

# Waterlines

## Technical Brief N°24/Groundwater dams

Groundwater dams are artificial structures that intercept or obstruct the natural flow of groundwater and provide storage for water underground.

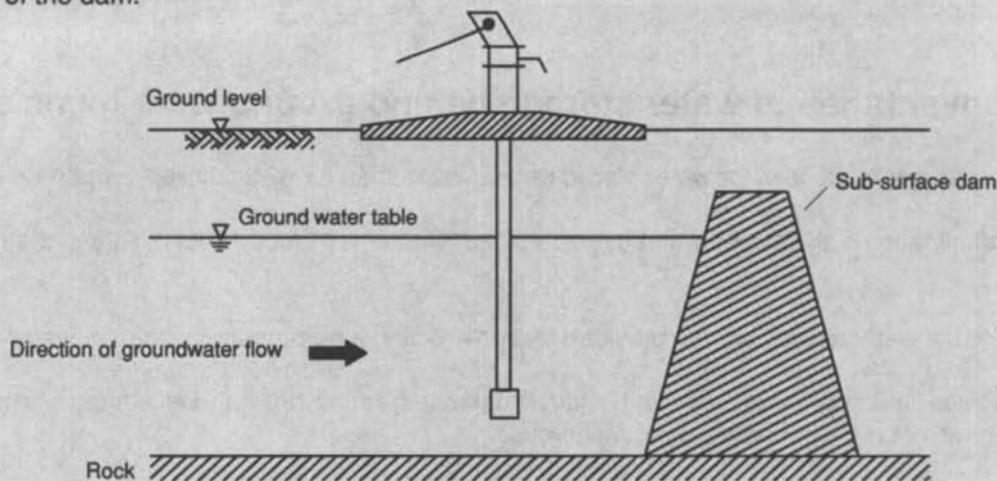
They have been in use for many hundreds of years and are used in several parts of the world nowadays. Their use is in areas where flows of groundwater vary considerably during the course of the year, from very high flows following rain to negligible flows during the dry season.

Groundwater dams provide storage to regulate the flow of groundwater and to provide constant storage for a reliable water supply. Excess water flows over the top of the dam to replenish aquifers downstream.

**There are two main types of groundwater dam:**

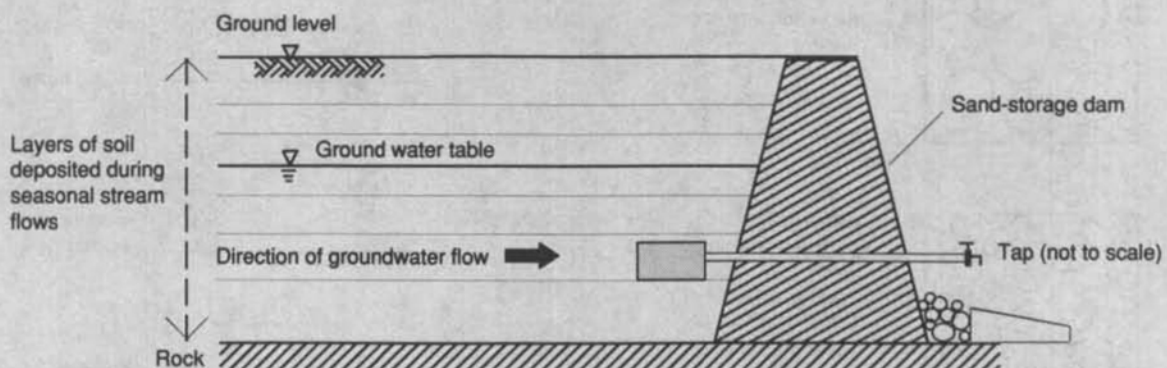
### The sub-surface dam

A sub-surface dam intercepts or obstructs the flow of an aquifer and reduces the variation of the level of the groundwater table upstream of the dam.



