Rough measurement typical spring

1. Introduction

The rough measurement step for a spring is led by woreda construction expert and has 3 important goals:

- Validate spring pre-excavation by community (if the form MF4-F26 cannot be filled, the pre-excavation is not over)
- Have a first assessment on the shape of the catchment and the work to be done and avoid over expensive structures compare to network size
- Give data to design department to realize an initial BoQ as accurate as possible for contractor selection

That said it is important to keep in mind that this is only a first assessment, **mistakes or changes are allowed**. Final catchment can be very different due to contractor or design recommendation, new soil specificity discovered during contractor digging.

To carry on these measurements you need a 25m tape measure, a string spirit level, 25m of string (sibago) and 4 pegs.

2. Community digging validation and working conditions

a) Excavation

All this methodology is describing how to fill format **MF4-F26** Spring rough measurement. This format can be filled only if community digging is finished, meaning that the next construction steps will be led by the contractor. 3 elements have to be checked before considering the community digging finished:

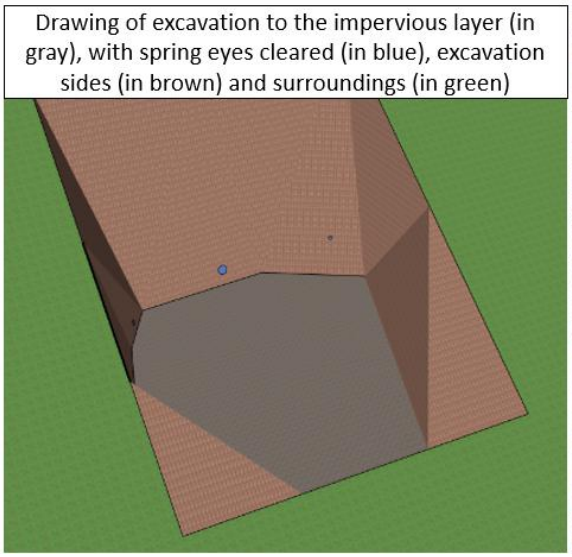
- Bottom of the excavation is hard impervious soil (generally rocks or clay), check it with a wooden peg that should not go deeper than 5cm when you try to stab it in the ground
- Eyes of the spring are cleared (clearly visible and water flowing on impervious)
- Upstream side of the excavation is 2m high at least (for catchment protection)

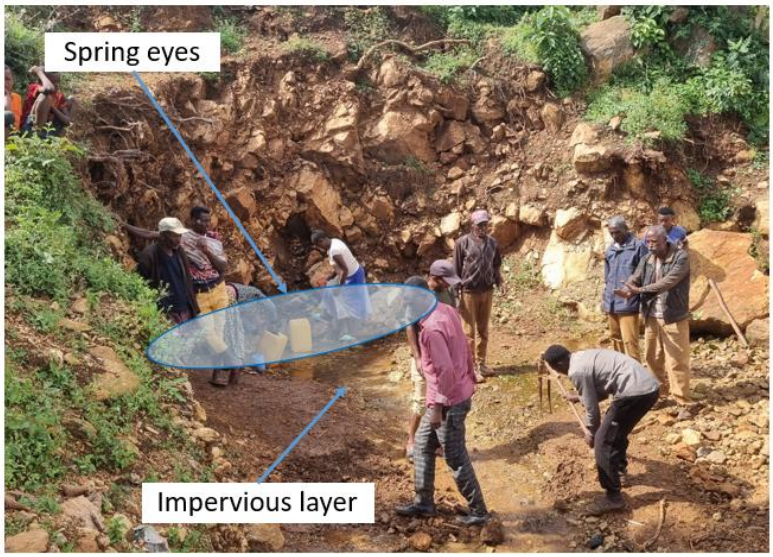
Eye cleared



Wooden peg used to check soil







For more details on community excavation, check ***Doc n° MF4-M20 "Spring Pre-Excavation"***. If the area of excavation is a swamp, if the soil is very loose or if the spring is an artesian (water with pressure) the spring is out of these methodologies and need specialist guidance.

b) Contractor expense & preliminary work

The beginning of format **MF4-F26** is meant to identify the logistic expenses for the contractor.

