

# Septic tanks

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## *Septic tanks*

Septic tanks are watertight chambers sited below ground level which receive excreta and flushwater from flush toilets and other domestic sullage (collectively known as wastewater). The solids settle out and break down in the tank. The liquid remains in the tank for a short time before overflowing into a sealed soakaway or drainfield where it infiltrates into the ground. A permeable soil is essential for the soakaway to function properly.

Septic tanks must be emptied periodically (for instance, every three years) and the solids disposed of hygienically. This is usually done with a vacuum tanker.

Septic tanks allow safe disposal of wastewater, particularly in rural areas where it might otherwise go directly into rivers. Septic tanks can also be used in urban areas (provided a suitable site for the soakaway is available) but other options such as pour flush latrines, aquaprivies or sewerage may also be selected, based on financial and technical factors. Septic tanks can be later connected to small-bore sewers if so desired. Further information concerning small-bore sewerage and other forms of sewerage are covered in Fact Sheet 3.11.

Septic tanks have the advantages of little maintenance, isolation and partial treatment of excreta, few odour or fly problems, and the possibility of subsequent connection to a sewerage system. Their disadvantages are high cost of construction ; the need for periodic mechanical emptying ; the need for large volumes of flushing water ; and the fact that soakaways can overflow if not designed, built and operated properly. Septic tanks are only suitable where flush toilets are used and there are reasonably large amounts of domestic sullage to be disposed of. They are therefore most likely to be built where there is a house connection to a water supply.

Septic tanks produce liquid effluent which must be disposed of by infiltrating into the ground. The liquid effluent contains large numbers of germs which are dangerous. It is important that they are only disposed of by infiltration, thus septic tanks should only be built where the soil is permeable and the liquid effluent they produce will infiltrate. Where soils are very permeable, however, there is a risk of groundwater contamination from soakaways, particularly where the water table is high.

The permeability of soil can be assessed by measuring the percolation rate, as described in Fact Sheet 3.6. If the percolation rate is 15 mm/h or more, then it is usually considered that the soil has sufficient percolative capacity for a septic tank soakaway or drainfield to be constructed. When the soil has a percolation rate of below 15 mm/h, then excreta disposal options which do not require soakaways or drainfields should be sought. Where results are marginal, local experience may indicate the appropriateness of these technologies.

## *Where to build a septic tank*

The septic tank should be :

- Downhill and the minimum safe distance from any drinking water source. This is site specific and should be established for each water source on the basis of local hydrological and hydrogeological conditions.

A distance of 30 metres has been suggested by some workers as standard practice. It is recommended that this figure is taken as a guide to establishing a minimum safe distance, in the absence of local information.

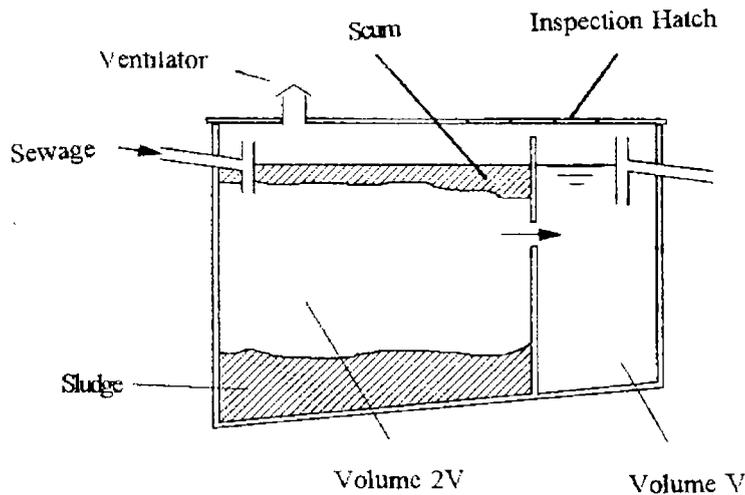
The soakaway should be :

- Downhill and the minimum safe distance from any drinking water source.
- At least 3 metres from the septic tank.

