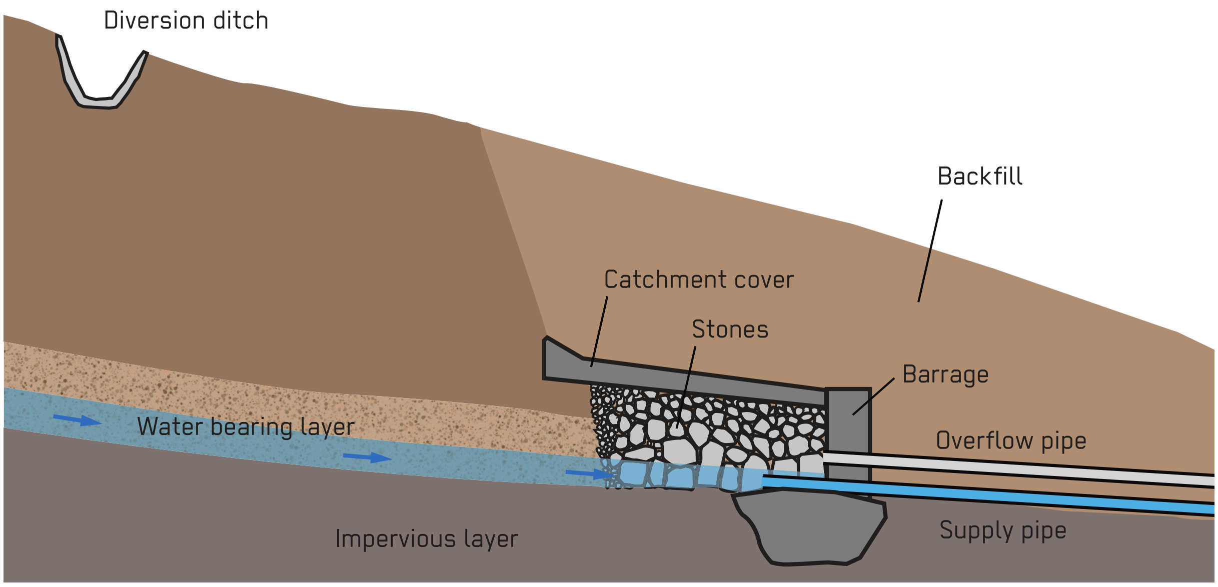
Protected Spring Intake

Response Phase	Application Level	Management Level	Objectives / Key Features
** Acute Response ** Stabilisation ** Recovery	* Household ** Neighbourhood ** City	* Household ** Shared * Public	Natural flowing groundwater, no pumps needed, generally good quality water
Local Availability	**Technical Complexity**	**Maturity Level**	
*** High	** Medium	*** High	



A Protected Spring Intake is designed to collect, store and transport spring water while preventing source contamination. If springs are available, the technology is suitable for all response phases.

Springs result as a coincidence of hydrogeology and topography and can be gravity flow or artesian in nature, can emanate from a defined point (a spring eye) or from a diffuse seepage area, and can be seasonal or permanent **(see S.6)**. Spring protection works include protecting the area around the spring from contamination, finding means for transporting the water to where it is needed, storing the water (not always needed), and delivering the water conveniently. Protected Springs can be both developed as the source of a distribution network and/or used directly for water collection.

Design Considerations: Spring constructions vary significantly, with the exact works depending on the type of spring, yield, level of spring eyes in relation to other topographical features, proximity to the population and the time and materials available for the work. The area where water exits the ground surface must be protected from contamination, which at its simplest is an enclosure of stones that is either topped with flat stones/tiles and covered with 100 mm of puddled clay and backfilled (simple, cheap, quick, replicable and can be built on a clay base), or topped with a concrete slab with a masonry wall on one side as shown above (requires more expense, skills and time, and there must be a solid foundation for building the wall onto). In some designs, this structure doubles as a storage box, but this must be carefully considered, as some spring eyes can disappear if overly disturbed (e.g. where the impermeable layer is dug out too far). It is therefore generally recommended to channel/protect the source and then transport the water away from the spring to a larger storage structure where damage to the spring

