34. Protecting springs — an alternative to spring boxes

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Many publications describe the protection of springs from contamination using spring boxes similar to the one in Figure 1.

The construction of such a structure takes time and money, and in many cases it may not be really necessary.

x?

A spring box can be useful as:

- where particles of sand carried in the spring water can settle out.
- , which is useful for springs where the peak rate of demand exceeds the rate of flow of the spring.
- A method of from contamination.
- A way of by giving it an easy flow path from the aquifer into a delivery pipe.

... water from a spring can be without a spring box,

... because the water carries only a low level of suspended solids,

... because the water flows at a rate sufficient to meet the peak demand...

x .

x

■

Protecting springs — an alternative to spring boxes

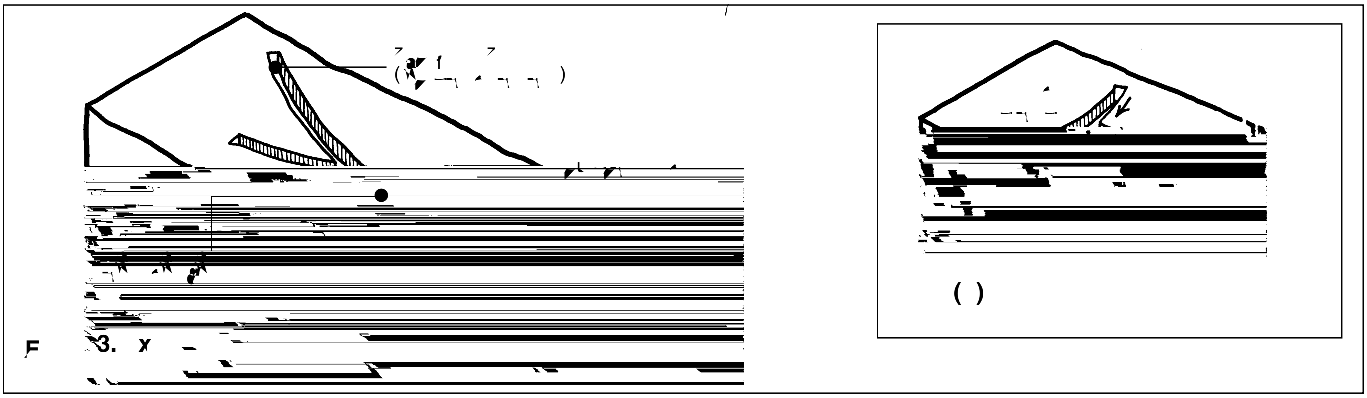
1.

First, check the following:

- Does the community want the spring protected?
- Are local construction materials available?
- Is the community willing to contribute by way of organization, money, labour, materials, transport, etc.?
- Check the existing spring flow rate (e.g. by inserting a pipe into a clay dam at the overflow point and by recording the time taken to fill a container of known volume — see Figure 2). By protecting the spring you may be able to achieve an increased flow, but consider whether there is likely to be enough water to meet the demand.
- During what season of the year are you measuring the flow? Has the community noticed a change of flow with season?
- Latrines, animal pens, etc. uphill of the spring pose a pollution risk. They should be at least 50m away.
- The site needs to slope sufficiently to dispose of surface water and wastewater.

2.

- Clear the site of bushes, long grass, etc.
- Starting at the highest point(s) at which there is evidence of water issuing from the soil, excavate narrow trenches uphill following the direction from which most of the water is flowing. Stop when the trench is about 1.0m deep if sufficient water is flowing into the end of the trench from the 'eye' of the spring. If there is more than one main source then several trenches can be joined.
- If there are no main flow paths it may be necessary to excavate a seepage trench across the slope, to intercept water seeping through the aquifer (see Figure 3).

