B FIELD EXAMPLE

This example shows the construction of a spring catchment and a water point with an adjoining washing area, carried out by ACF in Ethiopia. The water point is designed for continuous distribution of water (without a tap), installed at the end of a water supply line (20 to 200 m). The adjoining laundry area, in the form of a low slab, is supplied by an open channel.

1 Spring catchment

The spring catchment is shown in Figure 10.8. It is fed by four infiltration galleries from four springs, a maximum of 20 metres away. Water from all four springs is required because of their low flow.

The materials used in the Ababuo spring are shown in Table 10.V.

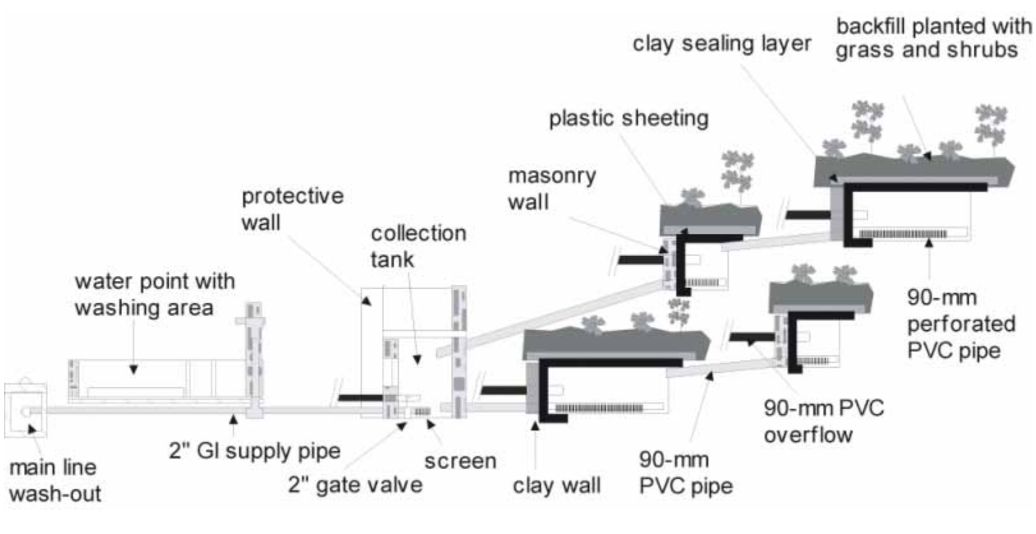

Figure 10.8: Spring catchment.

Table 10.V: Materials and cost of a spring catchment.

Site: Ababuo Number of beneficiaries: 605 (123 families)
Kebele: Sundusa
Woreda: Soro Starting date: 16/11/92
Area: Hadya Hand-over to beneficiaries: 17/08/93

MATERIALS AND EQUIPMENT	Quantity	Unit cost (US$)	Total (US$)
Building materials			
cement (50 kg)	37	15	74.00
sand (100 kg)	110	5	73.33
stone (m^3)	35	10	46.67
8-mm reinforcement (12-m bars)	30	30	120.00
6-mm reinforcement (kg)	7.5	20	20.00
binding wire (kg)	5	10	6.67
barbed wire (m)	200	0.9	24.00
wood for fence	1	300	40.00
nails	8	12	12.80
metal door	1	175	23.33
Plumbing materials			
2" GI			
tee	2	35	9.33
socket	5	25	16.67
2" / 1"1/2 reducer	2	25	6.67
plug	1	20	2.67
union	1	50	6.67
gate valve	1	90	12.00
pipe (6 m)	5	200	133.33
1" 1/2 GI			
tee	1	30	4.00
elbow	1	20	2.67
pipe (1.40 m)	1	35	4.67
PVC			
90 mm pipe (6 m)	49	100	653.33
50 mm pipe (6 m)	3	24	9.60
TOTAL 1			1 302.40