Woreda:				WUA created	Yes ☐	No ☐
Name of spring:				Turbidity check	Yes ☐	No ☐
Community povide stones:	Yes ☐	No ☐		Design yield		_____ l/s
Sino truck material dump distance from spring construction site:						_____ km

Estimated excavation to be done by contractor (if necessary)

2 elements are important for this, does community provide stones and where can sinotrucks dump material (cement, sand, pipes…)? Those elements are crucial to obtain an accurate estimate from contractors. If stones are available naturally around the site, community should provide stones and help with the transportation from the sinotrucks dump site (that depend on road condition). These elements have to be filled after discussion (negotiations if necessary) with the federation and water user association representatives.

Then the supervisor have to check if the water is turbid when the rain is falling, by his eyes or with trusted members of community (this is why this check should be done during rainy season). If the water is turbid, additional digging can be decided or other turbidity mitigation measures (additional protected land above spring, additional channels…)

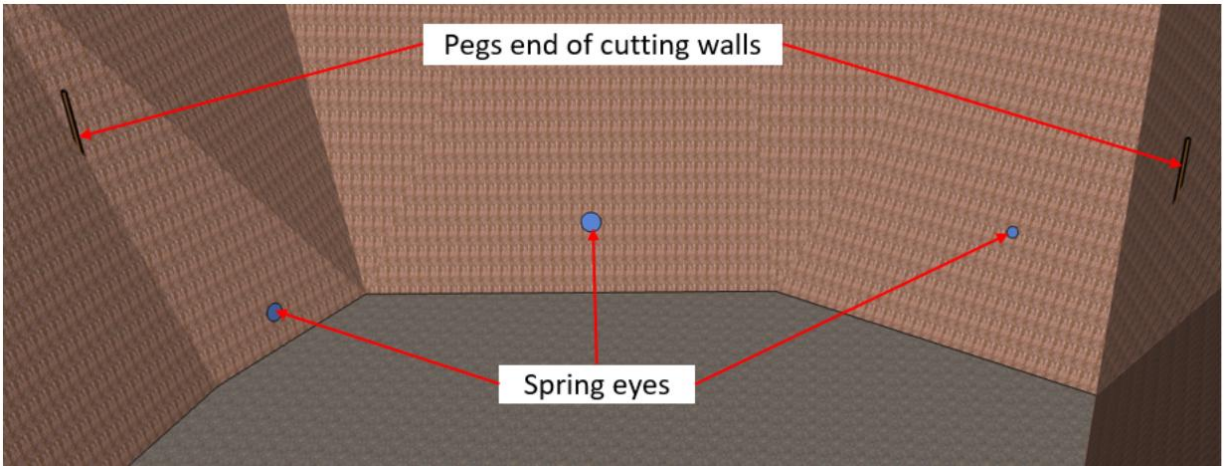
The chart below is to estimate the amount of excavation that the contractor will have to lead. This include precise digging around spring eyes, preparation for box foundation or retaining walls… Don't forget that this is a **rough** measurement. Precise measurement will follow don't spend too much time.

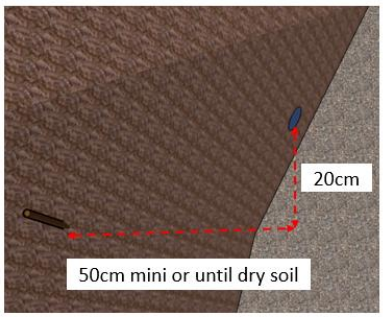
Estimated excavation to be done by contractor (if necessary)			
Zone to dig	**Depth (m)**	**Width (m)**	**Length (m)**

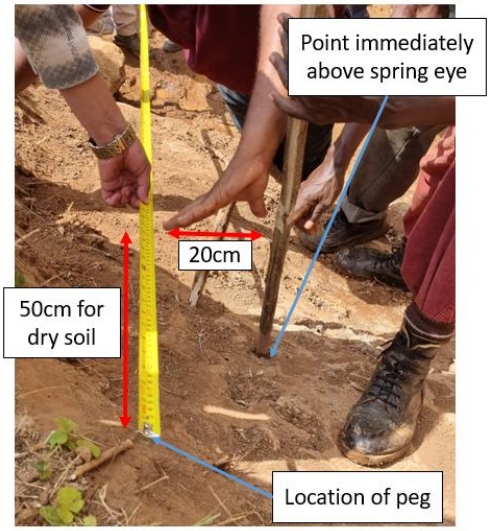
3. Spring structure limits

a) Cutting wall range

To find the left and right limits of the future spring structure, imagine that the future cutting walls should have a clearance of 20cm with the right-most and left-most eyes of the spring downward. With this wall direction set, the peg should be installed 50cm after the eyes (1m or more for wet soil). Those pegs represent right and left finishing points for the cutting walls and the limits of the catchment area (cover slab). Install a small rope or string (sibago) in between.