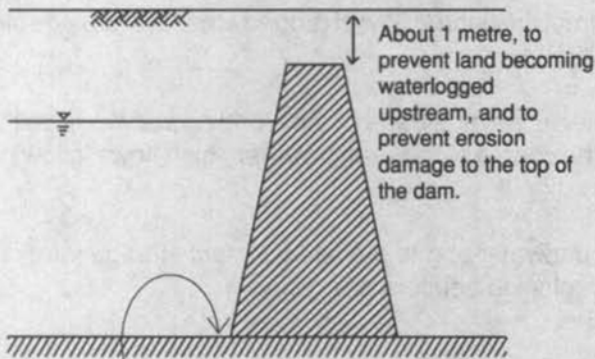
### The sand storage dam

A sand storage dam obstructs the seasonal flow of water in streams. Sand and soil particles transported during periods of high flow are deposited behind the dam, and water is stored in these soil deposits.



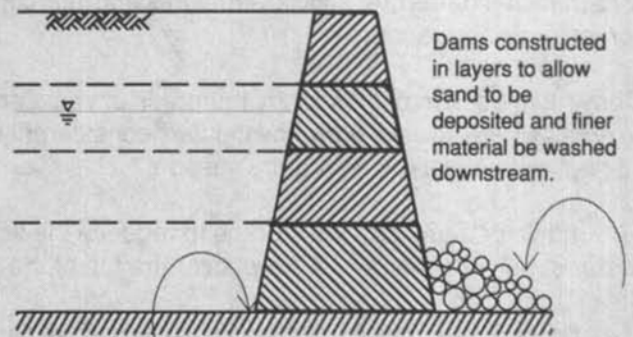
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## Sub-surface dams



Base of dam founded on firm rock or clay. Loose material to be removed, and any cracks sealed.

## Sand storage dams



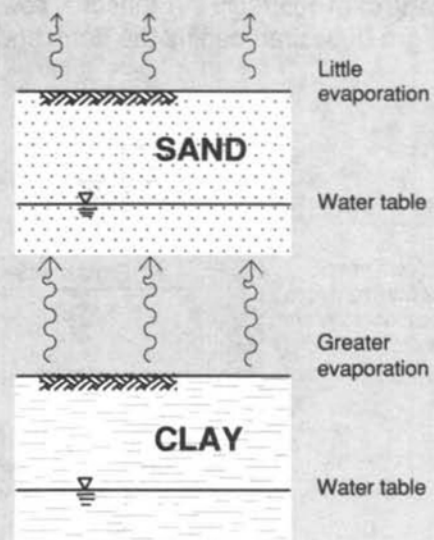
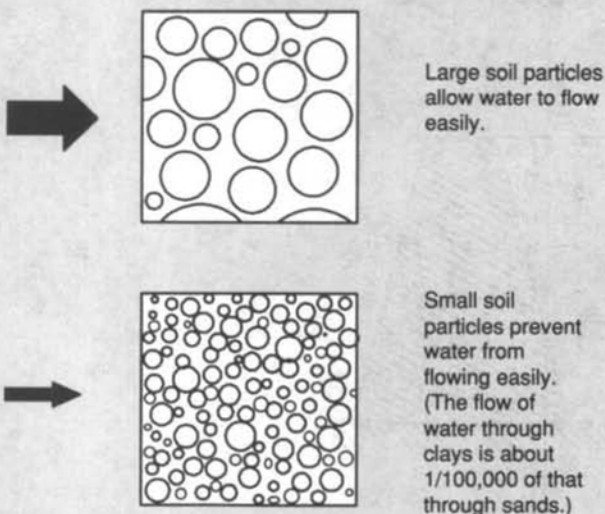
Base of dam founded on firm rock or clay. Loose material to be removed, and any cracks sealed.

Protection in front of and at ends of dam to prevent erosion of the stream bed and banks.