LABOUR	Number	Working days	Cost/day (US$)	Total (US$)
Foreman	1	28	21	78.40
Mason	2	54	18	259.20
Assistant mason	4	54	12	345.60
Project assistant	1	52	19	131.73
Mechanic	1	28	18	67.20
Driver	1	54	16	115.20
Stonemason	1	43	12.5	71.67
Labourers	4	32	6	102.40
TOTAL 2				1 171.40
LOGISTICS				
Transport				533.48
Storage				128.07
TOTAL 3				661.55
ADMINISTRATIVE COSTS				275.40
TOTAL 4				275.40
GENERAL TOTAL				3 410.75
Cost per beneficiary				5.64

2 Water points

The following technical description lists the stages of construction:
– earthworks,
– foundations,
– concrete reinforcement,
– slab,
– plumbing,
– masonry,
– constant-level channel,
– drainage channel.

The materials used and the time required for constructing the water point are shown in Table 10.VI (water point with one outlet, water supply in 1”1/4 GI, drainage channel 5 m long).

Table 10.VI : Resources necessary for the construction of a water point.

Activity	Labour (man/day)	Stone (m^3)	Sand (m^3)	Gravel (m^3)	Cement (50 kg)	6-mm bars (kg)	8-mm bars (12 m	Plumbing fittings
Excavation	4 labourers							
Foundations	1.5 masons							
	4.5 assistant masons	4.1						
Reinforcement	2 masons							
	6 assistant masons					15	9 bars + 2 kg binding wire	
Slab	2 masons							
	6 assistant masons		0.625	1.25	10			
Plumbing	1 plumber							union (1); tee(2)
	1 labourer							socket (2); nipple (1); elbow (1); plug (2); GI pipe (1.25 m)
Masonry	2 masons	0.65	0.35		3			
	6 assistant masons							
Constant-level channel	0.006 mason 0.018 assistant mason	0.002	0.001		0.25 l			75 mm PVC pipe or GI 2”1/2 (0.10 m)
Dainage channel + toe	3 masons 9 assistant masons	0.795	0.225	0.24	2.8	13 + 0.5 kg binding wire		
TOTAL (rounded)	11 masons 33 assistant masons 1 plumber 5 labourers	5.6	1.3	1.5	16	28 + 2.5 kg binding wire	9 bars	

2.1 Earthworks

Earthworks include all the various tasks involved in preparing the ground for the water point and washing area. The choice of location of the spring is first of all linked to the slope: a minimum slope of 3% is necessary for the supply line, and 1% for the water point channels and drainage channel. Therefore, it is necessary to choose the location which best meets these conditions, while minimising the length of the transmission line from the spring, to limit costs.

The water point (Table 10.VII) is marked out with wooden stakes or similar materials and cord (4-mm diameter nylon). Right angles must be checked with a square.

Table 10.VII: Quantities of excavation for the siting of a water point.

Area required	3.00 m x 4.80 m = 14.4 m^2	
Depth of foundations	0 → 1.65 m 1.65 → 4.80 m	Depth = 0.40 m Depth = 0.45 m
Excavated volume	6.25 m^3	
Labour	4 man/days	

2.2 Foundations

The depth of the foundations is variable, and depends on the nature of the ground. The depths used in ACF constructions are quite large, and can be used in relatively unconsolidated ground (Figure 10.92 & Table 10.VIII).