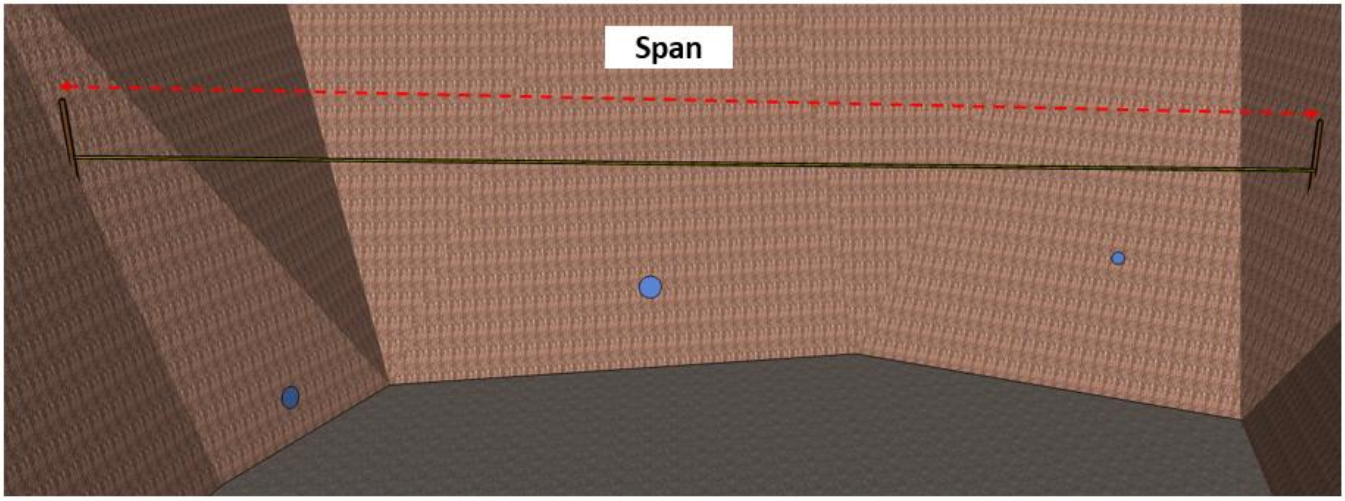








With these 2 pegs, the span of the spring can be measured.



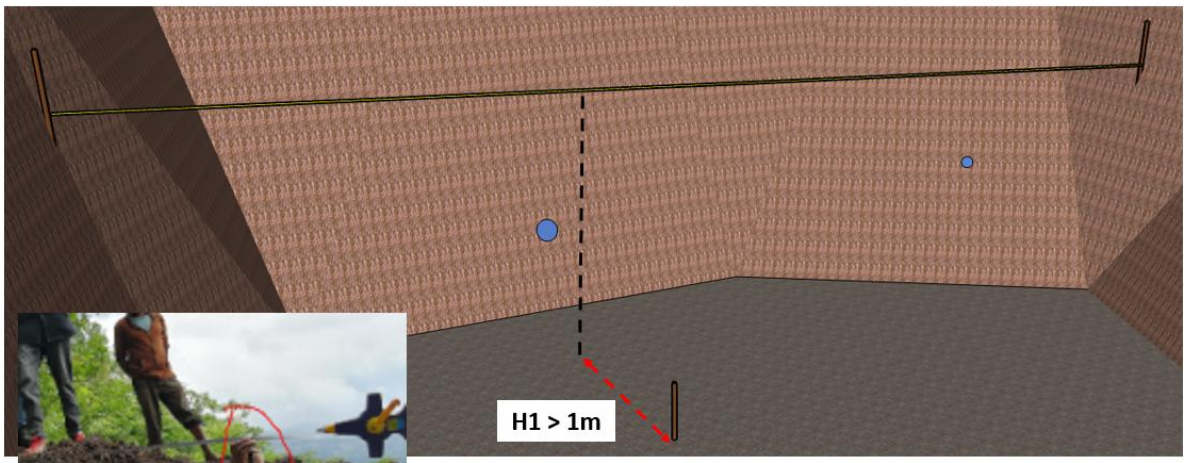


Distance	Estimation (m)
H1	
H2	
Span	
Right cut foundation	
Left cut foundation	
Overflow length	

b) Box location

To find the center of the future spring box location, you need to find a Ø2.3m flat area with stable soil located at least 1m downstream of the span line. This location should be as cantered as possible compared to all the eyes position. When this area is found, install a peg in the middle of the Ø2.3m.

