

The siphon drain® process is an innovative and proven solution to slope stability problems developed by TP Geo in France.

#### Principles

Wells are inserted in a vertical or inclined borehole in or above the unstable zone of a slope.

The wells are then pumped using a siphon drain® driven by the fall in elevation of the slope.

The wells reduce the pore pressure in the slope increasing the effective stress and stabilising the slope.

#### Automatic control

The priming of the siphon is controlled by an automatic flushing system located at the downstream outlet of each siphon pipe.

This system enables the siphon to operate intermittently at low flows, thus maintaining the prime by preventing the build up of air in the siphon.

At high flows the flushing system automatically switches to continuous running.

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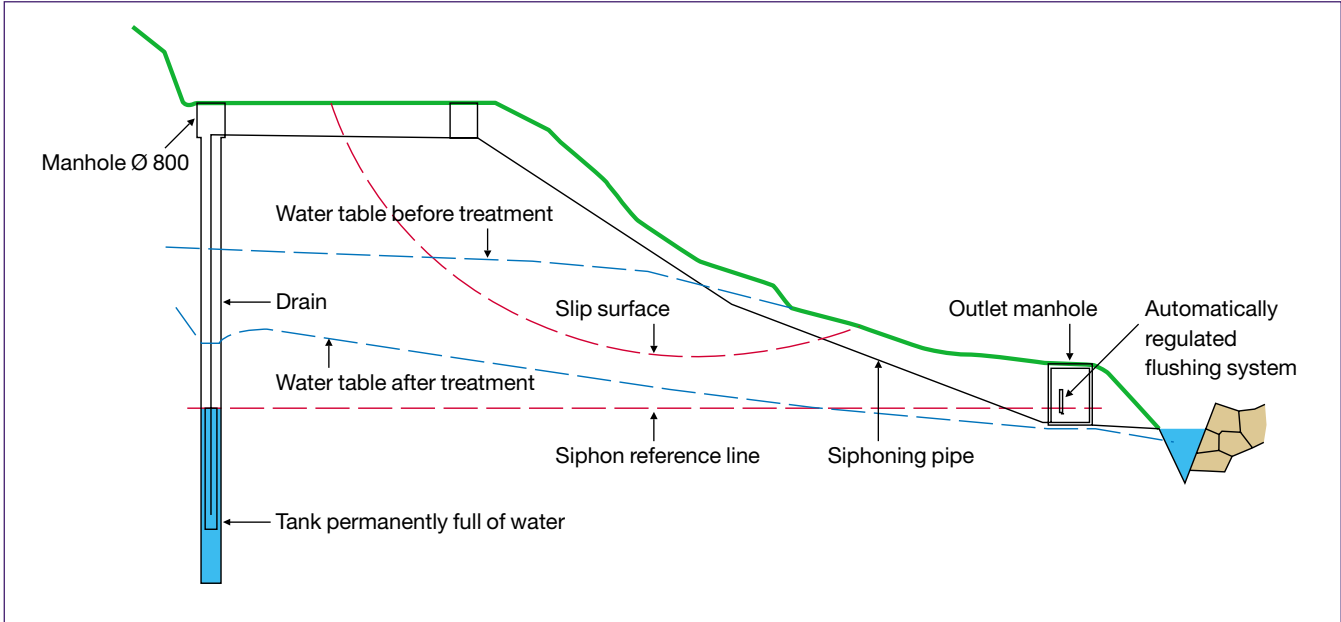


**front**  
 Outlet manhole with flushing system installed

**below left**  
 Well manhole with duct for siphon tubes

**left**  
 Unstable slope – Langres, East of France

**below**  
 Installation at Langres



Section showing well and siphon drain® installation

**Effective and efficient**

The siphon drain® system is a very effective solution to slope stability problems in terms of adaptability and durability.

Maintaining a low water table level prevents the build up of localised pore-water pressures in the unstable zone of a slope.

The water table can be lowered to 8.5 metres vertically below the surface when the suction inlet is placed at 10 metres below the crown of the siphon.

Depending on the gradient of the slope, it is possible to achieve greater effective lowering of the water table if the length and the slope of the wells are modified.

Alternatively greater drawdown can be achieved with pneumatic wells.

Both the diameter and the number of siphon pipes depend on the drainage flow. Diameters range from 10mm for 150 litres/hour per well, to 25mm for 1m³/hour per well.

**History**

The first siphon drain® system was installed by TP Geo in 1986 and remains in use today. Since then about 200 siphon drain systems have been installed in Europe. Examples are:

- 200 metre landslide treated with 40 siphon drains®, Rhone-Alpes, France
- Five landslides treated on public roads, Normandy, France
- 80 metre landslide treated with 15 siphon drains®, Champagne-Ardenne, France
- Three sites treated in Sestriere, Valtournanche, Varazze, Italy
- One site treated with 116 siphon drains® and 35 pneumatic wells at Castlehaven, Isle of Wight, United Kingdom