

STONE CONSULTING ENGINEERS LTD.

CONSULTING CIVIL, STRUCTURAL AND
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Job No. 1870

Date: Jan 2019

QA INFORMATION

CLIENT:	Aaron Millar
JOB ID:	37 Hill Lane. Barnham
SCOPE OF WORK:	Soakaway Design
DESIGN CODES AND REFERENCES:	BRE 365
SOFTWARE:	MS EXCEL
SUB-SOIL/ FOUNDATION DATA:	N/A

MATERIAL DATA

CONCRETE:	
REINFORCEMENT:	
STEELWORK:	
TIMBER:	
OTHER:	Infiltration test by others (data included)

OTHER INFORMATION / NOTES

Rev - First issue

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Project:	37 Hill Lane, Barnham	Date:	Jan 2019	Made by:	KS	Sheet No.	1
CALCULATION SHEET		Job No.	1870	Chkd:	-	Rev.	0

Summary:

The site is underlain by 'Brickearth' overlying chalk. Groundwater monitoring on the site recorded a maximum winter (march) water table at a depth of 3.6m bgl.

Infiltration rates were measured for within the wider site and are used in this design.

The calculation is based on a 100 year return period with a 30% allowance for Climate Change.

The infiltration rates established from the soakage tests were undertaken in two trial pits. Soakaway designs have been based on the infiltration measurements for each test and the average of the two tests, and rationalised accordingly.

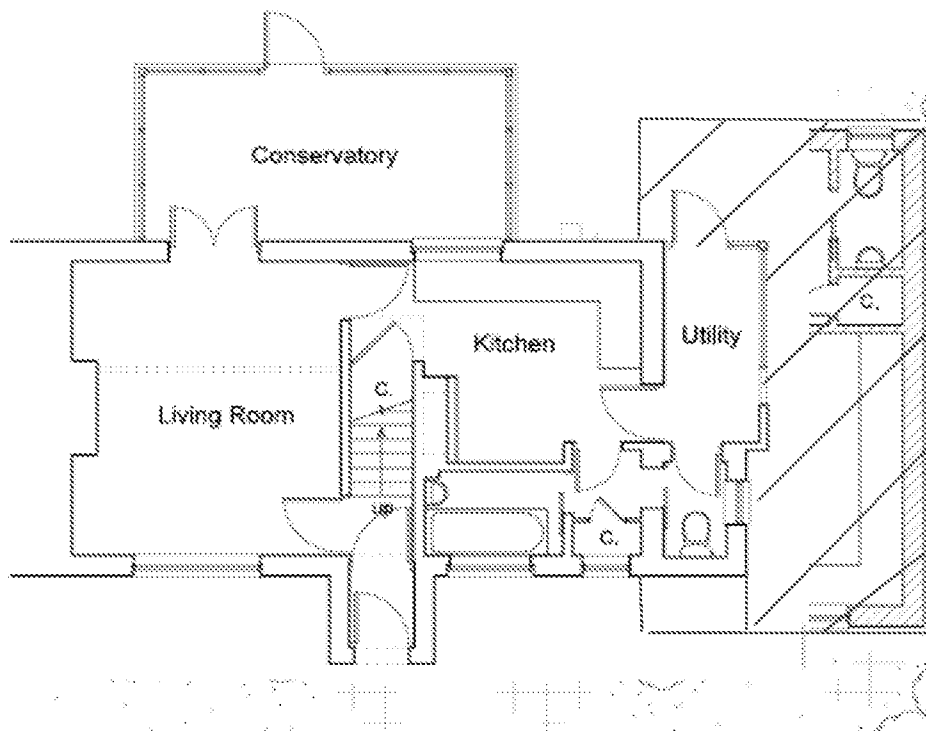
Storage volume:

For the proposed soakaway pit the storage volume is 6.6m³. A volume of 1.8m³ is required. Consequently the pit is able to attenuate outflow from a further 2.6 storm events.

Discharge rate:

The discharge rate is associated with poor draining ground and as such the soakaway performance is unable to empty by 50% in 24 hours. Using the average measured infiltration rate 50% discharge occurs in 47 hours and using the higher infiltration rate in 28 hours and 100 hours for the lowest infiltration rate.

In view of the significant additional capacity of the soakaway, and the fact that the soakaway is located in a garden, and hence any overflow would not be detrimental to the property or adjacent properties, and there would be minimal



New roof area (shown hatched) = **23.20** m²

Percolation test data supplied Infiltration rates

Test hole A

Infiltration rate, $f = 1.02\text{E-}06$ m/sec

Test hole B

Infiltration rate, $f = 3.50\text{E-}07$ m/sec

Average

Infiltration rate, $f = 6.85\text{E-}07$ m/sec

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SOAKAWAY DESIGN TO BRE(1991)

SOAKAWAY DETAILS

Ring		Pit/crates	
Soakaway size, Ds =	2.10 m	Length =	2 m
Depth of below invert, Hs =	1.50 m	Width =	1.5 m
		Depth below invert =	2.2 m
Free volume, S =	5.20 m ³		= 6.60 m ³
Rubble filled volume, S' =	1.56 m ³		= 2.18 m ³

INITIAL SOAKAWAY SIZING

Drained area to soakaway = 23.20 m²
 Climate change allowance = 30 %

INFLOW

Inflow, I = (run off area) x (design rainfall)
 = A x (M10-D)

DESIGN RAINFALL

Return period = 100 yrs
 Ratio of 60 min to 2-Day rainfalls of 5 year return period, r = 0.35 BRE(1991) Fig 1.