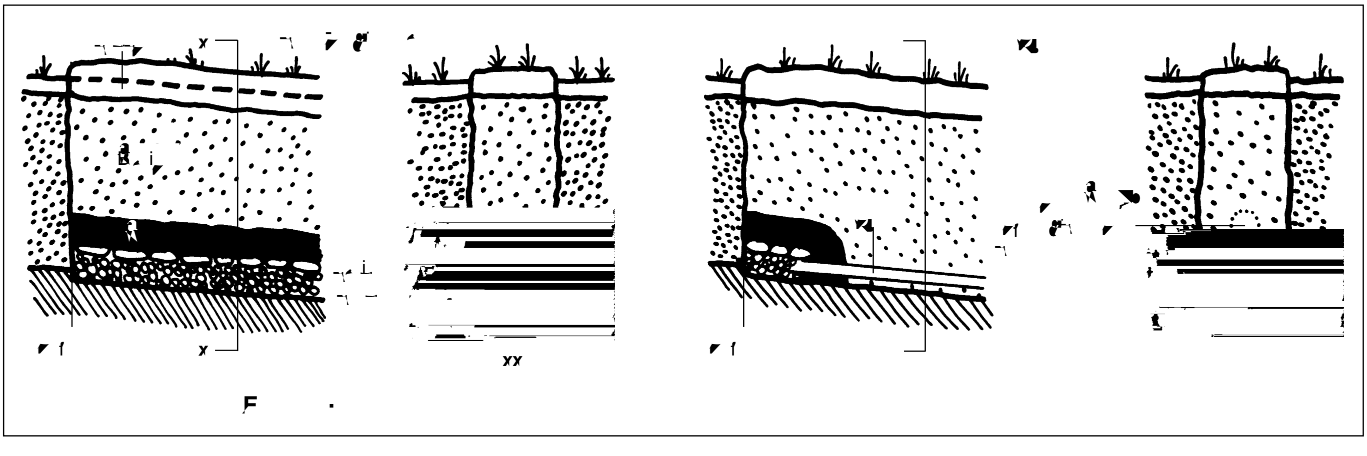


3.

The spring eye at the head of the trench should be surrounded with clean stones through which water can flow into the trench. Stones of between 10 and 40mm diameter are usually suitable for this, but larger ones can be used. A layer of stones about 100mm deep will usually suffice, and this should then be covered with a layer of rocks and a layer of 'puddled clay' about 100mm deep. This clay is prepared by wetting and kneading it underfoot until it is uniformly plastic. Its purpose is to prevent surface water and grains of backfill material from entering the stone-filled channel. (See Figure 4.)

Once the clay has been trodden into place the remainder of the trench can be backfilled. The excavated material can be used, and it should be compacted by foot in layers of about 100mm. The final layer in the trench should be of topsoil, which is raised a little above the ground to compensate for the future settlement of the backfill. This topsoil should be planted with creeping grass plants to prevent soil erosion.

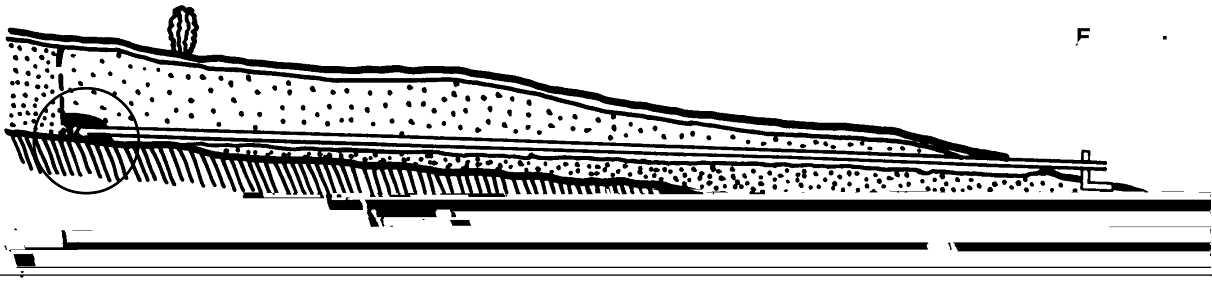
It is useful for future reference to measure and record the positions of the spring eyes from some permanent features, such as the corners of the headwall, so that if problems occur the eyes can be found again quickly. Alternatively, a large flat stone can be embedded in the topsoil on the surface above the eye to mark its position.



There are two options for conveying the water from the protected source to the headwall:

■ - If the bottom of the trench that you have dug to the eye is in fairly impermeable strata, and if it is smooth and sloping, then it can be backfilled with a layer of stones in a similar way to that already explained and shown in Figure 4. Water can then flow between the stones and along the trench to the headwall.

■ If it is affordable, a 30-50mm internal-diameter plastic pipe can be used to carry the water. This has three advantages:
  - it eliminates the water losses that can occur from stone-filled trenches;
  - it protects the spring water from pollution as it travels to the headwall; and
  - if desired, and if the topography is suitable, the pipe can allow a delivery point to be above ground. This means that a large excavation for the headwall and for the wastewater drain is avoided, and only a small headwall structure is needed to support the delivery pipe.



