BUILD RIGHT

Soak pits

When a soak pit is required, a building consent application with calculations for pit sizing must be lodged. So, how do you make the calculations?

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SOAK PITS, also known as soakaways or soakage pits, are required for properties with no reticulated stormwater system provided by the council for removing water run-off from roofs and hard sealed surfaces. They can be:

- a hole filled with rocks (see Figure 1)
- a lined underground chamber with porous sides and base (see Figure 2), into which surface water can drain and be dispersed by percolation or soakage into the surrounding soil
- a series of factory-made plastic drop-in modular interlocking infiltration cell blocks wrapped in geotextile fabric.

All options must be lined with a filter cloth with a mass per unit area of 140 grams/m² and a minimum thickness of 0.45 mm.

In addition to water dispersal, a soak pit must also provide water storage to ensure water that drains into the soak pit will not overflow before soakage has occurred.

Their efficiency depends on their size, the permeability of the ground (the rate at which soakage occurs) and the rainfall intensity of the region.

Building consent required

Where a soak pit is required, a building consent application with calculations for soak pit sizing must be approved by the building consent authority.

Guidelines for soak pit design, including sizing, are provided in Verification Method E1/VM1 to New Zealand Building Code clause E1 *Surface water* or can be obtained from your local council.

Steps for designing a soak pit

The first step in designing a soak pit is to determine the soakage rate of the natural ground. This is done by conducting a percolation test and, from the results of the test, determining the soakage rate.

Conduct a percolation test

E1/VM1 provides a percolation test method in paragraph 9.0.2. Percolation testing should be done when the groundwater is high and is carried out as follows:

1. Drill a test hole 100–150 mm in diameter for the expected depth of the soak pit. If groundwater is struck before the expected depth is reached, the depth of the ground water is taken as the maximum depth of the soak pit.
2. Fill the hole with water and maintain it for at least 4 hours to presoak the ground.
3. Refill the hole with water to 750 mm below the ground level (if possible).
4. Measure and record the drop in water level at 30-minute intervals maximum until the water is approximately 250 mm from the base of the hole or for 4 hours, whichever occurs first.
5. Plot the results of the fall in the water level against the time it takes on a graph.

Determine the soakage rate

Using the results of the water level drop rate from the minimum slope of the curve on the graph over a 10-minute period, determine the soakage rate (mm/hour) using the formula:

soakage rate (S_r) = 6 × (water level drop in mm) / 10 minutes.

Where there is a significant decrease in soakage rate as the hole empties, disregard the lower rates and use a value closer to the average.

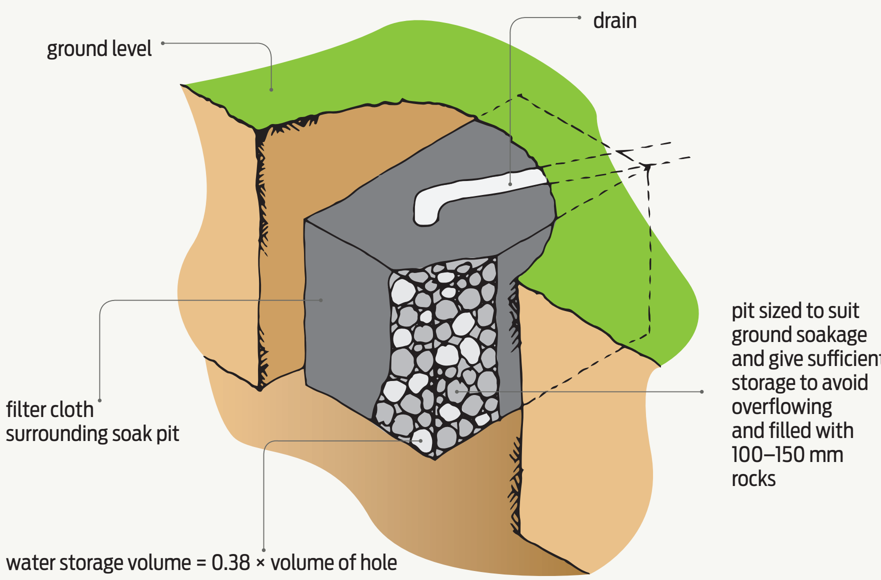

Figure 1 **Rock soak pit.**

Calculate volume of storage required

Once the soakage rate is determined, the volume of storage required (in m³) can be calculated according to the formula given in E1/VM1 paragraph 9.0.5 as follows:

$V_{stor} = R_c - V_{soak}$

where R_c = run-off from catchment to soak pit in 1 hour (m³)

V_{soak} = volume disposed of by soakage in 1 hour (m³)

and R_c = 10 CIA

where C = run-off coefficient (from E1/VM1 Table 1)

I = rainfall intensity (mm/hr) based on 1 hour duration of an event having a 10% probability of occurring annually

A = area (in hectares) of the catchment discharging to the soak pit

and $V_{soak} = A_{sp}S_r/1000$

where A_{sp} = area of the base of the soak pit (m²)

S_r = soakage rate (mm/hr).

