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Design of Soakaway in Accordance with

BRE Digest 365

At

Forgefield Lodge, Stocking Lane, Rathfarnham D16X9P2

Prepared by

Dr. Eugene Bolton
Senior Consultant
Trinity Green

Soakaway Design

The development consists of a single dwelling.
The total impermeable area of the extension is 142.51m2.

In order to design the soakaway the rate of infiltration of water into the soil was established (Appendix 1).
The infiltration test was conducted in accordance with the BRE 365 guidelines and an infiltration rate (f) of 3.06E-06 m/sec was established.
In estimating the rainfall volumes the data obtained from Met Erin was used. The rainfall under differing duration and return periods was estimated (Appendix 2).

Using stone as the support medium (30% void space) and if the depth of the soakaway is 0.6m below the inlet then the dimensions of the soakaway for the Driveway is:

Depth = 0.6 m (below level of invert), Width 1.5m and length 35.6m

Trench can be installed as several lengths with the total adding to 35.6m. Trenches should be 1.2m apart (Twice the depth)
A layer of geotextile material should be used on all sides of the trench to protect the stone from soil particle ingress (Appendix 3).
It is recommended that the edge of the soakaway should be 5m from the foundations of any building.
A silt trap should be installed before the soakaway with access available for inspection and maintenance (Appendix 3).

It is recommended that an inspection hatch be installed to allow for inspection and maintenance of the soakaway. All gullies and silt traps must also be left such that they can be accessed for cleaning.

Signed .....

Dr. Eugene Bolton
Senior Consultant
Trinity Green

21/08/2023

Appendix 1

Soil Infiltration Test

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Report on Soil Infiltration Test

Introduction

To manage the surface water from the proposed development it is proposed to construct Soakaways in accordance with BRE Digest365 As part of this, the infiltration capacity of the soil was assessed. Dr. Eugene Bolton of Trinity Green Environmental Consultants was commissioned to carry out soil Infiltration Tests in accordance with BRE Digest365 to establish the suitability of the site for disposal of water.

1.0 Visual assessment of Site

The site is located off Stocking Lane in Rathfarnham.
On the day of the tests there was no surface water present. There is no vegetation on the site or in adjoining area that would indicate poor soakage.

2.0 *Sub-soil profile*

As part of a Site Characterisation Report it was established that the upper horizon of the subsoil is a gravely clay down to 1m bgl. Below his and down to at least 2.2m bgl the subsoil is a gravely silt/clay.
The watertable was recorded at 1.9m bgl but mottling was present at 1.1m bgl.

4.0 Infiltration Tests

The Infiltration rate, generally expressed as metres per second, is the volume of water that enters the soil over a unit area and unit time. In order to obtain this measurement a pit is excavated and filled with water. The fall in the level of the water is recorded over time.
A new test pit was excavated that had dimensions

Length 1.3m
Width 0.3m
Depth 1.0m

.
The base of the pit was filled with water to a depth of 600mm and the drop in the water level was followed over time

5.0 Results

The time required for the level to fall from 75% full to 25% full (ie 50% drop) – from a water depth of 0.45m to a water depth of 0.15m is estimated to be 472min.

Table 1 – Time taken for water level to fall

Elapsed Time (Mins)	Depth of Water (mm)
0	600
33	480
53	440
94	390
134	350
205	300
289	240
361	200
433	170
521	150

Infiltration rate (f) = Volume of water used/unit exposed area /unit time

Volume = pit length (m) x Width (m) x Drop in water level (m)
= 1.3 x 0.3 x 0.3
= 0.117m3

Exposed area = (Length x Half the effective height x 2) + (Width x Half the effective height x 2) + Base area
= (1.3 x 0.3 x 2) + (0.3 x 0.3 x 2) + (1.3 x 0.3)
= 1.35m2

Time = 472min

Infiltration rate (f) = 0.117/1.35/472

= 1.8E-04 m/min

f = 3.06E-06 m/sec

6.0 *Conclusions*

From the above observation it is concluded that the soakage is reasonable but watertable is relatively high at 1.1m bgl.

Signed .....