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1.

The headwall needs to be constructed in dry conditions. During construction the flow of spring water into the excavation can be prevented in two ways:

■ By using a temporary clay dam in the main trench to divert the water into a diversion trench (see Figure 3).

■ By carrying the water over the excavation in a pipe or locally made gutter (e.g. of bamboo or split banana tree trunk) supported on forked sticks (see Figure 7).

F 7. X

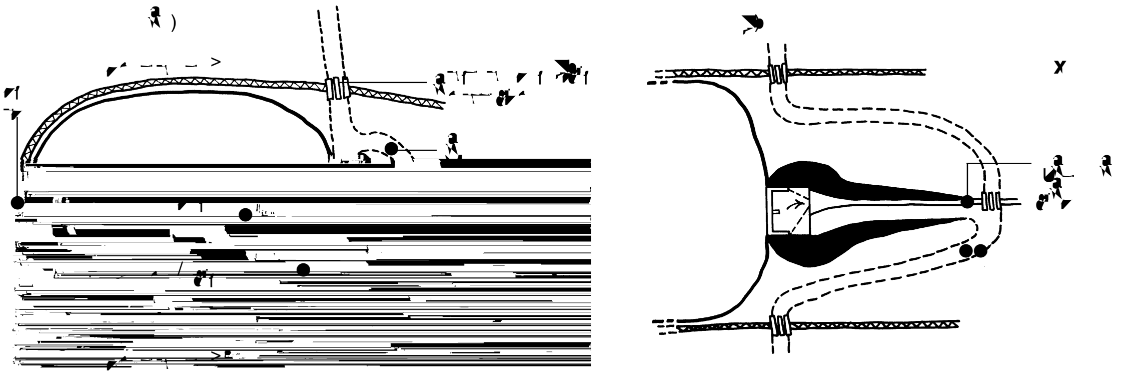
F .

2.

A variety of materials can be used to build the headwall, but well-burnt bricks, concrete blocks, or stones laid in a 1:3 cement:sand mortar are the most common materials. Small wingwalls at right angles to the headwall help to support it against the soil pressure. A drainage layer behind the headwall prevents hydrostatic forces from acting on the wall.

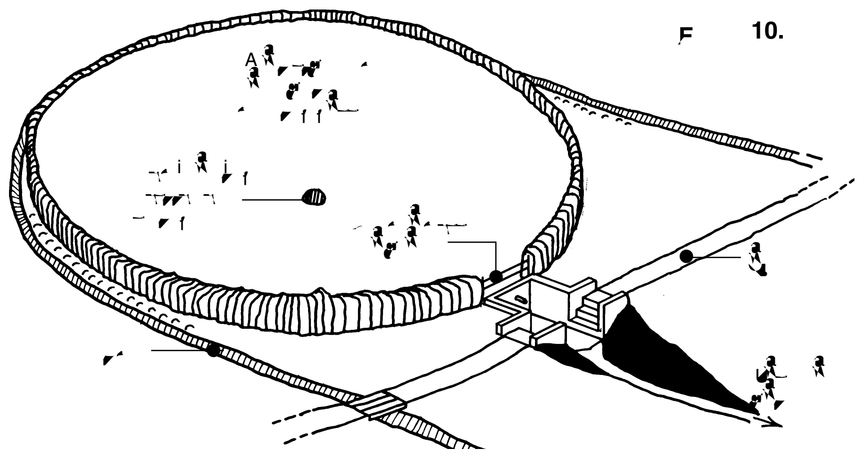
3.

The purpose of the apron slab and steps is to give users convenient access to the delivery pipe. The apron slab also protects the wall foundations and it should slope to discharge wastewater into the drain. If the users approach from both sides of the spring, then two sets of steps may be provided, or a simple footbridge can be built across the drain. It may be possible to avoid the use of steps altogether by providing access alongside the drain serving the apron slab.



F 9.

The area immediately above and uphill of the spring eyes needs to be fenced off to prevent pollution from people or animals. The fence should extend at least 10m uphill of the spring eyes. To prevent polluted surface water from flowing through the fence onto the site of the spring, a free-draining ditch should be constructed uphill of the fence. The alignment of the ditch needs to be chosen to suit the topography before the fence is built beside it. A hedge of animal-resistant bushes usually makes a good permanent fence. The area inside the fence should be planted with creeping perennial grass if it is available, and other vegetation should be cut down to keep the area tidy and to prevent roots from penetrating the spring water trenches.



F 10.