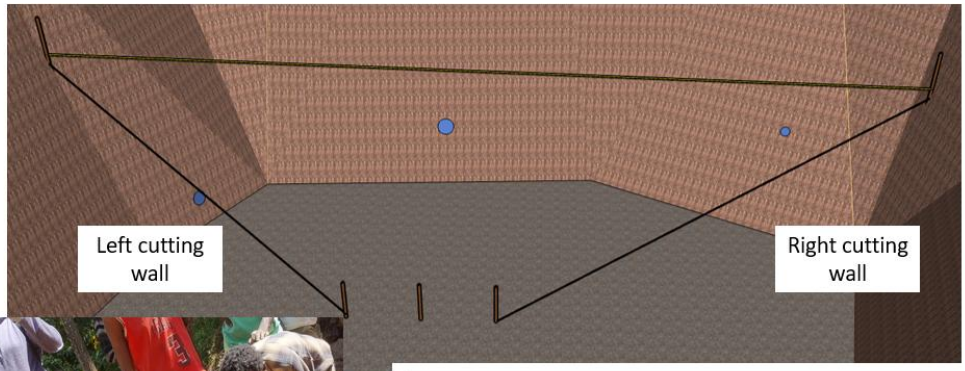
The dimension from the span line to the center of the box is H1, use a straight stick to extend the peg and measure it as parallel as possible from the ground.





Distance	Estimation (m)
H1	
H2	
Span	
Right cut foundation	
Left cut foundation	
Overflow length	

Install 2 peg 1.15m from the center peg on the left and the right. Distance from these 2 pegs and the right and left span pegs are the estimate of the dimensions of left & right cutting walls foundation. Final position of the box will be decided with the contractor.

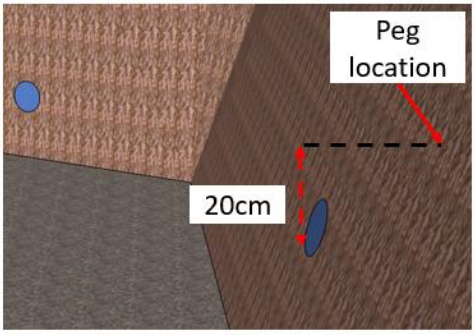


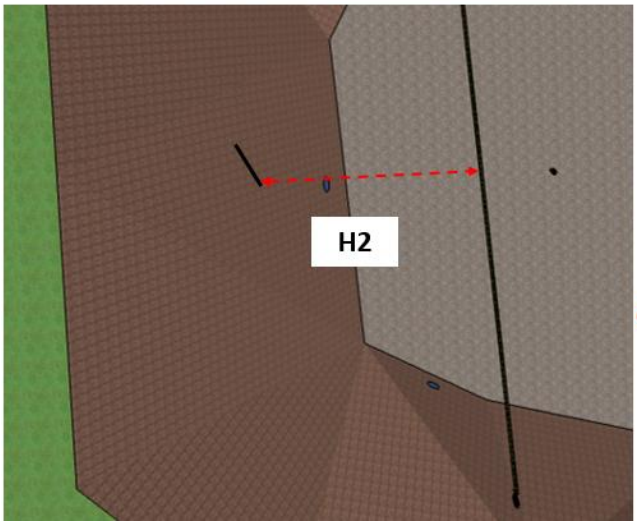


Distance	Estimation (m)
H1	
H2	
Span	
Right cut foundation	
Left cut foundation	
Overflow length	

c) Cover slab end

To find the cover slab ending point, measure 20cm above the eye in front of the box and extend beyond the eye until the ground is touched. Install a peg at this location, H2 is the distance from this peg to the span sibago.