## The advantages of water storage behind groundwater dams are:

- Evaporation losses are much less for water stored underground than for water stored in open reservoirs.
- The risk of contamination of the stored water by people and animals is reduced because the underground water is protected.
- A clean and reliable water source can be provided by constructing a permanent system for water collection.
- Insects and parasites (such as mosquitoes and Bilharzia parasites) cannot breed in water that is stored underground. Similarly, algae will not grow in underground reservoirs.

The full reservoir volume behind a groundwater dam is not available for storage of water, which can only be held in the spaces between soil particles. Sand is a better soil for storage than the finer silts and clays, because water flows more easily through sands, more stored water can be collected from sands, and sands reduce evaporation losses.

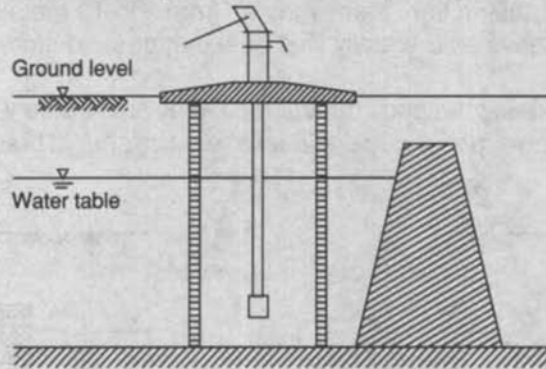


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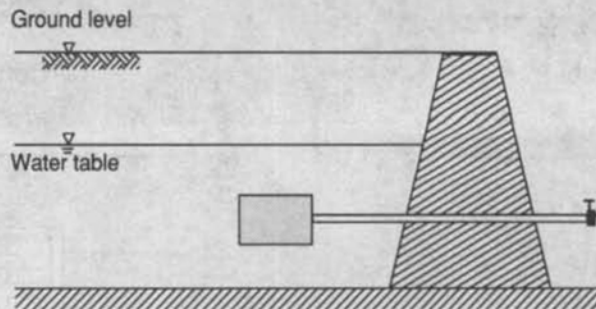
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## Water may be obtained from the underground reservoir either:

a) from a well upstream of the dam and preferably fitted with a handpump. (This may be used with either type of dam.)

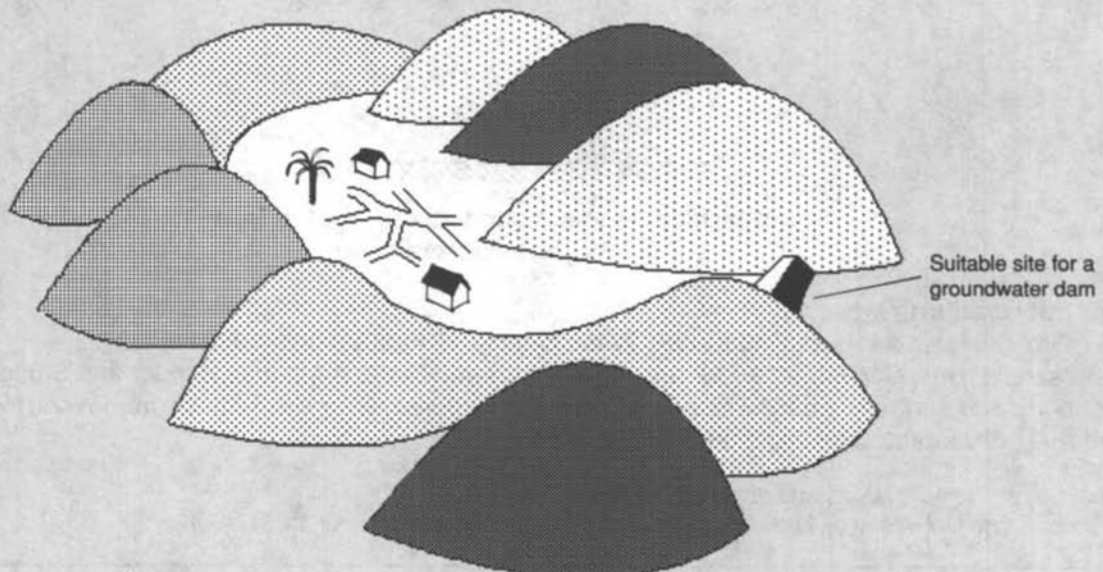


b) from a pipe, passing through the dam, and leading to a collection point downstream. (This is most suitable for sand storage dams.)



