

Spring Development Guidelines

A spring is a place where groundwater **surfaces** naturally. The water source of most springs is rainfall that seeps into the ground up hill from the spring outlet. While springs may seem like an ideal water supply, they need to be selected with care, developed properly, and tested periodically for contamination.

Spring water moves downhill through soil or cracks in rock until it is forced out of the ground by natural pressure. The amount, or yield, of available water from springs may vary with time of year and rainfall.

Groundwater obtained from springs is similar to water pumped from shallow wells. Like shallow wells, springs may be contaminated by surface water or other sources on or below the ground surface.

Springs are susceptible to contamination because the water feeding them typically flows through the ground for only a short distance, limiting the amount of natural filtering that can occur. Springs may not be a good choice for a water supply if the area uphill where the water collects is used for industry, agriculture, or other potential sources of pollution.

Proper spring development helps protect the water supply from contamination. The objective of spring development is to collect the flowing water underground to protect it from surface contamination and store it in a sanitary spring box.

A. Choosing a site – Locating the spring

1. A point source is the ideal situation. **A point source is one where the water emerges from a single location.**
2. A “horizontal seep line” spring area requires more work and has a higher degree of risk of contamination from surface water.
3. It’s important to collect the spring water at its point source, not down gradient where surface contamination is likely. The source of the spring is usually at the uphill edge of the saturated area.
4. The degree of slope is important. Generally steeper slopes are more desirable. You get depth of cover quicker digging into a steep slope.
5. Avoid **spring sites that are located** in depressed, concaved areas where surface water drainage is toward the spring.
6. **Avoid spring sites that are located** down gradient from bodies of surface water like ponds, lakes creeks, irrigation ditches, etc.
7. **Avoid spring sites that are located** downhill from sources of pollution such as pit toilets, sewage disposal systems, animal enclosures, fuel storage tanks, etc.
8. If possible, avoid spring sites that are covered by growths of deep rooted trees, bushes, etc., because greater maintenance is required to keep the tree roots out, The decaying dead root systems provide channels underground which may allow surface water to pollute the spring.
9. **Ensure that the spring site is located on land that is owned by the user, or ensure that the user has documented rights to use the spring. Water rights, maintenance agreements, and recorded on the deed can be written to address use of the adjacent watershed to protect the spring site for the user. Proof of Ownership or deeded rights** will guarantee the right to use the water from the spring.
10. If the spring can not supply the system by gravity flow, consider **the** alternative of drilling a well, since electrical power will have to be provided in either case.
11. Evaluate the burrowing rodent population in the area. Avoid a site with **extensive evidence** of burrowing rodents or plan to deal with them by extermination or installation of underground wire mesh to prevent them from burrowing into the spring collector.
12. Evaluate the site for **accessibility of** construction equipment such as a backhoe for delivering gravel and other material.
13. Springs that demonstrate wide seasonal fluctuations in flow from spring to fall are suspected **as** being under the influence of surface water.
14. A rock-**filled** collection bed or trench in a flat swampy meadow, beside a stream, **or** in the stream bed itself, is not a spring source which is producing ground water. Rather, it is a collector

of **sub**surface water, or shallow ground water, which is under the influence of surface water and is therefore subject to the treatment requirements of the Surface Water Treatment Rule.