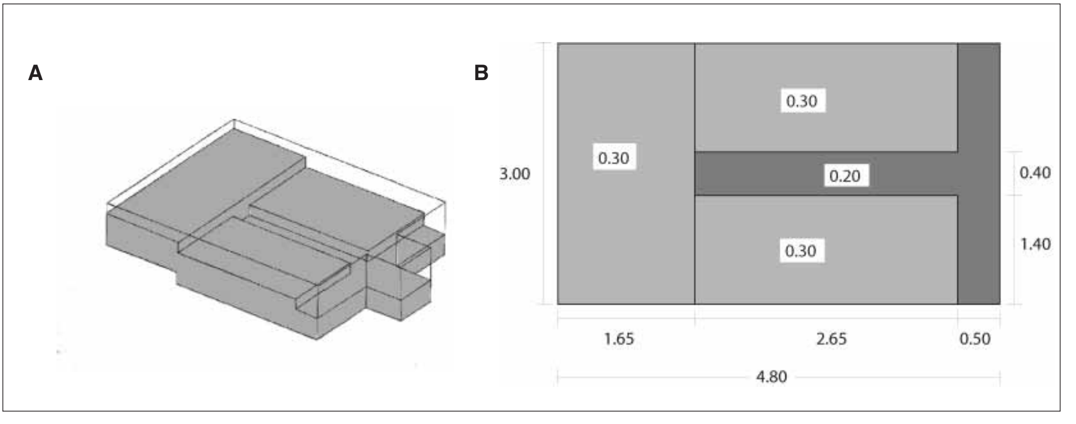

Figure 10.9: Foundations of tapstand and laundry area.
A: perspective view. B: plan.

Table 10.VIII: Quantities of foundation works for a tapstand.
These foundations extend 0.10 m beyond the slab to provide sufficient bearing.

Thickness of coarse stone	0 → 1.65 m 1.65 → 4.80 m	Depth = 0.30 m Depth = 0.20 to 0.30 m
Total volume of stone	4.1 m^3	
Labour	1.5 mason/days 4.5 assistant mason/days	

2.3 Reinforced-concrete slab

The slab is made of reinforced concrete. The first part of the work is to prepare and place the reinforcement which will be embedded in the concrete (Figure 10.10). The second operation is pouring the slab.

The concrete is reinforced with 8-mm (twisted) and 6-mm (smooth) reinforcement bars, alternated, in a 0.20-m mesh (Figure 10.10). The bars are curved at the ends to provide better anchorage in the concrete.

