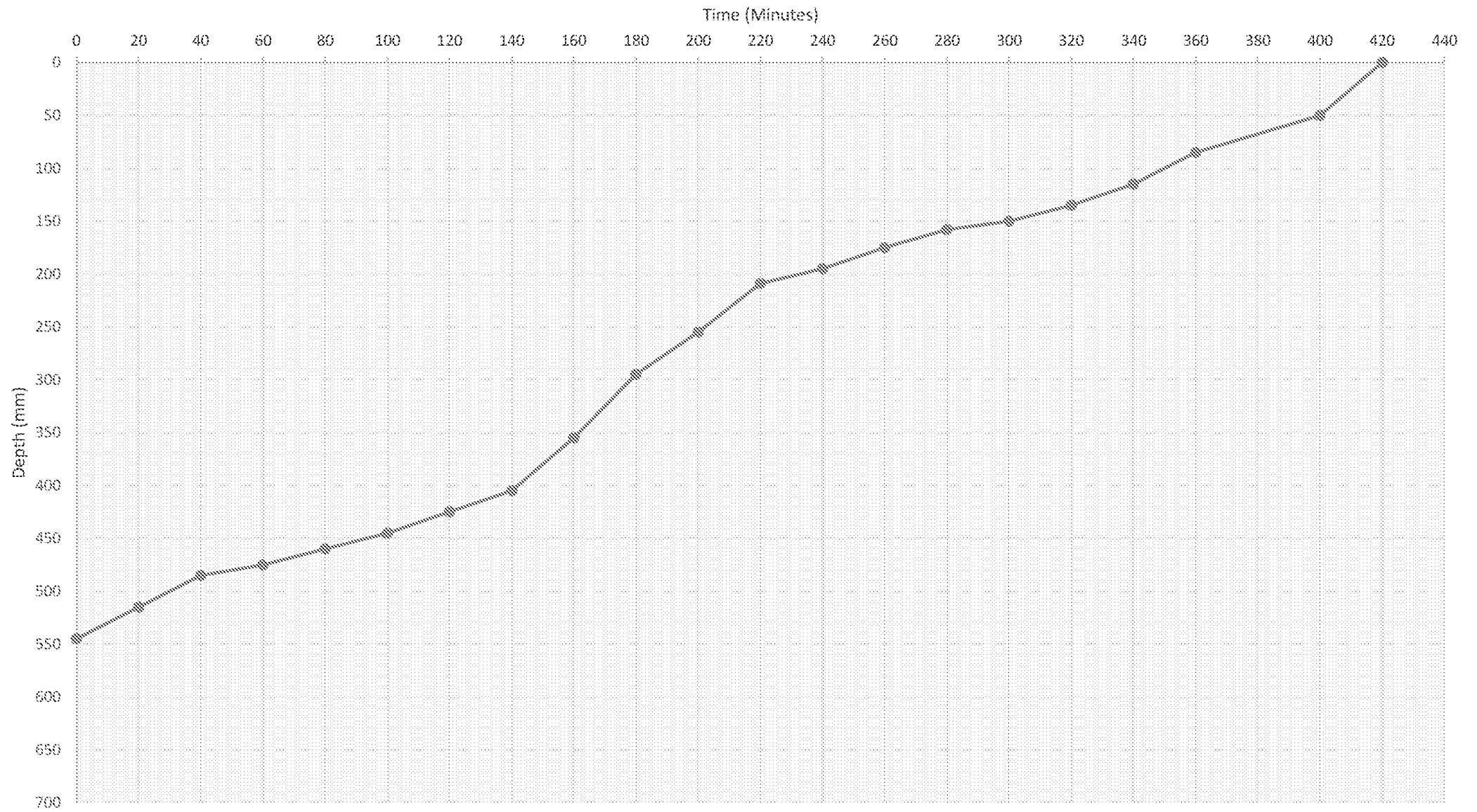
CMW/424927/CMW

APPENDIX

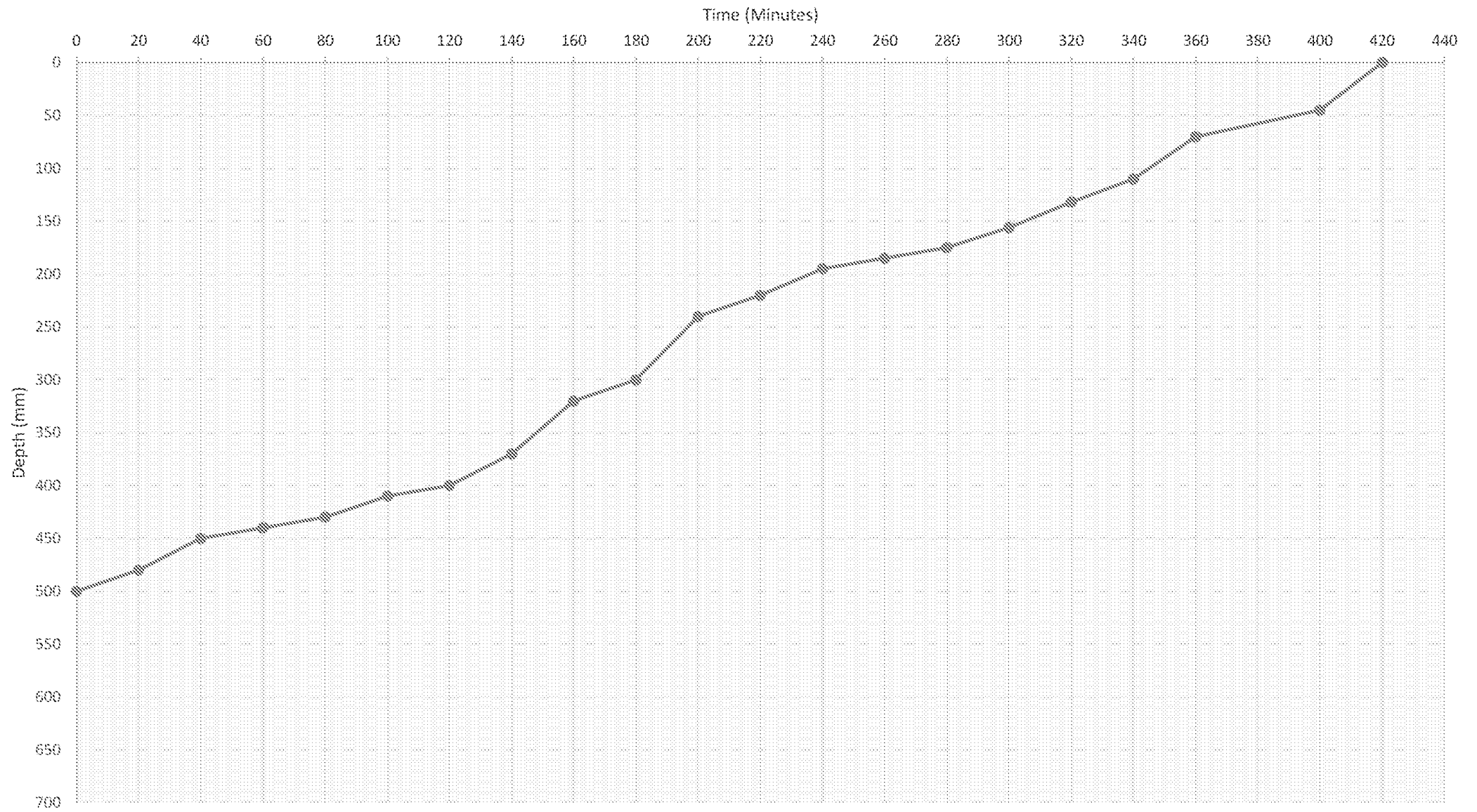
TEST 1



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	Mar-21
Job	ORCHARD	By TB	Checked	CMW

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Soakaway Design for Proposed Building SO1 & SO2 Combined

Area 212.000 m²
Climate change 1.400 m²
296.800 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	2.58 m ³
I10	3.68 m ³
I15	4.54 m ³
I30	5.82 m ³
I60	7.36 m ³
I120	8.99 m ³
I240	10.77 m ³
I360	12.14 m ³
I600	13.83 m ³
I1440	17.16 m ³

Outflow from Tank

f 1.42E-05 m³/s

Soakaway dims:

Length	55 m
Width	0.4 m
Depth	1.2 m

As50 66.48
Void ratio 40. %

Outflow from Tank:

O5	0.2832 m ³
O10	0.5664 m ³
O15	0.8496 m ³
O30	1.6992 m ³
O60	3.3985 m ³
O120	6.7969 m ³
O240	13.5938 m ³
O360	20.3907 m ³
O600	33.9846 m ³
O1440	81.5630 m ³

Storage required:

S5	2.30 m ³
S10	3.11 m ³
S15	3.69 m ³
S30	4.12 m ³
S60	3.96 m ³
S120	2.20 m ³
S240	-2.82 m ³
S360	-8.25 m ³
S600	-20.15 m ³
S1440	-64.41 m ³

Time to drain:

ts50	0.34 hours
ts50	0.46 hours
ts50	0.54 hours
ts50	0.61 hours
ts50	0.58 hours
ts50	0.32 hours
ts50	-0.41 hours
ts50	-1.21 hours
ts50	-2.97 hours
ts50	-9.48 hours

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

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

Storage provided 10.6 m³

Critical storm = S30
Storage required = 4.13
Time to discharge = 0.61 Hours 0.03 Days

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

Soakaway size proposed is satisfactory

Job No.	424927	Sheet	Date	Mar-21
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Soakaway Design for Proposed Building SO1 & SO2 Combined

Area	212.000 m ²		
	m ²		
	212.000 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	4.68 m ³		
I10	5.85 m ³		
I15	6.65 m ³		
I30	8.25 m ³		
I60	10.19 m ³		
I120	12.54 m ³		
I240	15.41 m ³		
I360	17.37 m ³		
I600	20.17 m ³		
I1440	26.02 m ³		
Outflow from Tank			
f	1.42E-05 m ³ /s		
Soakaway dims:			
L	55 m		
W	0.4 m		
Depth	1.2 m		
As50	66.48		
Void ratio	40 %		
Outflow from Tank:			
O5	0.2832 m ³		
O10	0.5664 m ³		
O15	0.8496 m ³		
O30	1.6992 m ³		
O60	3.3985 m ³		
O120	6.7969 m ³		
O240	13.5938 m ³		
O360	20.3907 m ³		
O600	33.9846 m ³		
O1440	81.5630 m ³		
Storage required:		Time to half drain:	
S5	4.40 m ³	ts50	0.65 hours
S10	5.28 m ³	ts50	0.78 hours
S15	5.80 m ³	ts50	0.85 hours
S30	6.55 m ³	ts50	0.96 hours
S60	6.79 m ³	ts50	1.00 hours
S120	5.75 m ³	ts50	0.85 hours
S240	1.82 m ³	ts50	0.27 hours
S360	-3.02 m ³	ts50	-0.44 hours
S600	-13.81 m ³	ts50	-2.03 hours
S1440	-55.54 m ³	ts50	-8.17 hours

Storage provided **10.6** m³

Critical storm = **S60**

Storage required = **6.79**

Time to half discharge = **1.00** 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
0.083333	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

Soakaway size proposed is satisfactory

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Soakaway Design for Proposed Building SO1 & S02 Combined

Area 212.000 m²
212.000 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	6.87 m ³
I10	8.52 m ³
I15	9.64 m ³
I30	11.88 m ³
I60	14.60 m ³
I120	17.91 m ³
I240	21.94 m ³
I360	24.68 m ³
I600	28.62 m ³
I1440	36.84 m ³

Outflow from Tank

f 1.42E-05 m³/s

Soakaway dims:

L	55 m
W	0.4 m
Depth	1.2 m

As50 66.48

Void ratio 40 %

Outflow from Tank:

O5	0.2832 m ³
O10	0.5664 m ³
O15	0.8496 m ³
O30	1.6992 m ³
O60	3.3985 m ³
O120	6.7969 m ³
O240	13.5938 m ³
O360	20.3907 m ³
O600	33.9846 m ³
O1440	81.5630 m ³

Storage required:

S5	6.59 m ³
S10	7.95 m ³
S15	8.79 m ³
S30	10.18 m ³
S60	11.20 m ³
S120	11.12 m ³
S240	8.34 m ³
S360	4.29 m ³
S600	-5.36 m ³
S1440	-44.73 m ³

Time to half drain:

ts50	0.97 hours
ts50	1.17 hours
ts50	1.29 hours
ts50	1.50 hours
ts50	1.65 hours
ts50	1.64 hours
ts50	1.23 hours
ts50	0.63 hours
ts50	-0.79 hours
ts50	-6.58 hours