B. Spring Development/Construction

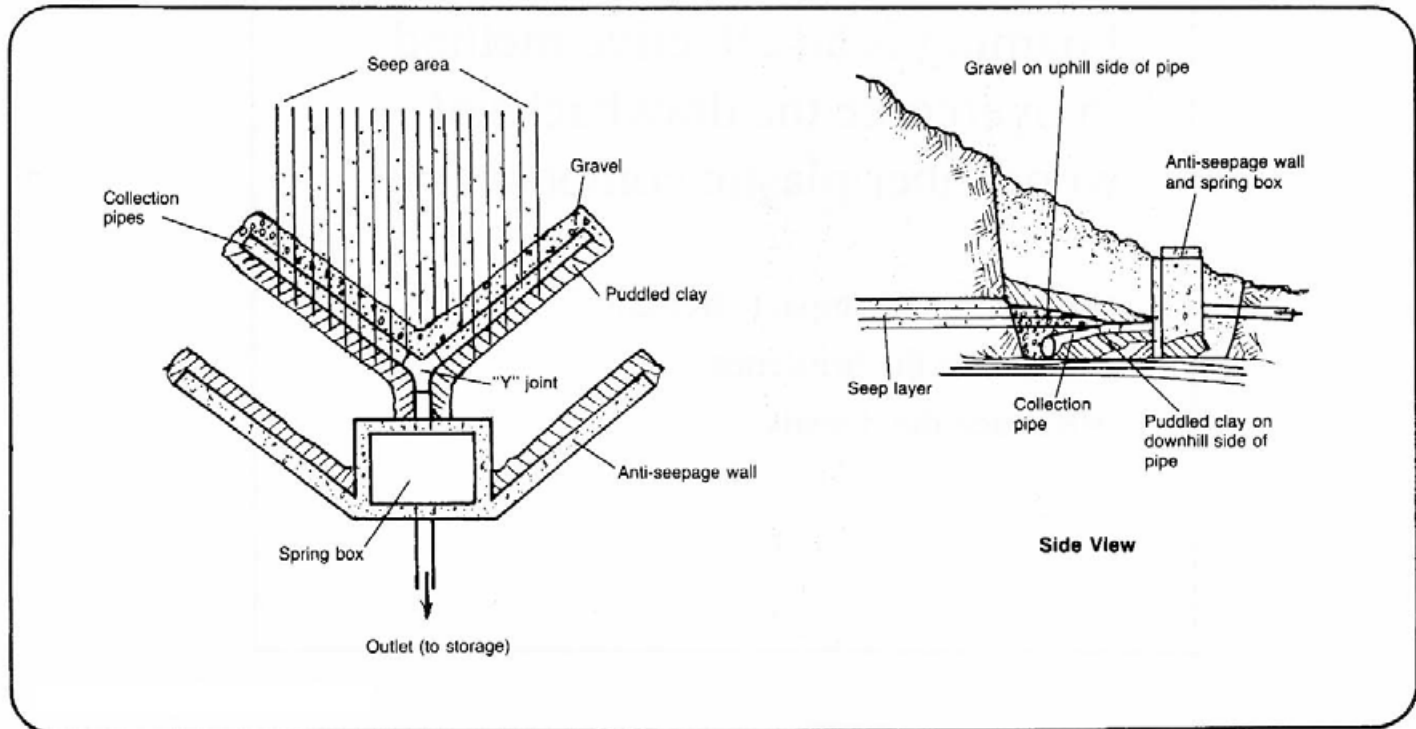
1. Determine the general approach to development of the spring site and the best way to collect the water.
 - a. Use a horizontal trench excavation parallel to the contours of the hill, or
 - b. Use a trench excavation parallel to the slope of the hill.
2. Carefully excavate and remove the soil overburden to locate and isolate the exact point source of the spring water, if possible, and **to** expose the point where the water emerges from the “parent material or bedrock”. Hand excavation may be necessary instead of machinery excavation.
3. At this time, make measurements of the spring flow to determine if the quantity is adequate to supply the needs of the system.
Note: Spring production is typically at its peak in the spring and at its lowest in the late fall or early winter.
4. Dig as deep or as far into the slope as reasonably possible to get as close to the origin of the spring where it issues from the “parent material/bedrock”. The reason for this is to maximize the solid backfill cover over the spring and minimize the possibility of contamination of contamination by surface water and the need to import backfill material. Plan to provide a minimum cover of 5 feet of acceptable backfill material above the collection bed.
5. Place the drain rock (use rounded river run gravel, not crushed rock) in the trench excavation to create a collection bed. Use **one to two** inch **diameter** rock. Place the rock all around the perforated collection pipe for a minimum of 10 inches in all directions. These dimensions assume a 4 inch diameter collector pipe in a 24 inch wide trench.
6. Use PVC plastic pipe, concrete pipe, or vitrified clay tile pipe to construct the collector pipe. The types of pipe are generally more durable under these circumstances than metal pipe or asbestos cement pipe.
7. Place a Hypalon (or equivalent polyethylene) membrane on the top of the drain rock to prevent migration of backfill material into the rock collection bed. Seal and anchor the edges of the membrane by keying it into undisturbed soil in the walls of the trench. **(Describe keying?)**
8. Backfill the trench with compacted select fill (a suitability impervious soil) backfill. This backfill soil should have a significant content of clay and silt (approximately 20 percent or more) to ensure that surface water can not percolate through it easily.
9. Place a second Hypalon or equivalent membrane at the top of the trench at a depth of 12 to 18 inches below the final ground surface.
10. Provide a watertight seal at the point where the discharge pipe penetrates the Hypalon membrane using clamps or other means.
11. Particular care must be taken to provide a waterproof barrier dam of compacted impervious soil or other material around the discharge pipe to prevent seepage out of the collector bed along the discharge pipe. ***It is important to note that the discharge pipe should remain the size of the collection pipe in order to allow full flow out of the spring and prevent water back pressure from high flows leading to damage to collection system.***
12. Place the remainder of the selected backfill above the upper membrane. **Maximize the** backfill soil cover above the collection bed **to a minimum of five feet** to prevent surface water from percolating into the spring and comingling with the spring water. The backfill should be graded into a mound shape that will shed surface water away from the spring area. The mounded area should be seeded with native grasses or other small vegetation which will discourage erosion and maintain the shape of the mound.
13. Construct a surface water diversion ditch approximately 12 inches deep on the uphill side of the mounded area. Some sites may require more extensive measures to intercept shallow groundwater flow. In such cases, consider **installing** a rock curtain drain system uphill from the