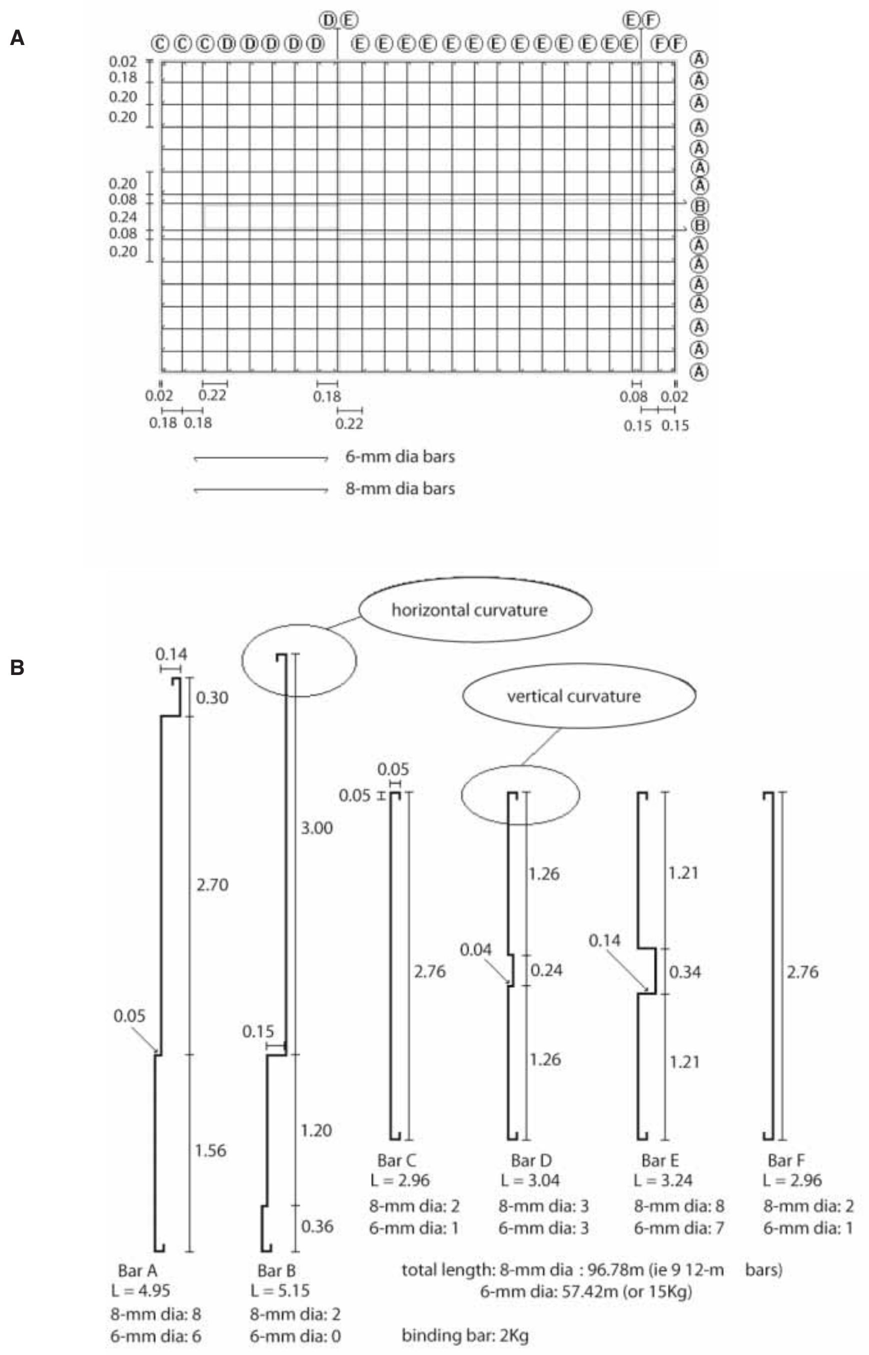

Figure 10.10: Slab reinforcement plan.
A: general plan. B: diameters of the different bars

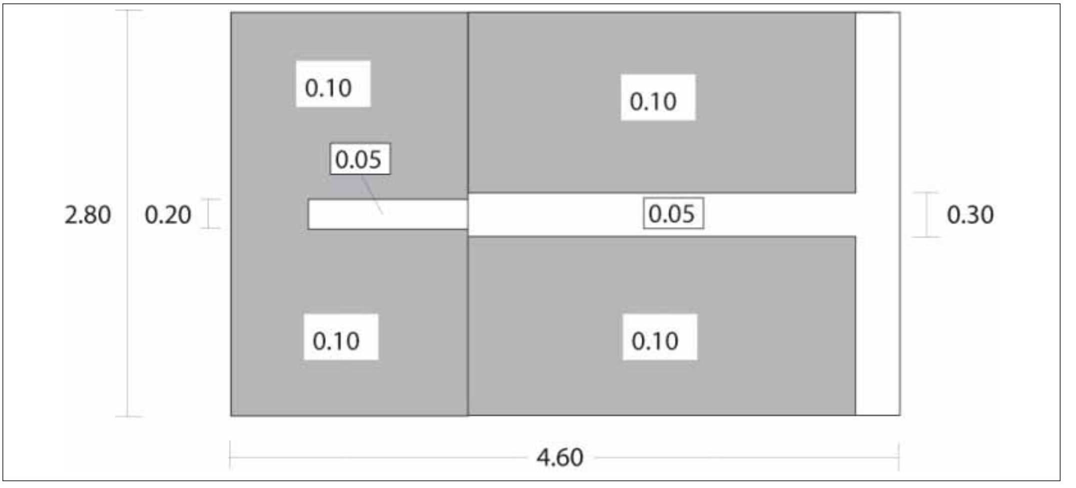

Figure 10.11: Plan of the slab.