Distance	Estimation (m)
H1	
H2	
Span	
Right cut foundation	
Left cut foundation	
Overflow length	

d) Overflow length

To find the overflow length, first locate the overflow spillage point respecting the following rules:

- Find a spot with slope to allow water evacuation
- The water evacuation should not overlap the future location of pipeline (to avoid erosion of the soil protecting the pipes
- The spot should be as close as possible from the spring box

Install a peg on this location and measure the distance with the center of the box to obtain overflow length.

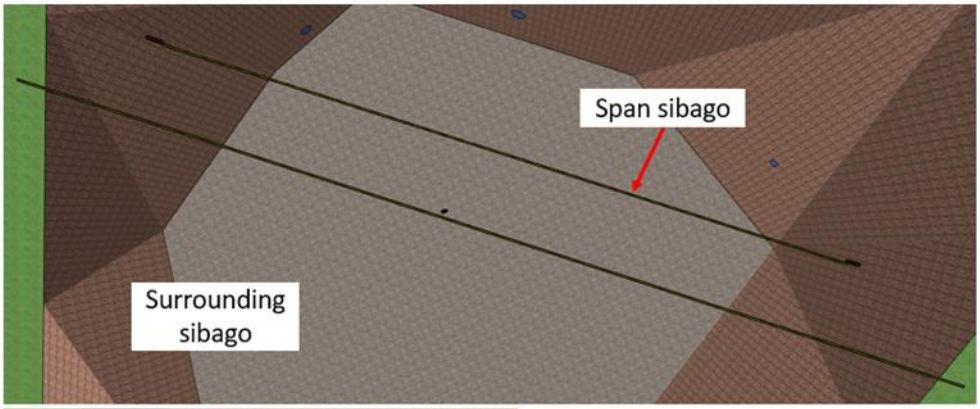
Distance	Estimation (m)
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H2	
Span	
Right cut foundation	
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Overflow length	

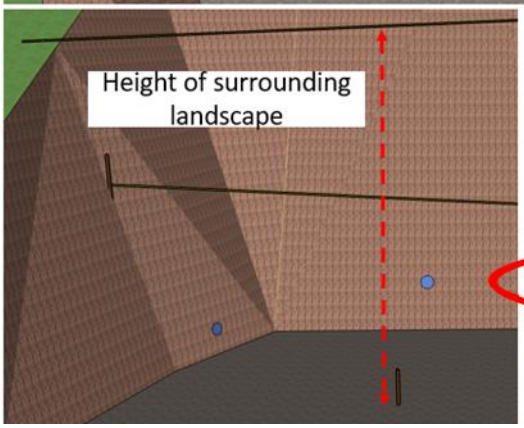
4. Surrounding measures

a) Natural ground

To evaluate the height of the future spring box and the amount of retaining walls work necessary, a sibago above the center of the box must be installed, in the same direction as the excavation. The distance between this sibago and ground level at the center of the box is the dimension surrounding level.