eye is avoided. A screened overflow at the spring ensures that water will always flow, and that no back pressure will develop that could cause the spring to divert elsewhere. The spring should also be protected from contamination by having a fence and drainage channel at least 10 metres uphill from the spring eye to divert surface runoff. To ensure this less glamorous task is done, scheduling it at the start of works can help since community enthusiasm wanes towards the end of construction. Water then needs to be transported to where it is going to be further treated (if needed), stored or used.
Water can be transported over short distances using plastic pipes (avoid metal pipes if water pH < 5) or a stone-filled trench (stones covered with clay and backfilled). Over longer distances, proper pipe design will be needed with adequate numbers of washout valves at low points and air release valves at high points **(see also S.7, D.6)**.
Storage may be needed depending on the waiting times, which in turn depends on dry season flow rates and the water demand of the population. Sphere suggests that the flow rate should be at least 0.125 L/s per outlet, with no more than 250 people per outlet. If the measured flow is less than this or there are more people per outlet, water storage is needed for an efficient supply. In these cases, outflow from the system at peak times will be greater than inflow, so the required reservoir volume must be designed accordingly **(see D.5, D.6)**. Storage tanks require a washout valve for desilting and a screened overflow. Water is normally distributed at a headwall, which should be higher and stronger the closer it is to the spring eye. Access to the apron should be safe, and steps and handrails should be considered for slippery paths.

Materials: For Protected Spring Intakes, local materials can be used, including stones, clay, stone masonry or concrete, along with plastic pipes and tanks.

Applicability: Protected Spring Intakes are suited to all response phases when springs are available. In the acute response phase, improving an existing spring protection structure can be achieved quickly, and water from an unprotected spring can be easily treated and trucked elsewhere in the short term. The additional construction of storage and transport pipes (to a collection point at a distance) can take more time. In this case several weeks may be needed to install Spring Intakes, in addition to the time required to locate the source and carry out topographical surveys and spring yield analyses (which should be carried out at the start of the rainy season).

Operation and Maintenance: Little O & M is needed, as water flows from springs by gravity (i.e. little need for pumping). Increased water turbidity after heavy rains could indicate contamination from surface runoff. When this occurs, the fence and channel uphill of the spring should be checked. Annual microbiological water quality checks are also recommended. If the flow rate decreases, the intake may be clogged, and a re-excavation of the spring eye may be necessary. In such a case, markers placed during construction can help indicate the position of the spring eye at a later date. Siltation may occur in the pipeline that transports water from the spring to storage or in the storage tank itself, and both should be de-silted annually via washouts in pipes and cleaning/draining tanks. Where baseline turbidity is high, a sedimentation tank installed before the water enters the pipes can reduce silting.

Health and Safety: Spring water is usually of good quality, though should be checked for microbiological or chemical contamination where the catchment is polluted, where the water is not truly groundwater (predominantly subsurface runoff) or where there are rapid transit times for water through the ground (e.g. in karstic terrain). Access paths to springs located near the bottom of slopes can be slippery, and steps and handrails are sometimes needed.

Costs: Springs can be comparatively cheap to improve. Costs usually vary between 200–3,500 USD, depending on the extent of the works.

Social and Environmental Considerations: Springs are usually well accepted by the population as a water source and can be easier to manage, as the community can see where the water is coming from. However, springs can often have existing users who may not want it used for other purposes, and a clear understanding of access, ownership and responsibility is needed. Springs can dry up or move position seasonally, and this might become more pronounced with climate change.

Strengths and Weaknesses:
(+) Low material costs
(+) Low cost/effort O & M due to gravity flow
(+) Usually good quality water

(−) Variability of water flow between seasons
(−) Total water available is limited to spring yield (which cannot be increased much by design), regardless of demand
(−) Spring Intakes are susceptible to temporary or permanent modified water flow following earthquakes
(−) Risk of impacting groundwater-dependent ecosystems downstream, especially if no overflow

→ **References and further reading material for this technology can be found on page 214**