

Design of Soakaway for Surface Water Drainage

Designed in accordance with BRE Digest 365.

Date: 06/07/2022
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Details

| | | |
|--|-------------------|-----------------|
| Roof area (m ²) | 25 | |
| Additional Impermeable area (m ²): | 0 | |
| Trench width (m): | 0.8 | |
| Effective depth (m): | 1 | |
| Void ratio: | 0.3 | |
| Infiltration Rate: (m/s) | 1.3E-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 | 25 | * | 21.0 | 0.525 |
| 15 | 25 | * | 24.7 | 0.618 |
| 30 | 25 | * | 30.8 | 0.771 |
| 60 | 25 | * | 38.6 | 0.966 |
| 120 | 25 | * | 48.5 | 1.212 |
| 240 | 25 | * | 60.6 | 1.515 |
| 360 | 25 | * | 69.1 | 1.728 |
| 720 | 25 | * | 86.6 | 2.166 |
| 1440 | 25 | * | 108.5 | 2.712 |

Outflow from the Soakaway:

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

- O = The outflow infiltrating into the soil during rainfall.
- a₅₀ = 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.

$$a_{50} = \frac{2}{0.8} * \left(\frac{0.8}{1} + \frac{L}{L} \right) * \left(\frac{1}{2} \right)$$

Duration D (mins)

| | | | | | | | | | | | | | | |
|------|-------|----------|---|----------|----|----|----------|---|---|---|---|---|----|---|
| | O = (| 0.8 | + | 1 | L) | *(| 1.30E-06 |) | * | (| D | * | 60 |) |
| 10 | O = (| 6.24E-04 | + | 7.80E-04 | L) | | | | | | | | | |
| 15 | O = (| 9.36E-04 | + | 1.17E-03 | L) | | | | | | | | | |
| 30 | O = (| 1.87E-03 | + | 2.34E-03 | L) | | | | | | | | | |
| 60 | O = (| 3.74E-03 | + | 4.68E-03 | L) | | | | | | | | | |
| 120 | O = (| 7.49E-03 | + | 9.36E-03 | L) | | | | | | | | | |
| 240 | O = (| 1.50E-02 | + | 1.87E-02 | L) | | | | | | | | | |
| 360 | O = (| 2.25E-02 | + | 2.81E-02 | L) | | | | | | | | | |
| 720 | O = (| 4.49E-02 | + | 5.62E-02 | L) | | | | | | | | | |
| 1440 | O = (| 8.99E-02 | + | 1.12E-01 | L) | | | | | | | | | |

Soakaway Storage:

| | | | | | | |
|-------------------|-------|-----|-----------|-----|----------|-------------|
| | $S =$ | | $L * 0.8$ | $=$ | 0.24 | L |
| | I | $-$ | O | $=$ | S | |
| 10 minute storm | 0.525 | - | 6.24E-04 | - | 0.00078 | L = 0.24 L |
| | | | | | 0.52 | = 0.24 L |
| | | | | | L | = 2.17782 m |
| 15 minute storm | 0.618 | - | 0.000936 | - | 0.00117 | L = 0.24 L |
| | | | | | 0.62 | = 0.24117 L |
| | | | | | L | = 2.55863 m |
| 30 minute storm | 0.771 | - | 0.001872 | - | 0.00234 | L = 0.24 L |
| | | | | | 0.769128 | = 0.24234 L |
| | | | | | L | = 3.17376 M |
| 60 minute storm | 0.966 | - | 0.003744 | - | 0.00468 | L = 0.24 L |
| | | | | | 0.962256 | = 0.24468 L |
| | | | | | L | = 3.93271 m |
| 120 minute storm | 1.212 | - | 7.49E-03 | - | 0.00936 | L = 0.24 L |
| | | | | | 1.204512 | = 0.24936 L |
| | | | | | L | = 4.83041 m |
| 240 minute storm | 1.515 | - | 1.50E-02 | - | 1.87E-02 | L = 0.24 L |
| | | | | | 1.500024 | = 0.25872 L |
| | | | | | L | = 5.79787 m |
| 360 minute storm | 1.728 | - | 2.25E-02 | - | 2.81E-02 | L = 0.24 L |
| | | | | | 1.705536 | = 0.26808 L |
| | | | | | L | = 6.36204 m |
| 720 minute storm | 2.166 | - | 4.49E-02 | - | 5.62E-02 | L = 0.24 L |
| | | | | | 2.121072 | = 0.29616 L |
| | | | | | L | = 7.16191 m |
| 1440 minute storm | 2.712 | - | 8.99E-02 | - | 1.12E-01 | L = 0.24 L |
| | | | | | 2.622144 | = 0.3523 L |
| | | | | | L | = 7.44251 m |

| Storm Duration | Required Soakaway Length (m) |
|----------------|------------------------------|
| 10 | 2.18 |
| 15 | 2.56 |
| 30 | 3.17 |
| 60 | 3.93 |
| 120 | 4.83 |
| 240 | 5.80 |
| 360 | 6.36 |
| 720 | 7.16 |
| 1440 | 7.44 |

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

Internal surface area at 50% effective depth.

$$a_{50} = 1 + 1 L$$

$$= 8.24 \text{ m}^2$$

Soakaway storage volume

$$S = 0.8 * 7.442507 * 1 * 0.3$$

$$S = 1.8 \text{ m}^3$$

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

$$t_{s50} = \frac{S * 0.5}{a_{50} * f}$$

$$= \frac{1.8 * 0.5}{8.24 * 1.3E-06}$$

$$= 1389.14 \text{ mins}$$

$$= 23.15 \text{ h} \quad (>24\text{h})$$

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

Length = 7.44 m
Width = 0.80 m
Depth below invert = 1.00 m