

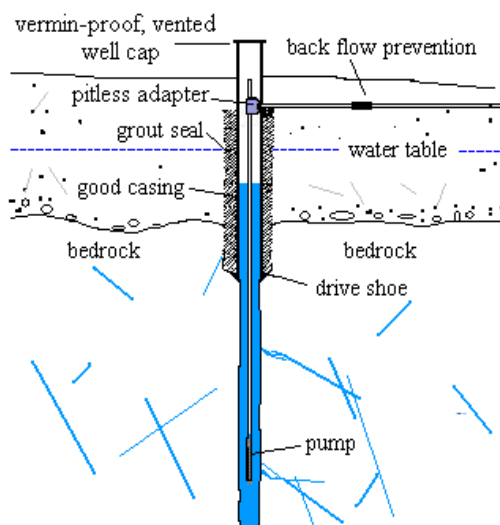


Fact Sheet

Commonwealth of Pennsylvania • Department of Environmental Protection

Guidelines for Installing Private Water Wells in Bedrock

Components of a properly constructed well



Introduction

This fact sheet contains guidelines for homeowners and contractors on the construction and maintenance of private wells. The guidelines cover construction of "open rock" wells in fractured rock aquifers.

Open rock wells are the most common type of private water well in Pennsylvania. The typical well has a steel casing set in bedrock with a borehole that taps groundwater in the fractures of the rock.

Additional construction precautions beyond those listed in this fact sheet may be warranted for some wells. A water well constructed without any precautions may be adequate; however, the use of these guidelines will provide better protection of the well owner's water supply. Proper well siting and construction are probably the most effective steps a homeowner can take to protect a private well.

Background

Private water supplies are unregulated in Pennsylvania. Consequently, homeowners who have their own private water supplies in Pennsylvania are on their own.

When a new well is drilled, no state requirements for construction materials, yield or quality apply. State law

does require drillers to have a valid rig permit and a Water Well Drillers License. They must also give the state and homeowner a copy of the Water Well Completion report. This report describes where, when and how the well was constructed.

A few local and county governments have adopted standards for private water supplies (i.e. Chester and Montgomery Counties). Mortgages associated with federal housing may require certain water analyses for the well. Other lending institutions also may have sampling requirements. But for the most part, private well owners must take responsible for their own water quality and for maintaining their well.

Reasons for Concern

Almost half of Pennsylvanians get their water supply from groundwater. Although some areas have inadequate amounts of groundwater, sufficient water supplies for a single family home occur just about everywhere in Pennsylvania.

The old saying "you never miss the water 'til the well runs dry" is true. Except in severe drought, dry wells don't happen often in Pennsylvania. What could be said more often is that "you never miss the well until you have contaminated water."

In the past, groundwater was thought to be protected from contamination by the soil layer. We now know that is not necessarily true. Water can pass through the soil with limited filtering of contaminants in many areas (for example, in areas with shallow bedrock, limestone with sinkholes, or high water tables). In addition, poor well construction is increasingly the prime suspect in the presence of bacterial contamination.

Coliform bacteria are a noted contaminant of concern by the U.S. Geological Survey (USGS). In a 1996 study of the Lower Susquehanna River Basin, the USGS found that “nearly 70 percent of the [146] wells sampled had total coliform present and thus were not suitable for drinking without treatment.” The USGS concluded that poor well construction can allow contaminated surface or shallow groundwater to directly enter the well. Complicating this threat is the fact that microbial contamination can be sporadic and often does not affect taste, appearance, or odor of the water.

A properly constructed well minimizes the threat of contamination entering the well, and keeps people healthy who otherwise might get sick from their own well water.

What Can You Do?

As a first defense, wells should be sited at least 100 feet away from sources of contamination such as septic system leach fields, roads, fuel tank and barnyards. Ideally, the well will be uphill from these pollution sources. Combining these isolation distance guidelines with sound construction practices will go a long way toward protecting the groundwater quality and the user's health.

The homeowner can require the driller to construct a well that protects the water supply. This is slightly more expensive than a traditional well with no such features. However, the increased cost of constructing a “sanitary well” may be offset by savings associated with better health of users and protection of the water source, or by preventing the need for costly treatment equipment in the future.

Recommended Construction for Open Rock Wells

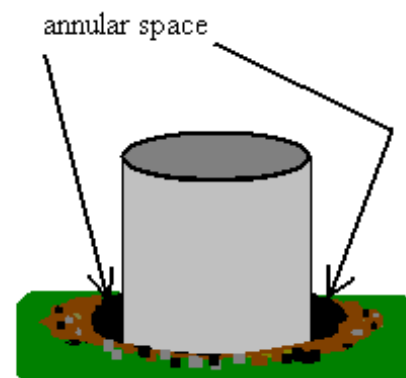
Casing – Drillers typically install a steel casing to keep the loose rock and soil from collapsing into the well. Properly installed casing also should keep shallow groundwater and surface water from entering the well. This water is likely to be contaminated and often enters the well by flowing down the outside of the casing. The casing should be new and meet ASTM (American Society of Testing and Materials) standards. Casing should be at least 20 feet in length *and* extend at least five feet into sound bedrock. Finally, the casing should extend at least 12 inches above land surface, more if the

area is subject to water accumulations that might enter the well.