- mound to intercept this shallow flow and divert it away from the spring area. Be careful **not** to dig the curtain drain so deep that it intercepts the spring flow and diverts it to waste also.
14. During all phases of the spring construction, take reasonable care to avoid contaminating the spring excavation area. Topsoil and organic matter contain bacteria which may contaminate the excavation. Also keep the spring construction materials (drain rock, pipe, membranes, etc.) as clean as possible. Consider using granular **High Test Hypochlorite (HTH)** to disinfect the work area as construction proceeds.
 15. Provide **a** suitable sample tap on the spring discharge pipe to allow collection of samples of the spring water for **water quality (i.e. bacteriological, chemical, physical and radiological)** analyses.
 16. If livestock (cattle, horses, sheep, etc.) graze in the area, consider fencing the spring area to prevent **at least 100 feet uphill and between 25 and 100 feet downhill from the source** these animals from trespassing. Animal wastes are a pollution threat to the spring and the presence of many animals may encourage erosion.
 17. Remove all trees, shrubs and other woody growth in the area to prevent intrusion of root growth into the collector. A clear area of 100 feet radius (more or less) from the spring may be necessary to prevent roots being a problem. The roots of water loving plants like alders, willows, thistles, blackberries, etc. will quickly grow to completely plug the spring collector. These plants can also “steal” a significant portion of the flow produced by the spring, and their roots provide a channel for surface water and bacteria to enter the spring and pollute it.
 18. Take care to protect the spring piping from freeze damage by providing adequate depth of burial, by providing insulation, and by maintaining continuous flow through the piping.
 19. Provide an adequately constructed, raised, **screened** U-bend air vent on the discharge pipe as it exits the spring collector. This vent will prevent formation of air bubbles in the discharge pipe between the spring and the storage tank, and it will prevent the creation of vacuum conditions in the spring collector by flow draining down the discharge pipe to the tank.
 20. Provide two flow meters; one meter to measure the flow produced by the spring; and a second meter the flow used by the system. These two meters will usually be quite different because the surplus water produced by the spring will overflow the tank and be discharged to waste. These meters should register both the total flow that has passed through the meter over time as well as the instantaneous rate of flow occurring at any given moment. Records of the flow produced by a spring source are often invaluable for future planning.
 21. The discharge piping from a spring collector must be constructed so **that** the flow from the spring is always draining out of the collector and can never be turned off. If a valve on the discharge pipe is closed and water is backed up into the collector, the accumulating water pressure may seriously damage the collector. It may also cause a decrease in the spring’s production capacity because the spring flow has been diverted underground to another location away from the collector.
 22. Provide a lock for the valves (if any) on the spring discharge pipe to prevent unauthorized tampering or vandalism.

C. Maintenance

1. Maintain the surface water drainage ditch uphill from the spring.
2. Keep **fencing in a** repaired **state**.
3. Cut all woody plant growth every year **to control root damage to the water source and collection piping**.
4. Control erosion of the mounded area.
5. Keep open all drains from the valve boxes to prevent ponding water.

Most spring contamination results from poor spring development, construction, or from direct flow of surface water into shallow groundwater feeding the spring. Spring water should be tested before and after heavy rains each year for bacteria, pH, turbidity, and conductivity to determine if surface-water contamination is a problem. If water levels change frequently when it rains, the spring is very susceptible to contamination. If bacteria are found at any time in the water, properly disinfect the system and retest the water before using it again.



Typical Spring Construction