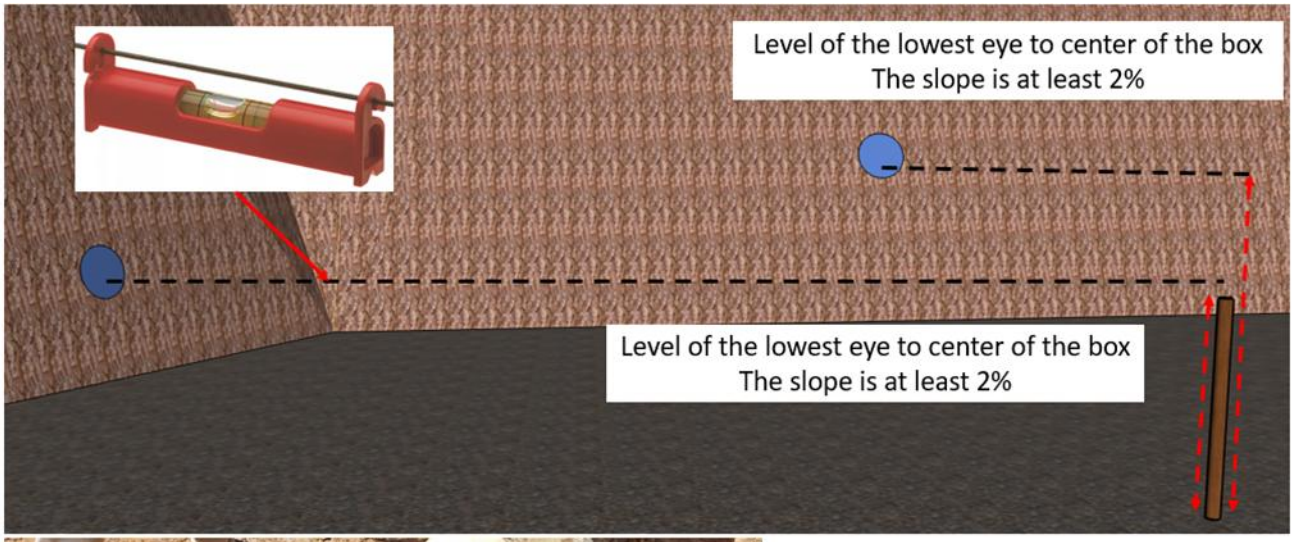




Level (measure with sibago)	Estimation (m)
Highest eye (from 0)	
Lowest eye (from 0)	
Surrounding level (from upstream box	

b) Eyes

To measure eyes the string spirit level has to be assembled on a sibago. The sibago must be stretch from lowest eye to the center box peg with the level maintained in the middle. The distance at center box pegs ground level to the sibago is the lowest eye dimension. The same method have to be applied on the highest eye. Check that the slopes are at least 2%, if not the box location needs to be changed.





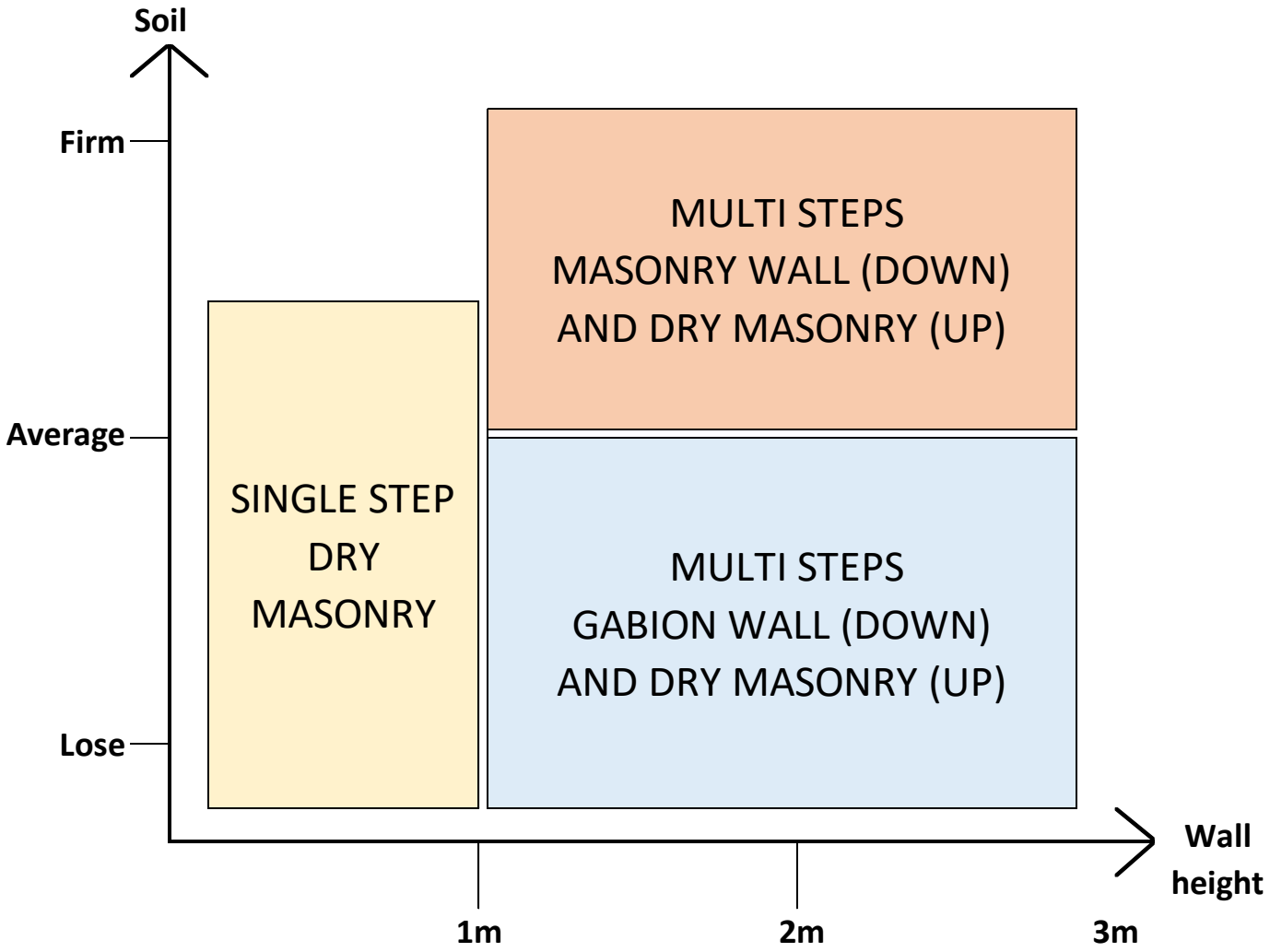
Level (measure with sibago)	Estimation (m)
Highest eye (from 0)	
Lowest eye (from 0)	
Surrounding level (from upstream box	