M5 rainfalls are calculated from table 1 (BRE 365) using Z1 factor

Storm duration (hrs)	Storm duration (mins)	Z1	M5-D (mm)	Z2 M10 (cor. Fac)	M10-D* rainfall	Z2 M100 Design	100 yr + 30%	
							rainfall	
0	5	0.36	7.2	1.19	11.14	1.84	17.22	
0	10	0.54	10.8	1.22	17.13	1.92	26.96	
0	15	0.65	13	1.23	20.79	1.96	33.12	
1	30	0.82	16.4	1.22	26.01	2.00	42.64	
1	60	1	20	1.24	32.24	2.03	52.78	
2	120	1.19	23.8	1.24	38.37	2.01	62.19	
4	240	1.39	27.8	1.22	44.09	1.97	71.20	
6	360	1.53	30.6	1.21	48.13	1.94	77.17	
10	600	1.7	34	1.2	53.04	1.90	83.98	
24	1440	2.07	41.4	1.18	63.51	1.81	97.41	
36	2160	2.38	47.6	2.18	134.90	1.75	108.29	

* including 30% for climate change

OUTFLOW

Soil infiltration rate*, f = 6.85E-07 m/sec
 effeptive storage depth, a(50) = H x .5 = 0.75 m (ring)
 Outflow /sec = 3.142 x Dia x a(50) = 3.39E-06 m3/sec (ring)
 effeptive storage depth, a(50) = H x .5 = 1.1 m (pit)
 Outflow /sec = 2(L + W) x a(50) x f = 5.27E-06 m3/sec (pit)

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STORAGE CAPACITY

$$\text{Storage capacity, } S = \text{Inflow} - \text{Outflow}$$

$$= I - O = [A \times (M10-D)] - O$$

Ring soakaway					Pit/crates soakaway	
Storm duration (hrs)	Storm duration (mins)	Inflow S(1) m ³	Outflow Max m ³	Required capacity m ³	Outflow Max m ³	Required capacity m ³
0	5	0.40	0.00	0.40	0.00	0.40
0	10	0.63	0.00	0.62	0.00	0.62
0	15	0.77	0.00	0.77	0.00	0.76
1	30	0.99	0.01	0.98	0.01	0.98
1	60	1.22	0.01	1.21	0.02	1.21
2	120	1.44	0.02	1.42	0.04	1.40
4	240	1.65	0.05	1.60	0.08	1.58
6	360	1.79	0.07	1.72	0.11	1.68
10	600	1.95	0.12	1.83	0.19	1.76
24	1440	2.26	0.29	1.97	0.46	1.80

Max required capacity =	1.97		=	1.80	
Max ring capacity =	5.20	OK	Free volume =	6.60	OK
Rubble filled volume =	1.56	FAIL	Rubble filled volume =	2.18	OK

Storage volume

Ring soakaway				Status
Diameter	2.10	m	Unfilled	OK
Depth below invert =	1.50	m	Filled	FAIL

Pit or terna ch				Status
Length =	2.00	m	Unfilled	OK
Width =	1.50	m	Filled	OK
Depth below invert =	2.2	m		

Select pit/crate soakaway	Additional capacity =	4.80 m3
	No storm events stored =	2.66

Discharge time

	Unfilled pit
Required soakaway storage volume =	1.80 m3
50 outflow area =	7.70 m2
Infiltration rate =	6.85E-07 m/s
Time for emptying soakaway to 50% volume	1.71E+05 sec
	<u>47 hrs 31 mins</u>

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Summary of soakaway performance

Based on TP 1

Discharge time

	Unfilled pit		
Required soakaway storage volume =	1.58 m3		
50 outflow area =	7.70 m2		
Infiltration rate =	1.02E-06 m/s		
Time for emptying soakaway to 50% volume	1.01E+05 sec		
	27.00 hrs	57.94	mins

Based on TP2

Discharge time

	Unfilled pit		
Required soakaway storage volume =	2.03 m3		
50 outflow area =	7.70 m2		
Infiltration rate =	3.50E-07 m/s		
Time for emptying soakaway to 50% volume	3.76E+05 sec		
	104.00 hrs	28.28	mins

Based on average infiltration from TP1 and TP2

Discharge time

	Unfilled pit		
Required soakaway storage volume =	1.80 m3		
50 outflow area =	7.70 m2		
Infiltration rate =	6.85E-07 m/s		
Time for emptying soakaway to 50% volume	1.71E+05 sec		
	47.00 hrs	30.65	mins