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## *Building the septic tank*

The septic tank should be designed to hold three times the volume of waste water flowing into it every day. This allows the solid material to settle out. It is best to build a septic tank with two compartments, the first compartment being twice the size of the second (see Figure 1).

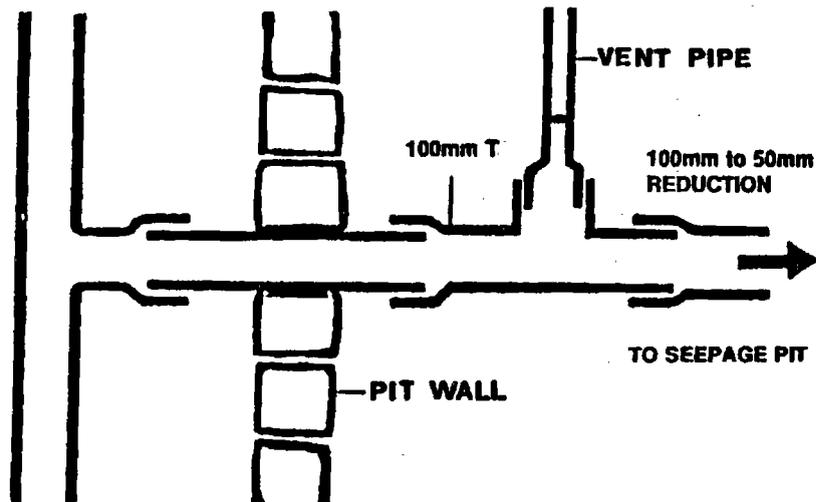


**Figure 1. Two-compartment septic tank**

The volume of the tank should be at least 1.5 cubic metres, with an additional 300 millimetres space above the water level.

Building a septic tank should be undertaken by skilled or semi-skilled individuals. Experience of working with concrete is essential. The general steps to be followed are described below :

- *Estimate the required volume. If it is possible to estimate the volume that will flow into the tank daily, then the tank should hold three times this volume of liquid. A family generally uses from 0.5 cubic metres to 1.5 cubic metres per day.*
- *Design the tank. There should be 300 millimetres of space between the level of the liquid and the roof, to allow for an overflow. There should be a wall dividing the tank into two compartments - the first being twice the volume of the second. The two compartments should be joined by a pipe at the level of the outlet. The inlet, compartment connector and outlet overflow pipes are generally of 100 millimetre diameter PVC pipe.*
- *Build a reinforced concrete floor. Build up the walls, including the dividing wall. Incorporate the inlet, outlet and compartment connector pipes in the walls as they are built. The walls are most commonly made of reinforced concrete, bricks or mass concrete. Mass concrete will be the preferred material, except for small septic tanks.*
- *The tank should be waterproof. Render the inside with cement mortar. Add "T" junction pipes to the inlet, outlet and compartment connector pipes, as shown in Figure 2. These are to protect against scum blocking the pipework or being carried over into the seepage pit.*



**Figure 2. Septic tank pipework**

- Add a reinforced concrete roof with an inspection hole over each compartment of the tank. Make reinforced concrete covers with handles for the inspection holes. The covers should either be of the sanitary type or be cemented into place using a very sandy mortar mix. This is to stop flies and vermin getting into the tank or odours getting out. The mortar can easily be broken to remove the covers.