5. Retaining walls

Last input on the form needed is the retaining walls. It is impossible to write a standard methodology for retaining walls because it is entirely related to the landscape of the catchment area (slope, type of soil, material available…). But some general rules can be applied:

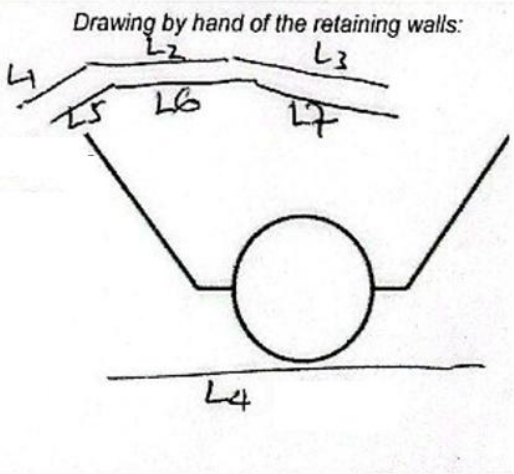
- If the soil is not too lose (clayey soil) and the slope between top of the box and top of the excavation is not too high (around 20% max.), backfilling with soil is advised. It gives a better protection for the catchment and it is the less expensive type of protection.
- If possible use dry walls for economical purposes (dry walls can be built above masonry or gabions)
- Very firm soils don't need retaining walls (strong clay for example)
- Plant grass on contour lines
- Low retaining wall can be added downstream of the catchment to reduce the backfill slope. Use very permeable materials (dry stone, gabion) to let the infiltrated surface water seep through this retaining wall

The total height of the retaining wall is defined as the vertical difference between the level below the spring box and the top of the excavation front. Depending on the site's topography, the design may consist of a single wall or a series of structures. The specific height of each individual wall determines the most appropriate construction materials to be used. This chart can be used to help decision making for retaining walls. This must be used with caution just for information, not as pure facts.



With these rules in mind fill the retaining all estimate chart giving clear tags, dimensions and types to all the potential walls like in the example below:

	Width (m)	Length (m)	Heigth (m)	Foudation depth (m)	Gabion (G) Dry wall (D) Masonry (M) Concrete (C)
1	0.5	4	1m		M
2	0.5	5	1m		M
3	0.5	4	1m		M
4	1m	8.9	3	1	G
5	1	5	2	1	G
6	1	7.6	2	1	G
7	1	3.6	2	1	G
8					



6. Thresholds

This rough measurement step is also designed to detect the expensive spring. An expensive spring is not necessarily to avoid but it needs special care to avoid projects with no economic sense. “Expensive” is different for a project that concerns 900 households or 125 households. That’s why you should consider ranking networks in 3 categories:

- Small networks: up to 3 water points
- Medium networks: from 4 to 8 water points
- Big networks: 9 water points and above

This chart summarizes the criterias that qualifies a spring as potentially expensive and needing special attention:

	Small network max.	Medium network max.	Big network max.	Possible compensatory measures
Span	5m	10m	15m	Take measure again in dry season to see if some eyes are dry
Highest eye level	0.7m		1m	Lower the cutting walls height from standard
H1+H2	2m	2.4m	2.8m	Try to found a box location closer to the eye, consider masonry foundation for the box
Retaining walls	25m3 gabion 6m3 masonry	30m3 gabion 8m3 masonry	45m3 gabion 12m3 masonry	Prioritize backfilling and dry masonry everywhere it is possible