

Appendix 1: Drainage – Guide Sheets

1.5a: Cross drain – positioning, placing the first side stone.

Side Stones:

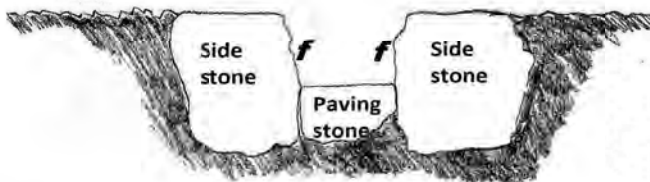
Dig a trench where you want the cross drain to be. (Unlike a waterbar, this can go straight across without being angled.)

The stones will fit in the trench as shown here:

Faces of side stones along here - - - - -

Paving stones here - - - - -

Faces of side stones along here - - - - -

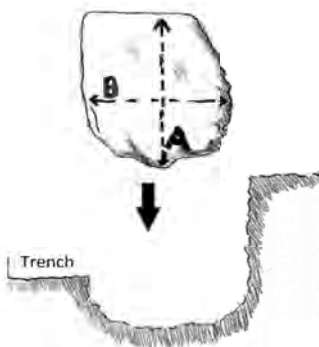
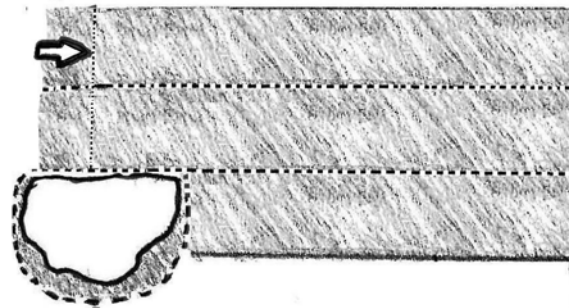


The faces of the side stones (*f*) are vertical, or sloping back slightly. They should not lean forward as they would get pushed over. The drain should be wide enough to be cleaned out with a spade. Width can be

varied according to expected water flow but must not be too wide to step over easily. Side stones are buried at least 1/3 below the top of the paving stones.

The drain extends beyond the edge of the path by about 30cm.

Measure the first stone and mark the approximate shape of the hole it will need. Make adjustments to the trench so that the stone will fit.



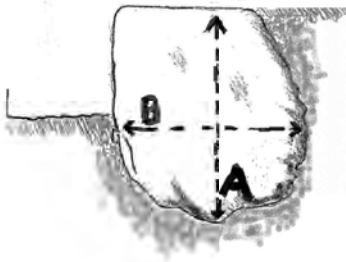
Measure the stone where it is deepest (A) and widest (B).

keep the sides of the hole vertical – or the stone will get stuck and will not drop to the bottom.

(Continued, 1:5b Cross drain – side stones (continued))

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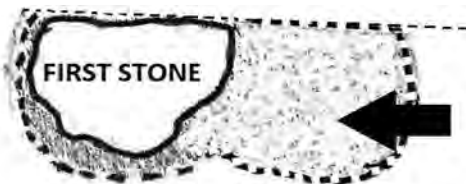
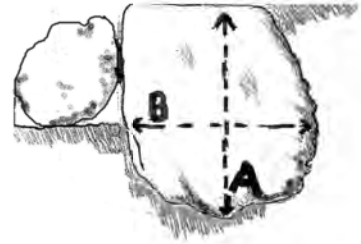
1.5b: Cross drain – side stones (continued)



Pack earth around the stone and make it secure.

Check: is the face vertical? Is the top level with the path behind it?

If necessary, use another stone to provide temporary support while you work around it.



Prepare a hole for the second stone.

Put the second stone in and make adjustments until the tops and faces are in line, and the stones fit tight together.
Repeat until all the side stones are in.

Next: line the channel with paving stones: see *1.5c: Guide to Construction – Cross Drain, Paving Stones*.

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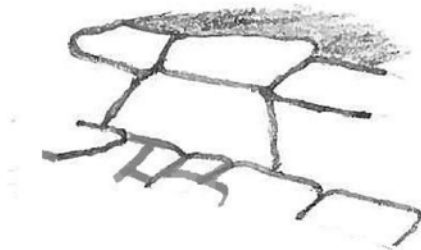
1.5c: Cross drain - paving stones.

When the two sides are built, **lay a 'floor' of paving stones** between them. Try to choose stones which fit together without gaps.

It's OK to use a small stone to fill a gap between paving stones if an exact fit isn't available. This should be **built in, not pushed in** at the end as it would soon wash out.

The paving stone 'floor' should slope down from the end where the water comes in from the side drain to the end where it leaves the cross drain. **The slope should fall about 9cm for every 1m of length.** but can vary depending on how much water is expected. (Upland Path Advisory Group, *Upland Pathwork*, 2-4)*. Start building at the low end and work towards the high end.

Adjust the depth of the trench to get the top of each paving stone to the right height.



Paving stones should fit tight against the **side stones** and should fit closely together. Joints between paving stones should not be next to joints between bar stones.

* *Upland Pathwork* gives the recommended slope in degrees: 5 – 10 degrees for a cross drain. The formula to convert from degrees to a ratio is:

degrees x 1.75 x metres = fall in cm.

So for a drain which is sloping at 5 degrees and 3m long:

$5 \times 1.75 \times 3 = 24.75\text{cm}$

This approximates to 8 or 9 cm fall per 1 metre length.

This is quite steep compared to a waterbar, so it is OK to vary it according to the expected volume of water, but bear in mind that a strong flow of water helps to clear debris from the drain.

See also: 1.6a - *Extra information for building stone waterbars and drains*