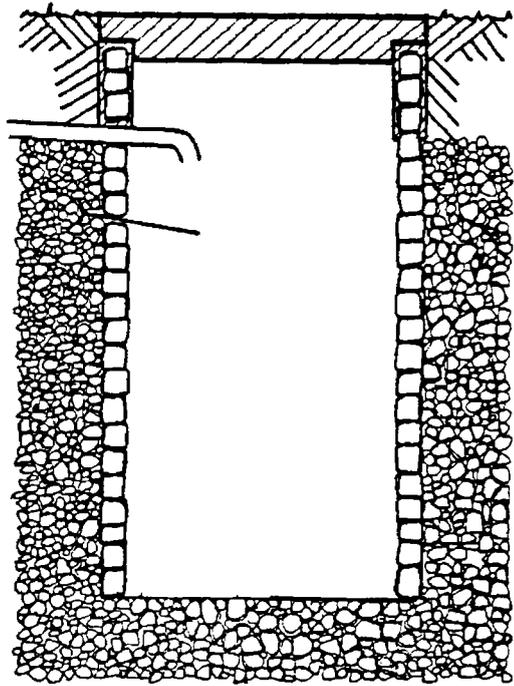
### *Final disposal of liquid waste*

Care must be taken with the liquid part of the wastewater, as it contains many germs which are dangerous to health. The outlet of the septic tank should carry the liquid part of the wastewater to a soakpit or drainfield, where it will soak into the ground and any organic material in the effluent will be broken down by bacteria in the soil. The outlet pipe should be laid with a slight slope (1 in 100).

### *Soakaway*

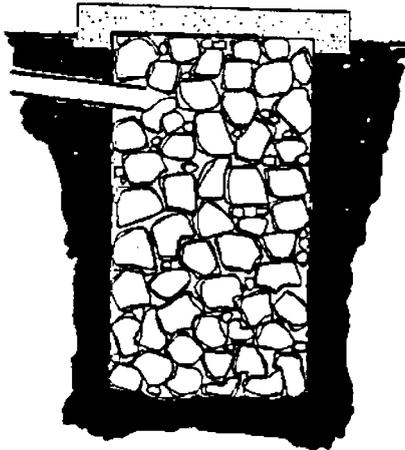
A typical soakaway for a family septic tank would be about one metre in diameter, or square, and 2.5 metres deep.

The soakaway can be lined with unmortared brick or stones as shown in Figure 3. A splash plate should be added to prevent cavitation or boring in the soakaway, as well as to distribute the flow.



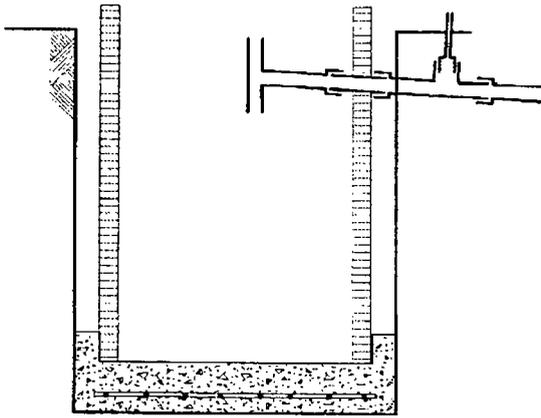
**Figure 3. Lined soakaway**

Alternatively, the seepage pit can be unlined and back-filled with rocks or stone, as shown in Figure 4.



**Figure 4. Unlined, back-filled soakaway**

The soakaway should be covered with a concrete lid, or with well-compacted clay or soil, to stop flies getting into the pit. The outlet pipe from the septic tank must enter the soakaway close to the top (see Figure 5).

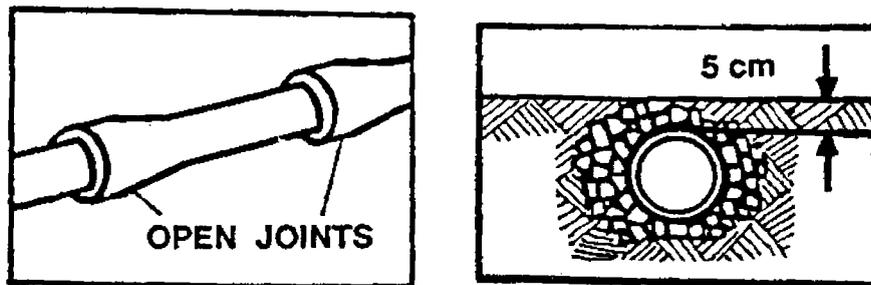


**Figure 5. Outlet from septic tank to soakpit**

## Drainfields

The liquid from a septic tank outlet can also be disposed of using drainfields. These are long lines of ceramic pipes with open joints buried in a trench just below the surface of the ground. The liquid seeps out of the joints and into the ground. Two trenches 450 millimetres wide, 450 millimetres deep and 30 metres long should be dug and then filled to a depth of 300 millimetres with gravel.