### Sites for construction

The best sites for construction of groundwater dams are on gently sloping land (typically slopes of from 1:500 to 1:25) where the soil consists of sands and gravels, with rock at a depth of a few metres. Ideally the dam should be built where rainwater from a large catchment area flows through a narrow passage.

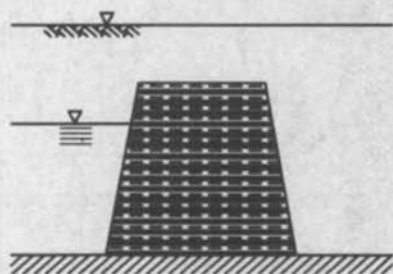


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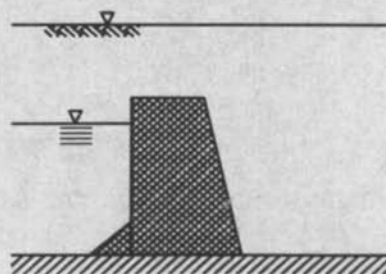
## Materials for construction

Various materials may be used for the construction of groundwater dams. Some of these are illustrated. Materials should be waterproof, and the dam must be strong enough to withstand the imposed soil and water loads. Depending upon the strength of the material used for construction, dams may be from 2 to 10 metres high. The diagrams below show materials for sub-surface dams but they could equally well be used for sand storage dams.

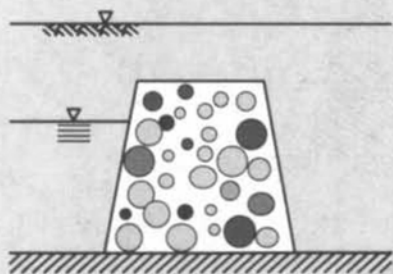
**Warning:** Dams need to be carefully designed and constructed if they are to safely carry imposed loads from soil and water without collapsing. Advice from an experienced engineer should be sought before construction starts on any dam.



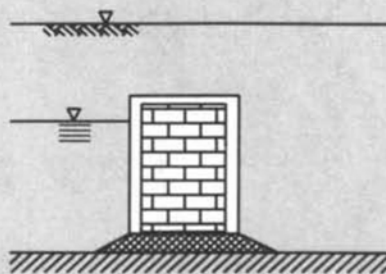
Compacted clay



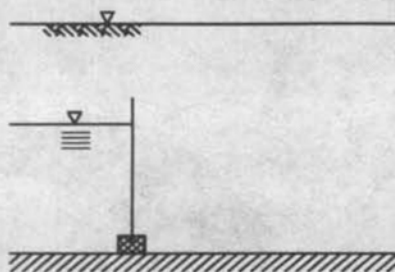
Concrete



Stones and clay



Masonry or brick wall covered with plaster on a concrete base



Impermeable sheet such as corrugated iron or PVC on concrete base

### For further information:

Nilsson, A., *Groundwater Dams for Small-scale Water Supply*, IT Publications, 1988.

Nissen-Petersen, E., *Rain Catchment and Water Supply in Rural Africa: A Manual*, Hodder and Stoughton, 1982.

World Neighbors. *Sub-surface dams. A water catchment system built by villagers*, Filmstrip from World Neighbors, 5116 N. Portland Ave., Oklahoma City, Oklahoma 73112, USA.

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