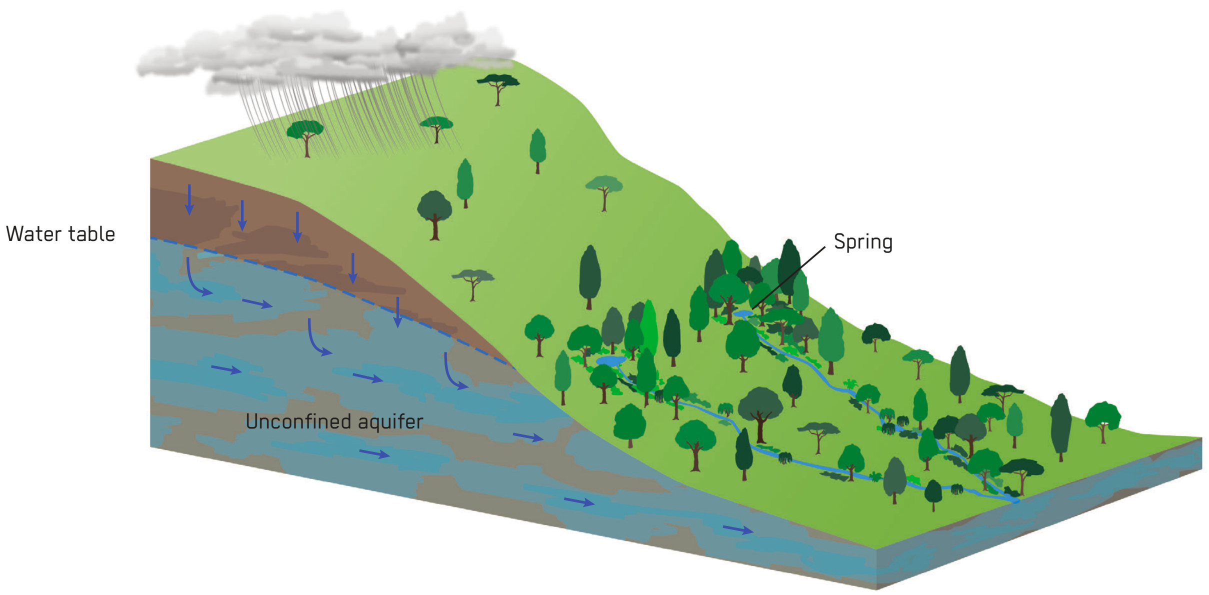
Spring Water



A Spring is formed where groundwater exits the surface at a particular point. When the water comes from unconfined aquifers where the water surface is open to atmospheric pressure, gravity springs are formed, and when the water comes from a confined aquifer that is under pressure, artesian springs are formed. Springs are useful in all phases of an emergency.

Springs result as a coincidence of hydrogeology and topography. For gravity Springs from an unconfined aquifer, an impermeable layer restricts downward groundwater flow, which causes water to flow out where the water level intersects with the ground surface. Artesian Springs are less common and occur in confined aquifers where the water pressure causes water to flow vertically upwards through weak points in the impermeable layer. For both Spring types, flow can be an identifiable point (a Spring eye) or a more diffuse seepage area and can be seasonal or permanent.

Spring Water has two main advantages that can be exploited: the water quality is usually good and gravity flow reduces the need for pumping, which in turn reduces maintenance and other associated costs. Even though Spring Water quality is generally good, it can be contaminated from microbiological pollution in the immediate catchment (e.g. open defecation or on-site sanitation systems) or from sources in the aquifer further away from the Spring (e.g. in fissured rock or limestone, pollution can rapidly affect water quality as water can reach the Spring quickly). Chemical pollution is also possible from the use of chemicals in the catchment (e.g. fertilisers) or from the aquifer itself (e.g. fluoride or arsenic sources). Various types of Spring protection constructions are designed to reduce the risk of contamination **(see I.4)**, but this may not always be possible and disinfection might be necessary. This will most likely involve chlorination, which is often standard in emergency settings **(see T.6)**, which could be done on a communal scale (e.g. when water is distributed via a piped system) or at a household scale using household water treatment (e.g. in remote areas, see section H). As indicators of the quality of Spring Water, the water temperature can be monitored throughout the day and the turbidity can be measured after rainfall. Good quality Spring Water tends to have a constant temperature and does not change in turbidity after rainfall, while a Spring with water that has a varying temperature and turbidity indicates that the water has not spent much time in the ground.

Because the available quantity of water from a Spring can vary according to the season, Spring yields need to be determined as part of the design process, which is normally done by timing how long it takes to fill a container of known volume. The ideal time when this flow should be measured is usually several weeks to months after the rains have started as opposed to the actual end of the dry season. An acute emergency, however, might not coincide with this period, so in this case it is recommended to measure the present flow rate and also to enquire with the community about the variations in Spring flow throughout the year. Even a small yield will still flow 24 hours a day and can significantly contribute to meeting demand if there is adequate storage. Spring yield can improve slightly with Spring protection works that uncover and clear flow paths, but the flow will return to normal after the water table stabilises. The flow that is possible at a Spring will generally be fixed according to the hydrogeological conditions, though joining water collected from several Springs can be an alternative way to increase flow.

Applicability: Spring Water is suited to all phases of an emergency. Unprotected or protected Springs may already be in use as a main water source, and these structures can be quickly improved in the acute response phase. Even an unprotected Spring will still yield water that has lower turbidity, which means it is easier to treat and could be trucked elsewhere before Spring protection structures are in place. However, the construction of additional storage (if needed) and distribution pipelines (where the collection point is further away) may require some time **(see I.4)**.

Operation and Maintenance: Springs require little O&M other than monitoring water quality, which can indicate a problem within the catchment. For example, an increase in turbidity after storm events could indicate contamination from surface runoff. In this case, the protected area around the Spring should be checked. ion trenches there should be an attendant at all times.

Health and Safety: Spring Water quality is usually good, but it should be verified as there can be microbiological contamination where the catchment is polluted or where the water has spent only a short time in the ground. Access paths to Springs located near the bottom of slopes can be slippery and cause people to fall.

Social and Environmental Considerations: Springs are usually very well accepted by the population.

Strengths and Weaknesses:

(+) Usually have good water quality
(+) Easier to maintain than wells or boreholes
(+) Reduced need for pumps and associated costs

(−) Variability in water flow depending on the site and season
(−) Water quality might be affected by the aquifer type and immediate catchment area
(−) Location of the Spring may not be easily accessible
(−) Total water available is generally fixed and limited to the actual Spring yield

→ **References and further reading material for this technology can be found on page 213**