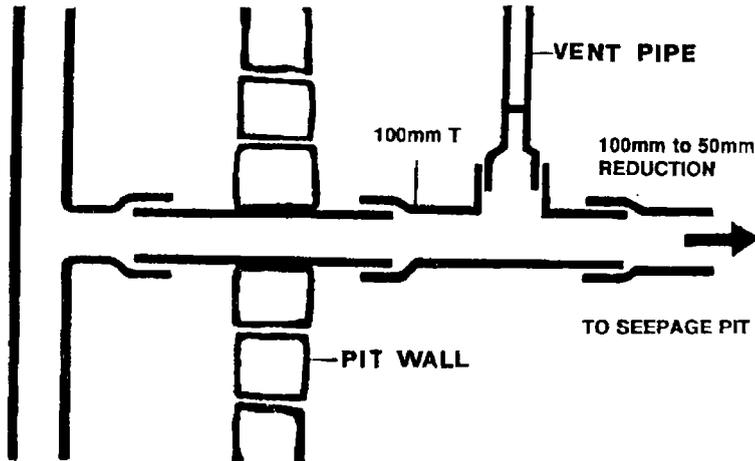
Ceramic sewer pipes, 100 millimetres in diameter, with bell and spigot joints, are the best type for building drainfields. A space of 6 to 12 millimetres should be left between pipes to allow the liquid to seep out. The pipes should be laid at a slight gradient (1 in 500 or 0.2 per cent) to help distribute the liquid to the whole length of the drainfield. After laying, the pipes should be covered with a layer of gravel to a depth of 50 millimetres above the pipes (see Figure 6).



**Figure 6. Drainfields**

## Vent pipe

A vent pipe is required to allow the gas, formed in the septic tank by breakdown of excreta, to escape. The vent pipe can be installed on the sewer pipe running from the house to the septic tank, using a 100 millimetre diameter PVC "T" and a PVC reduction from the 100 millimetre diameter sewer size to 50 millimetres in diameter. The vent pipe layout is shown in Figure 7. The vent pipe should be 50 millimetres in diameter, reach roughly half a metre above the top of the house and have a fly screen covering the end.



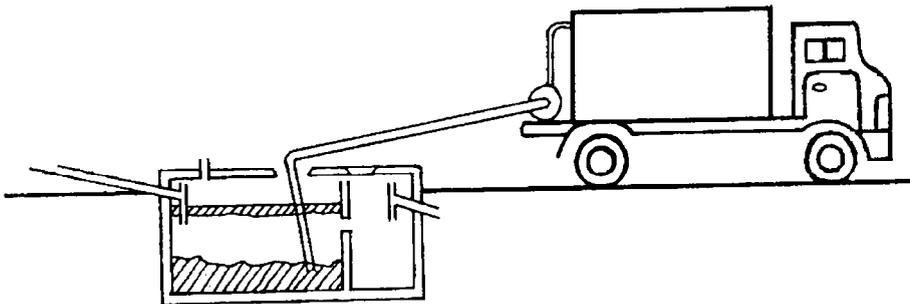
**Figure 7. Vent pipe**

### *Operating the septic tank*

Never use strong alkalis or disinfectants such as chlorine bleach in the septic tank. These chemicals will destroy or slow down the biological processes in the tank.

Before commissioning the septic tank, it should be filled with water up to the outlet level and, if possible, two buckets of sludge from a working septic tank or cow manure should be added to seed the tank with bacteria. This will make the tank more efficient from the start.

The septic tank fills slowly with sludge from the solid waste entering the tank. Every three to five years, the tank must be emptied of sludge. Usually this is done using a tanker with a suction pump, as shown in Figure 8.



**Figure 8. Desludging a septic tank with a tanker and suction pump**

Both soakaways and drainfields can block after a few years of use and the liquid will overflow. To stop this happening, the soakaway or drainfield should be checked every year and a new one built before the liquid starts to overflow and becomes a health hazard.