Rainfall intensity (I) is based on rainfall with a 1 hour duration and a 10% probability of occurring annually. Information about rainfall intensity can be obtained from local rainfall intensity curves produced by the building consent authority or from rainfall frequency duration information from NIWA.

Ways to reduce soakage capacity

The effectiveness of soak pits can be increased by storing or retaining stormwater on site with water storage tanks, areas planted in trees and shrubs that soak up water and irrigated areas.

When these are incorporated, the soakage capacity of a soak pit may be reduced if supporting calculations are provided.

Check for other council requirements

Soak pits should be located above the winter water table and not on a stormwater secondary flow path.

Most local authorities have specific requirements for soak pits, such as minimum distances from boundaries and existing buildings. These should be checked before making a soak pit application.

Soak pit maintenance needed annually

Soak pits require maintenance to prevent them becoming blocked with silt, vegetation or other matter that may cause flooding problems.

Maintenance and cleaning should be done annually by a company that specialises in the cleaning and maintenance of soak pits.

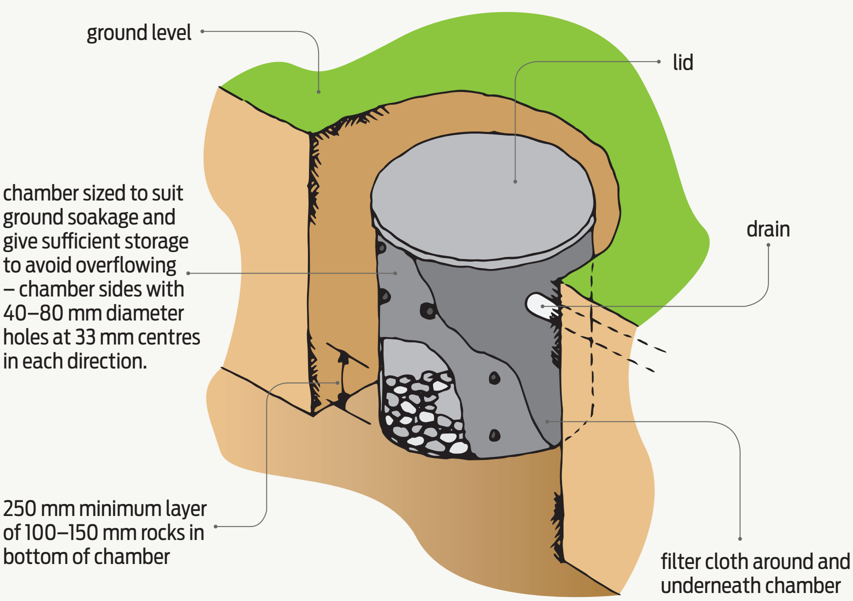

Figure 2 **Chamber soak pit.**

Calculate soakage rate and storage

Use the E1/VM1 formula: $V_{stor} = R_c - V_{soak}$

Step 1: Get the soakage rate from the percolation test

Assume that, from a percolation test, the soakage rate (S_r) has been calculated at **300 mm/hour**.

Then, where the soakage rate is:

- more than 500 mm/hour, soakage rather than storage is the main factor in the design of the soak pit
- significantly less than 500 mm/hour, storage becomes the main factor in the design
- around 500 mm/hour, the soak pit design must consider both soakage and storage to make sure that water will disperse into the ground before it overflows.

Step 2: Assess the stormwater catchment volume (R_c)

Use the formula: R_c = 10 CIA

Assume: Roof area = 200 m²

Paved area = 50 m²

Total run-off area (A) = 250 m² (0.025 ha)

Use run-off coefficient (C) = 0.9 (from E1/VM1 Table 1 for hard surfaces)

Rain intensity (I) = 70 mm/hour

R_c = 10 CIA

$R_c = 10 \times 0.9 \times 70 \times 0.025$

$R_c = 15.75\ m^3$

Step 3: Calculate the volume of water disposed by soakage (V_{soak})

Use the formula: $V_{soak} = A_{sp}S_r/1000$

Assume: Soak pit size = 5.0 m × 3.0 m × 2.0 m = 30 m³

The soak pit is to be a hole filled with rocks. (When calculating the size of a soak pit, the volume of water storage available for a rock-filled hole is 0.38 times the volume of the hole.)

So: $V_{stor} = 0.38 \times 30\ m^3 = 11.4\ m^3$

Calculate: A_{sp} (area of base of soak pit) = 5.0 m × 3.0 m = 15 m²

$V_{soak} = 15 \times 300/1000$

$V_{soak} = 4.5\ m^3$

Step 4: Calculate storage volume required

Use the formula: $V_{stor} = R_c - V_{soak}$

$V_{stor} = 15.75\ m^3 - 4.5\ m^3 = 11.25\ m^3$

$11.25\ m^3 \leq 11.4\ m^3$ so soak pit sizing is OK.