Storage provided 11.6 m³

Critical storm = S60

Storage required = 11.20

Time to half discharge = 1.65 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
0.083333	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

MH Storage (5No)450mm Ø

5No 0.450 m

$=V=\pi r^2 h$ 0.3578 m³

Pipes @ 100mm Ø

Pipe length = 90 m

$V=\pi r^2 h=$ 0.7069 m³

1.065 m³

Soakaway size proposed is satisfactory

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Soakaway Design for Proposed Building SO3

Area 117.000 m²
Climate change 1.400 m²
163.800 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	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 1.42E-05 m³/s

Soakaway dims:

Length	15 m
Width	1 m
Depth	1.2 m

As50 19.2
Void ratio 40. %

Outflow from Tank:

O5	0.0818 m ³
O10	0.1636 m ³
O15	0.2454 m ³
O30	0.4908 m ³
O60	0.9815 m ³
O120	1.9630 m ³
O240	3.9260 m ³
O360	5.8890 m ³
O600	9.8150 m ³
O1440	23.5561 m ³

Storage required:

S5	1.34 m ³
S10	1.87 m ³
S15	2.26 m ³
S30	2.72 m ³
S60	3.08 m ³
S120	3.00 m ³
S240	2.02 m ³
S360	0.81 m ³
S600	-2.18 m ³
S1440	-14.09 m ³

Time to drain:

ts50	0.68 hours
ts50	0.95 hours
ts50	1.15 hours
ts50	1.39 hours
ts50	1.57 hours
ts50	1.53 hours
ts50	1.03 hours
ts50	0.41 hours
ts50	-1.11 hours
ts50	-7.18 hours

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

Average daily rain	2.60 mm
Extra rain during storage	0.02 m ³

Storage provided 7.2 m³

Critical storm = S60
Storage required = 3.10
Time to discharge = 1.57 Hours 0.07 Days

Proposed soakaway material requires a void ratio ≥40%.
The use of gravel filled trenches 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 Combined

Area 117.000 m²
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 1.42E-05 m³/s

Soakaway dims:

L	15 m
W	1 m
Depth	1.2 m

As50 19.2

Void ratio 40 %

Outflow from Tank:

O5	0.0818 m ³
O10	0.1636 m ³
O15	0.2454 m ³
O30	0.4908 m ³
O60	0.9815 m ³
O120	1.9630 m ³
O240	3.9260 m ³
O360	5.8890 m ³
O600	9.8150 m ³
O1440	23.5561 m ³

Storage required:

S5	2.50 m ³
S10	3.06 m ³
S15	3.42 m ³
S30	4.06 m ³
S60	4.64 m ³
S120	4.96 m ³
S240	4.58 m ³
S360	3.70 m ³
S600	1.32 m ³
S1440	-9.19 m ³

Time to half drain:

ts50	1.27 hours
ts50	1.56 hours
ts50	1.74 hours
ts50	2.07 hours
ts50	2.36 hours
ts50	2.53 hours
ts50	2.33 hours
ts50	1.88 hours
ts50	0.67 hours
ts50	-4.68 hours

Storage provided 7.2 m³

Critical storm = S120

Storage required = 4.96

Time to half discharge = 2.53 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
0.083333	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

Soakaway size proposed is satisfactory

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Soakaway Design for Proposed Building SO3 Combined

Area 117.000 m²
117.000 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	3.79 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 1.42E-05 m³/s

Soakaway dims:

L	15.5 m
W	1 m
Depth	1.2 m

As50 19.8

Void ratio 40 %

Outflow from Tank:

O5	0.0843 m ³
O10	0.1687 m ³
O15	0.2530 m ³
O30	0.5061 m ³
O60	1.0122 m ³
O120	2.0244 m ³
O240	4.0487 m ³
O360	6.0731 m ³
O600	10.1218 m ³
O1440	24.2922 m ³

Storage required:

S5	3.71 m ³
S10	4.53 m ³
S15	5.07 m ³
S30	6.05 m ³
S60	7.05 m ³
S120	7.86 m ³
S240	8.06 m ³
S360	7.55 m ³
S600	5.67 m ³
S1440	-3.96 m ³

Time to half drain:

ts50	1.83 hours
ts50	2.24 hours
ts50	2.50 hours
ts50	2.99 hours
ts50	3.48 hours
ts50	3.88 hours
ts50	3.98 hours
ts50	3.73 hours
ts50	2.80 hours
ts50	-1.96 hours