Drive shoe – In most cases, a drive shoe should be used to protect the casing from cracking and splitting during installation into bedrock.

Pitless Adapter – This device diverts water laterally below the frost line from the well to a storage tank. It allows the well casing to extend above the ground surface. The pitless adapter should be manufactured by a reputable company and installed so that it is watertight.

Casing Grout – When a casing is installed down a hole, an annular space is created between the wall of the boring and the casing (see figure). If not properly sealed, the annular space becomes an avenue for pollution to move into the water supply. To remove this threat, the annular space should be filled with a watertight sealant, such as a cement-based grout, or a grout and clay mixture. The grout prevents contaminated surface water from seeping down along the casing directly into the groundwater. To ensure a watertight seal, the annular space should be filled from bottom to top. This is typically done by placing a pipe in the annular space and pumping the sealant as the pipe is withdrawn. The annular space should be grouted from the casing bottom to at least the base of the pitless adapter. For long casing lengths, the driller should grout at least 30 feet of casing to the pitless adapter.



It is recommended that the driller construct the well in two steps. The first step is the drilling of the hole into firm bedrock, and installing and grouting the casing. The second step would be to drill the hole to the desired depth (after allowing the grout to cure).

There may be instances where grouting could be effectively done after completing all the drilling. In either case, care should be given to make certain the casing seals off shallow water, and that grout is not placed into the open rock portion of the well.

Development, Yield and Disinfection

The driller should develop the well by cleaning out the fine material. The driller typically estimates the well's

yield at this time. A two- to four-person household typically requires 125-250 gallons of water per day.

After the development, the driller should disinfect the well to kill any organisms that may be introduced during the construction. The driller must provide a copy of the well construction record to the owner, who should keep it as a permanent record. Information on the well depth, water level (with no pumping), well yield and the depth of the pump should be included. The well should be topped with a vermin-proof, vented cap that can be locked.

Testing the Water Quality

The water may *look fine*, but could have undesirable substances. Sanitary well construction is no guarantee of safe water quality. If the aquifer is contaminated, then the construction of the well won't help. For this reason, the water should be tested yearly for total coliform bacteria and nitrates. In addition, the well owner may want to test for additional substances.

Common undesirable substances in groundwater include coliform bacteria, nitrates, hydrogen sulfide and excess iron, manganese, lead and turbidity. Volatile organic compounds and petroleum products are released to the groundwater from such sources as spills and underground storage tanks. It is recommended that a DEP certified laboratory for drinking water be used for the analysis. A list of certified laboratories can be obtained from a DEP regional office or website. An annual check on the water and the well is a good idea.

After the Well is Drilled

The well owner can take precautions to prevent problems by establishing their own "wellhead protection areas." This involves keeping potential contaminants away from the well.

- ◆ Keep livestock or the family pet away from the well.
- ◆ Do not dispose of waste into basement or garage floor drains.
- ◆ Take used oil to a recycling center – Never dump it on the ground. Yes, the oil may have initially come out of the ground, but it wasn't from a drinking water well.
- ◆ Mix pesticides or paints over a sidewalk or concrete pad, away from the well; apply fertilizers and pesticides with caution.
- ◆ Be careful where you dispose of waste or where you wash equipment.
- ◆ Don't allow back-siphonage from a container or tank into a well: Install a backflow preventer or keep hoses out of mixing containers or tanks.
- ◆ Properly dispose of household chemicals and refuse. Sinkholes are probably the worst place to put trash. Usually, a sinkhole is a direct connector to ground water.

- ◆ Properly seal old abandoned wells.
- ◆ And remember, water drawn from a well most likely originated nearby as rainfall or snowmelt. Good land use practices can pay off with good water quality.

References and Sources of Information

For the following Bureau of Water Supply Management publications, contact DEP at 717-783-3795, or visit DEP's website at <http://www.dep.state.pa.us>

- *Is Your Drinking Water Safe?*
- *Citizen's Guide to Home Drinking Water Treatment Devices*
- *Citizen's Guide to Volatile Synthetic Organic Chemicals in Drinking Water*
- *Disinfection of Home Wells and Springs*
- *Groundwater Monitoring Guidance Manual* (see Chapter 7 – Well Abandonment Procedures)

Other References:

Bickford, T.M., Lindsey, B.D., and Beaver, M.R., 1996, *Bacteriological Quality of Ground Water Used for Household Supply, Lower Susquehanna River Basin, Pennsylvania and Maryland*, USGS Water Resources Investigations Report 96-4212. USGS (website: <http://pa.water.usgs.gov/>)

Fleeger, G.M., 1998, *The Geology of Pennsylvania's Groundwater*, Department of Conservation and Natural Resources, PA Topographic and Geologic Survey (website: <http://www.dcnr.state.pa.us/topogeo/index.htm>)

National Well Owners Association, 601 Dempsey Rd., Westerville, OH 43081; Telephone: 800-551-7379; (website: <http://www.wellowner.org>)

Waller, R.M., *Ground Water and the Rural Homeowner*, U.S. Geological Survey

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www.GreenWorksChannel.org - A web space dedicated to helping you learn how to protect and improve the environment. The site features the largest collection of environmental videos available on the Internet and is produced by the nonprofit Environmental Fund for Pennsylvania, with financial support from the Pennsylvania Department of Environmental Protection, 800 334-3190.