If several water points of this type are to be constructed, a template may be made in order to facilitate the preparation of the reinforcement.

Special care must be taken with the placing the reinforcement, because its effectiveness in ensuring the strength of the foundation depends critically on this stage. In particular, the distance between the bars, and the depth at which the reinforcement is placed in the foundations, must be precisely maintained.

To keep the bars in the correct position, annealed steel wire is used for binding, plus gravel or small pebbles which are embedded in the concrete at the time of pouring. The curved end of the bars is 0.02 m from the external edge of the slab.

The foundation for the water point and washing area is constructed as a single piece, in order to provide sufficient strength over the whole area. If it is difficult to pour the slab in one operation, particularly because of the different levels of shuttering on the slope, the work may be completed over two days, taking care to leave keyed surfaces (rough, clean and well wetted) at the end of the first day.

The slab for the water point, the passage area and the washing areas is 0.10 m thick. The thickness of the concrete for the channels is 0.05 m (Figures 10.11 & 10.12).

Special care must be taken in the preparation of the concrete, which must have a 'plastic' texture, to be able to flow between the reinforcement bars completely.

When pouring the concrete, it is necessary to ensure that the aggregates do not prevent it from settling under the reinforcement (vibrate the concrete), and also that the reinforcement itself stays in place.

Quantities for the concrete are given in Table 10.IX.

Table 10.IX: Characteristics of concrete at 350 kg cement / m^3 used for the slab.

Proportions	1 volume of cement
	2 volumes of sand
	4 volumes of gravel
Total volume of concrete	1.25 m^3
cement	10 bags of 50 kg
sand	0.625 m^3
gravel	1.25 m^3
Labour	2 mason/days
	6 assistant mason/days