Storage provided 8.1 m³

Critical storm = S240

Storage required = 8.06

Time to half discharge = 3.98 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
0.083333	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

MH Storage (5No)450mm Ø

3No 0.450 m

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

Pipes @ 100mm Ø

Pipe length = 52 m

$V = \pi r^2 h = 0.4084 \text{ m}^3$

0.623 m³

Soakaway size proposed is satisfactory

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Soakaway Design for Proposed Building SO4, SO5 & SO6

Area 113.000 m²
Climate change 1.400 m²
158.200 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	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 1.42E-05 m³/s

Soakaway dims:

Length	15.5 m
Width	1 m
Depth	1.2 m

As50 19.8
Void ratio 40. %

Outflow from Tank:

O5	0.0843 m ³
O10	0.1687 m ³
O15	0.2530 m ³
O30	0.5061 m ³
O60	1.0122 m ³
O120	2.0244 m ³
O240	4.0487 m ³
O360	6.0731 m ³
O600	10.1218 m ³
O1440	24.2922 m ³

Storage required:

S5	1.29 m ³
S10	1.79 m ³
S15	2.17 m ³
S30	2.59 m ³
S60	2.91 m ³
S120	2.77 m ³
S240	1.69 m ³
S360	0.40 m ³
S600	-2.75 m ³
S1440	-15.15 m ³

Time to drain:

ts50	0.64 hours
ts50	0.89 hours
ts50	1.07 hours
ts50	1.28 hours
ts50	1.44 hours
ts50	1.37 hours
ts50	0.84 hours
ts50	0.20 hours
ts50	-1.36 hours
ts50	-7.48 hours

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

Average daily rain	2.60 mm
Extra rain during storage	0.02 m ³

Storage provided 7.4 m³

Critical storm = S60
Storage required = 2.93
Time to discharge = 1.44 Hours 0.06 Days

Proposed soakaway material requires a void ratio ≥40%.
The use of gravel filled trenches 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

Area	113.000 m ²	
	113.000 m ²	
	113.000 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	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 1.42E-05 m³/s

Soakaway dims:

L	15.5 m
W	1 m
Depth	1.2 m

As50 19.8

Void ratio 40 %

Outflow from Tank:

O5	0.0843 m ³
O10	0.1687 m ³
O15	0.2530 m ³
O30	0.5061 m ³
O60	1.0122 m ³
O120	2.0244 m ³
O240	4.0487 m ³
O360	6.0731 m ³
O600	10.1218 m ³
O1440	24.2922 m ³

Storage required:

S5	2.41 m ³	ts50	1.19 hours
S10	2.95 m ³	ts50	1.46 hours
S15	3.29 m ³	ts50	1.63 hours
S30	3.89 m ³	ts50	1.92 hours
S60	4.42 m ³	ts50	2.18 hours
S120	4.66 m ³	ts50	2.30 hours
S240	4.17 m ³	ts50	2.06 hours
S360	3.18 m ³	ts50	1.57 hours
S600	0.63 m ³	ts50	0.31 hours
S1440	-10.42 m ³	ts50	-5.15 hours

Storage provided 7.4 m³

Critical storm = S120

Storage required = 4.66

Time to half discharge = 2.30 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
0.083333	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

Soakaway size proposed is satisfactory

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Soakaway Design for Proposed Building SO4, SO5 & SO6

Area 114.000 m²
114.000 m²

100 year return period + 40%

	Storm duration (Min.)
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

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 1.42E-05 m³/s

Soakaway dims:

L	15.5 m
W	1 m
Depth	1.2 m

As50 19.8

Void ratio 40 %

Outflow from Tank:

O5	0.0843 m ³
O10	0.1687 m ³
O15	0.2530 m ³
O30	0.5061 m ³
O60	1.0122 m ³
O120	2.0244 m ³
O240	4.0487 m ³
O360	6.0731 m ³
O600	10.1218 m ³
O1440	24.2922 m ³

Storage required:

S5	3.61 m ³
S10	4.41 m ³
S15	4.93 m ³
S30	5.88 m ³
S60	6.84 m ³
S120	7.61 m ³
S240	7.75 m ³
S360	7.20 m ³
S600	5.27 m ³
S1440	-4.48 m ³