Dr. Eugene Bolton
Senior Consultant
Trinity Green
21/8/2023

Photo

Trial Pit – Depth 2.2 – water settled at 1.9 bgl but Mottling present at 1.1m bgl
(Taken from Site Characterisation report 2020)

Test Pit before water added – Depth 1.0m

Pit during test

Appendix 2

Soakaway Design

Design of Soakaway for Surface Water Drainage

Designed in accordance with BRE Digest 365.

Date: 21/08/2023
Designed by: A. Reddy BE CEng MIEI

Details

Roof area (m^2)		143
Additional Impermeable area (m^2):		0
Trench width (m):		1.5
Effective depth (m):		0.6
Void ratio:		0.3
Infiltration Rate: (m/s)		3.1E-06
Percentage Increase for Climate Change (%)		20.0
Rainfall rates (mm):	**Unfactored**	**Factored**
M30-10	17.5	**21.0**
M30-15	20.6	**24.7**
M30-30	25.7	**30.8**
M30-60	32.2	**38.6**
M30-120	40.4	**48.5**
M30-240	50.5	**60.6**
M30-360	57.6	**69.1**
M30-720	72.2	**86.6**
M30-1440	90.4	**108.5**

Rainfall rates obtained from Met Eireann for this location.

Volume Equation: **I - O = S**

I = Inflow from the impermeable area drained to the soakway.
O = The outflow infiltrating into the soil during rainfall.
S = The required storage in the soakway to balance temporarily inflow and outflow.

Inflow to the Soakaway:

I = A * R

I = Inflow from the impermeable area drained to the soakway.
A = The impermeable area drained to the soakway.
R = The total rainfall in a design storm.

Duration D (mins)	(m^2)		Rainfall Rate (mm)	Volume Collected m^3
10	143	*	21.0	3.003
15	143	*	24.7	3.53496
30	143	*	30.8	4.41012
60	143	*	38.6	5.52552
120	143	*	48.5	6.93264
240	143	*	60.6	8.6658
360	143	*	69.1	9.88416
720	143	*	86.6	12.38952
1440	143	*	108.5	15.51264

Outflow from the Soakaway:

$O = a_{50} * f * D$

O = The outflow infiltrating into the soil during rainfall.
a_{50} = The internal surface area of the soakaway to 50% depth; this excludes the base area which may become clogged.
f = the soil infiltration rate.
D = The storm duration.

a_{50} = 2 * (1.5 + L)*(0.6 / 2)
= 0.9 + 0.6 L

O = (0.9 + 0.6 L) * (3.06E-06) * (D * 60)

Duration D (mins)				
10	O = (	1.65E-03	+ 1.10E-03	L)
15	O = (	2.48E-03	+ 1.65E-03	L)
30	O = (	4.96E-03	+ 3.30E-03	L)
60	O = (	9.91E-03	+ 6.61E-03	L)
120	O = (	1.98E-02	+ 1.32E-02	L)
240	O = (	3.97E-02	+ 2.64E-02	L)
360	O = (	5.95E-02	+ 3.97E-02	L)
720	O = (	1.19E-01	+ 7.93E-02	L)
1440	O = (	2.38E-01	+ 1.59E-01	L)

Soakaway Storage:

S = L * 1.5 * 0.6 * 0.3 = 0.27 L

	I	-	O		=	S
10 minute storm	3.003	-	1.65E-03	0.0011016 L	=	0.27 L
				3.00	=	0.27 L
				L	=	11.0709 m
15 minute storm	3.53496	-	0.002479	0.0016524 L	=	0.27 L
				3.53	=	0.27165 L
				L	=	13.0037 m
30 minute storm	4.41012	-	0.004957	0.0033048 L	=	0.27 L
				4.405163	=	0.2733 L
				L	=	16.1181 M
60 minute storm	5.52552	-	0.009914	0.0066096 L	=	0.27 L
				5.515606	=	0.27661 L
				L	=	19.94 m
120 minute storm	6.93264	-	1.98E-02	0.0132192 L	=	0.27 L
				6.912811	=	0.28322 L
				L	=	24.408 m
240 minute storm	8.6658	-	3.97E-02	2.64E-02 L	=	0.27 L
				8.626142	=	0.29644 L
				L	=	29.0993 m
360 minute storm	9.88416	-	5.95E-02	3.97E-02 L	=	0.27 L
				9.824674	=	0.30966 L
				L	=	31.7275 m
720 minute storm	12.38952	-	1.19E-01	7.93E-02 L	=	0.27 L
				12.27055	=	0.34932 L
				L	=	35.1274 m
1440 minute storm	15.51264	-	2.38E-01	1.59E-01 L	=	0.27 L
				15.27469	=	0.4286 L
				L	=	35.6361 m