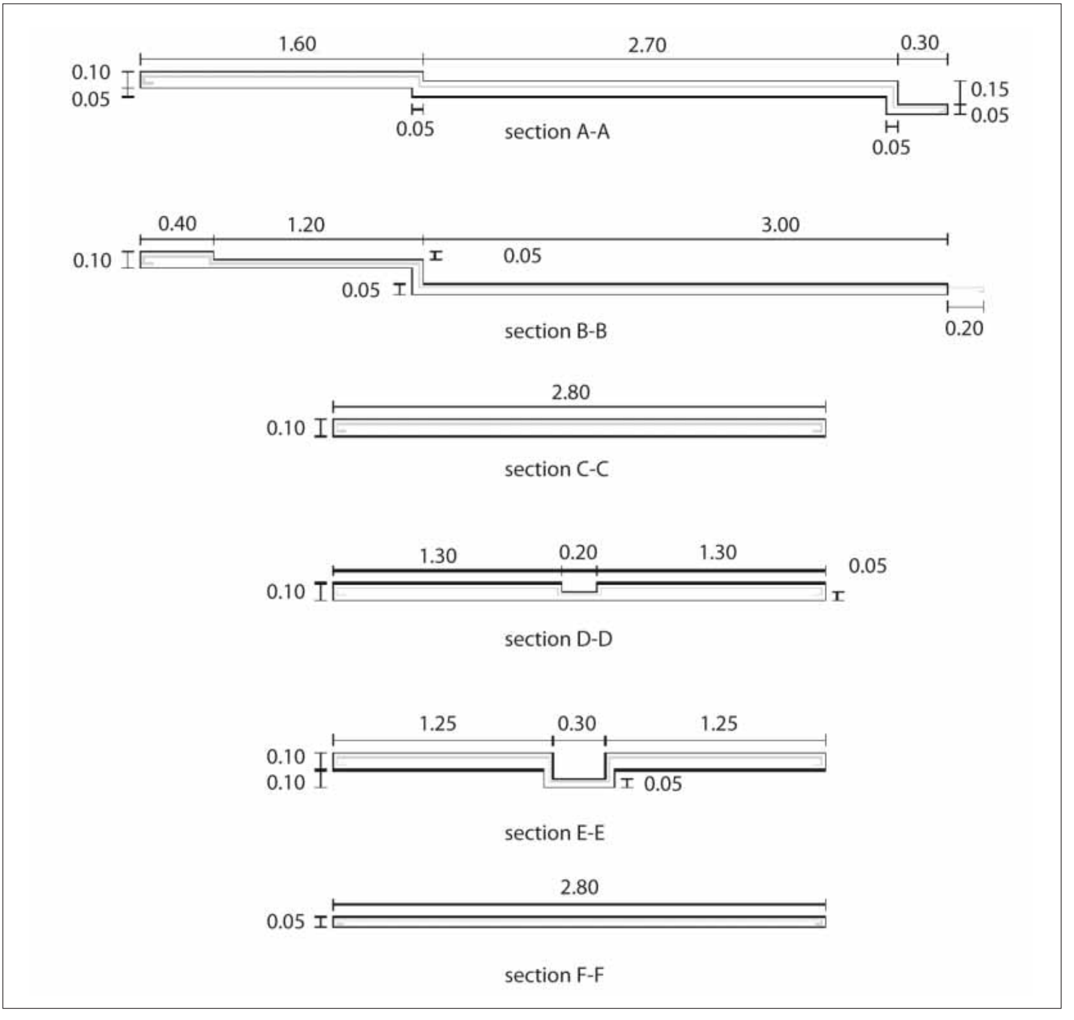

Figure 10.12: Sections of the slab.

2.4 Plumbing

For the water point, GI pipes are inserted into the masonry (PVC does not adhere well to mortar or concrete). Plugs are installed on pipes as shown in Figure 10.13:

– one at the bottom of the water point, allowing the supply system to be drained;

– the other opposite the outlet(s), so as to be able to clean any blockage without having to dismantle the water point.

The diameter used is determined by the flow of the spring. In the case of springs with variable flow, a compromise must be found between dry season and wet season flows to choose the diameter of the supply pipe.

2.5 Masonry

The water-point wall, the exterior protection walls and the low interior separation walls are made in masonry. The foundation serves as a base for the construction. The following wall dimensions are chosen:

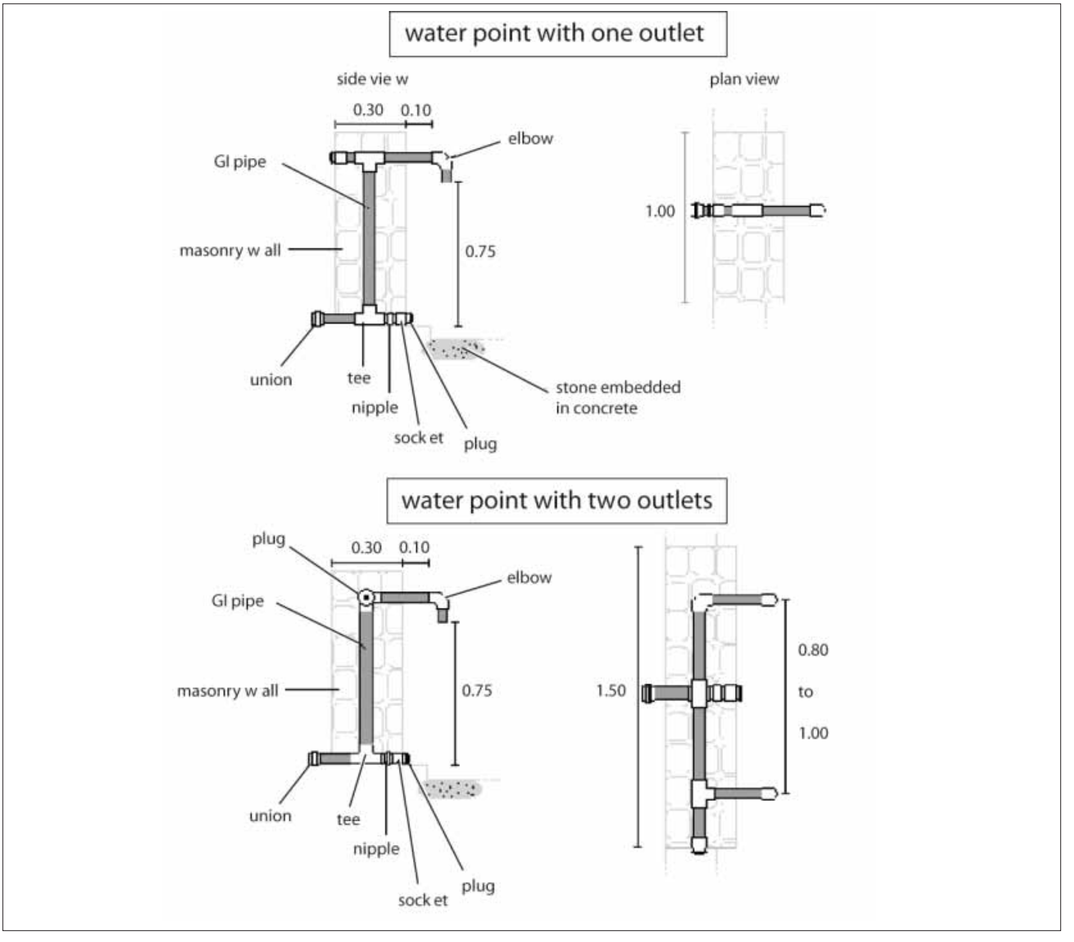

Figure 10.13: Plumbing for water point.

– for the exterior walls, a thickness of 0.20 m and a height above ground level of 0.20 m;

– for the interior walls, a thickness of 0.10 m with a height of 0.10 m for the water-collection area/passage area separation, and 0.15 m for the passage area/washing area separation.

The dimensions of the water-point wall are variable, depending on the number of outlets installed: here a diameter of 0.30 m and a height of 1.00 m have been used, with the outlet at 0.75 m from the ground (Figure 10.14 & Table 10.X).

Table 10.X: Materials for the construction of the water-point walls.
For these calculations, the dimensions of the water-point wall are 1.00 x 1.00 x 0.30 for a single outlet.

Volumes required		
stone	0.65 m^3	
mortar	0.35 m^3	
	sand:	0.35 m^3
	cement:	3 bags of 50 kg each
Labour	2 mason/days	
	6 assistant mason/days	