Time to half drain:

ts50	1.78 hours
ts50	2.18 hours
ts50	2.44 hours
ts50	2.91 hours
ts50	3.38 hours
ts50	3.76 hours
ts50	3.83 hours
ts50	3.56 hours
ts50	2.60 hours
ts50	-2.21 hours

Storage provided 8.0 m³

Critical storm = S240

Storage required = 7.75

Time to half discharge = 3.83 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
0.083333	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

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

Soakaway size proposed is satisfactory

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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 1.42E-05 m³/s

Soakaway dims:

Length	795 m
Width	1 m
Depth	0.3 m

As50 238.8

Void ratio 40. %

Outflow from Tank:

O5	1.0173 m ³
O10	2.0346 m ³
O15	3.0519 m ³
O30	6.1037 m ³
O60	12.2075 m ³
O120	24.4149 m ³
O240	48.8298 m ³
O360	73.2447 m ³
O600	122.0746 m ³
O1440	292.9789 m ³

Storage required:

S5	8.67 m ³
S10	11.77 m ³
S15	13.98 m ³
S30	15.71 m ³
S60	15.39 m ³
S120	9.31 m ³
S240	-8.43 m ³
S360	-27.72 m ³
S600	-70.21 m ³
S1440	-228.65 m ³

Time to drain:

ts50	0.35 hours
ts50	0.48 hours
ts50	0.57 hours
ts50	0.64 hours
ts50	0.63 hours
ts50	0.38 hours
ts50	-0.35 hours
ts50	-1.14 hours
ts50	-2.88 hours
ts50	-9.37 hours

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

Average daily rain 2.60 mm

Extra rain during storage 0.06 m³

Storage provided 95.4 m³

Critical storm = S30

Storage required = 15.77

Time to discharge = 0.64 Hours 0.03 Days

Soakaway size proposed is satisfactory

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

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SoaPERMEABLE 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 1.42E-05 m³/s

Soakaway dims:

L	795 m
W	1 m
Depth	0.3 m

As50 238.8

Void ratio 40 %

Outflow from Tank:

O5	1.0173 m ³
O10	2.0346 m ³
O15	3.0519 m ³
O30	6.1037 m ³
O60	12.2075 m ³
O120	24.4149 m ³
O240	48.8298 m ³
O360	73.2447 m ³
O600	122.0746 m ³
O1440	292.9789 m ³

Storage required:

S5	16.53 m ³
S10	19.90 m ³
S15	21.88 m ³
S30	24.82 m ³
S60	25.99 m ³
S120	22.63 m ³
S240	8.96 m ³
S360	-8.12 m ³
S600	-46.43 m ³
S1440	-195.39 m ³

Time to half drain:

ts50	0.68 hours
ts50	0.82 hours
ts50	0.90 hours
ts50	1.02 hours
ts50	1.06 hours
ts50	0.93 hours
ts50	0.37 hours
ts50	-0.33 hours
ts50	-1.90 hours
ts50	-8.00 hours

Storage provided 95.4 m³

Critical storm = S60

Storage required = 25.99

Time to half discharge = 1.06 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

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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 1.42E-05 m³/s

Soakaway dims:

L	795 m
W	1 m
Depth	0.3 m

As50 238.8

Void ratio 40 %

Outflow from Tank:

O5	1.0173 m ³
O10	2.0346 m ³
O15	3.0519 m ³
O30	6.1037 m ³
O60	12.2075 m ³
O120	24.4149 m ³
O240	48.8298 m ³
O360	73.2447 m ³
O600	122.0746 m ³
O1440	292.9789 m ³

Storage required:

S5	24.75 m ³
S10	29.90 m ³
S15	33.09 m ³
S30	38.44 m ³
S60	42.55 m ³
S120	42.76 m ³
S240	33.44 m ³
S360	19.32 m ³
S600	-14.75 m ³
S1440	-154.84 m ³

Time to half drain:

ts50	1.01 hours
ts50	1.22 hours
ts50	1.36 hours
ts50	1.57 hours
ts50	1.74 hours
ts50	1.75 hours
ts50	1.37 hours
ts50	0.79 hours
ts50	-0.60 hours
ts50	-6.34 hours

Storage provided 95.4 m³

Critical storm = S120

Storage required = 42.76

Time to half discharge = 1.75 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
0.083333	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

Soakaway size proposed is satisfactory