Storm Duration	Required Soakaway Length (m)
10	11.07
15	13.00
30	16.12
60	19.94
120	24.41
240	29.10
360	31.73
720	35.13
1440	35.64

Try a soakaway of length **35.64** m with a storm duration of **1440** mins.

Internal surface area at 50% effective depth.

a_{50} = 1 + 0.6 L

= 22.28 m^2

Soakaway storage volume

S = 1.5 * 35.63605 * 0.6 * 0.3

S = 9.6 m^3

Check on time for emptying half storage volume, t_{s50}.

$$ts_{50} = \frac{S * 0.5}{a_{50} * f}$$

$$= \frac{9.6 * 0.5}{22.28 * 3.1E\text{-}06}$$

= 1175.99 mins

= 19.60 h (>24h)

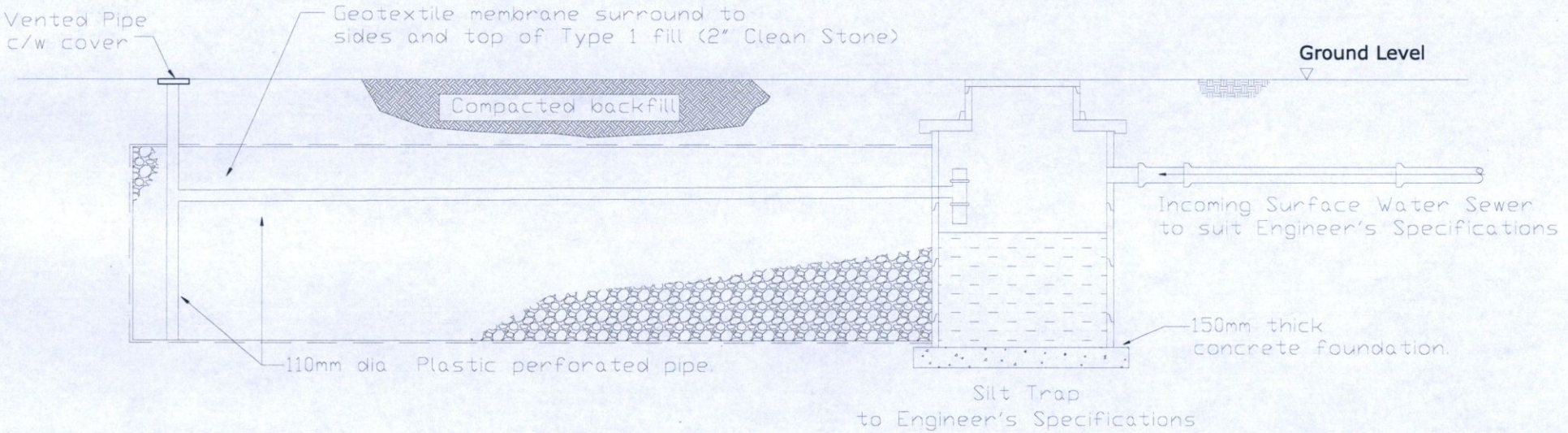
Therefore a soakaway of these **minimum dimensions** meet the design criteria set down.

Length = 35.64 m
Width = 1.50 m
Depth below invert = 0.60 m

Appendix 3

Silt Trap

RevNo	Revision note	Date	Signature	Checked



Itemref	Quantity	Title/Name, designation, material, dimension etc			Article No./Reference
Designed by EB		Checked by AB	Approved by - date EB - 12/05/06	File name SDL/EB	Date 09/05/06	Scale NTS

TYPICAL SOAKAWAY DETAIL

SLD/001	Edition 0	Sheet 1/1