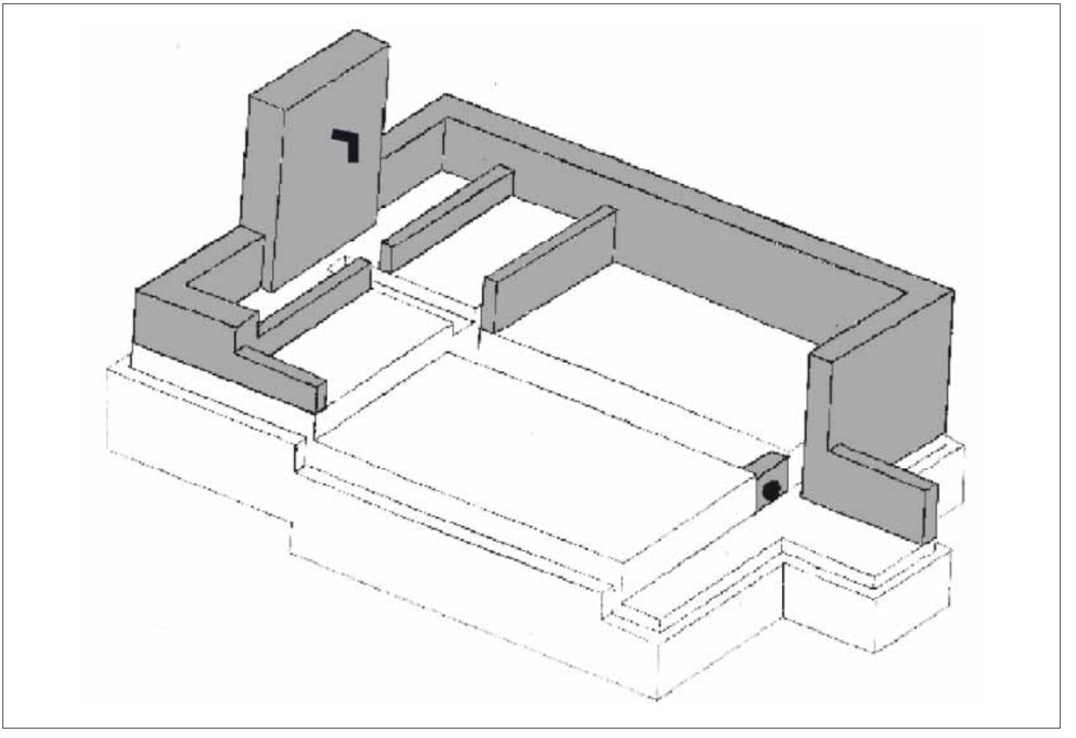

Figure 10.14: Water-point walls.

2.6 Constant-level channel

The aims are to have a permanent reserve of water always available for washing, and to limit water transport. If the drainage outlet is blocked (with a cloth, for example), the level of the water in the channel rises, until it overflows the sill at the end of the channel: by removing the 'plug' the water is drained normally and the channel can be cleaned.

The system consists of setting a pipe 0.10 m in length (75 mm PVC or 2"1/2 GI), in the masonry sill (0.10 x 0.10 x 0.30 m) at the end of the channel, to make a dam that can be plugged (Table 10.XI). The volume in the channel when full is 78 l.

Table 10.XI: Quantities for the construction of the channel.

Volumes needed		
stone	0.002 m^3	
mortar	0.001 m^3	
	– sand:	0.001 m^3
	– cement:	0.25 l
Pipe (75 mm PVC or 2" 1/2 GI)	0.10 m	
Labour	0.006 masons/day	
	0.018 assistant mason/day	

2.7 Drainage channel

This channel allows the drainage of water from the water point to a suitable location. It must have a minimum slope of 1% to ensure good flow and facilitate drainage.

The channel can be built of brickwork on a reinforced-concrete foundation, or of reinforced concrete alone. Its length is determined essentially by the slope, and the outlet should be at ground level to avoid any subsequent bogging.

It is essential to construct a toe at its end, to stop the channel being undercut by the drainage water, as well as to lay stone around the channel outlet to provide a free-draining surface (Figure 10.15).

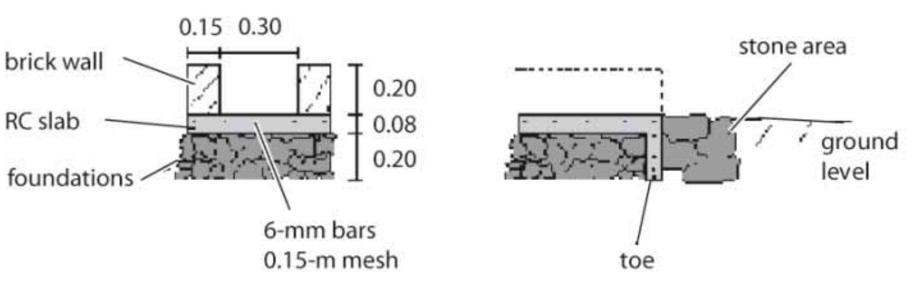

Figure 10.15: Drainage channel (A) and toe (B).

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