

Water Facts #7

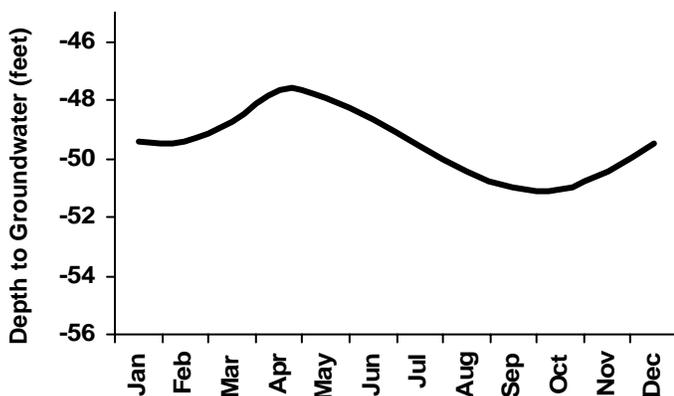
## Managing Your Well During a Drought

In recent years, frequent droughts have caused severe water shortages in parts of Pennsylvania. Droughts can be especially stressful for the one million rural homeowners who rely on private wells for their water supply. These individual wells tap groundwater aquifers that cannot easily be seen or monitored. The invisible nature of groundwater leads to an uneasy feeling among homeowners relying on wells that their water supply could dry up without warning during a drought. This fact sheet explains the typical variation of water in wells and gives some hints on estimating groundwater levels near your well and managing your water during drought.

### The Normal Cycle of Groundwater Levels

The water level in a groundwater well will fluctuate naturally during the year (Figure 1). Groundwater levels tend to be highest during March and April in response to winter snowmelt and spring rainfall. The movement of rain and snowmelt into groundwater is known as “recharge.” Groundwater levels usually begin to fall in May and continue to decline during the summer.

**Figure 1. Natural groundwater fluctuation during the year in a typical Pennsylvania water well.**



Groundwater recharge is limited during late spring and summer because trees and other plants use the available water to grow. Natural groundwater levels usually reach their lowest point in late September or October. In late fall, after trees and plants have stopped growing and before snow begins to fall, groundwater levels may rise in response to rainfall and recharge. Groundwater recharge persists through the fall until cold temperatures produce snowfall and frozen soil that limit the ability of water to infiltrate into the ground. Groundwater levels during winter may be stable or fall slightly until spring snowmelt and rainstorms start the annual cycle again. Given this natural cycle of groundwater, most problems with wells tend to occur in late summer or early fall when groundwater levels naturally reach their lowest levels.

The natural fluctuation of groundwater levels illustrated in Figure 1 tends to be most pronounced in shallow wells. As a result, shallow wells are usually more susceptible to drought than deeper wells. Shallow, hand-dug wells, for example, are often the first wells to dry up during drought. Although deeper wells may be slower to suffer from drought conditions, they may also take longer to recover after a drought has occurred.

### Can Land Use Changes Affect the Susceptibility of My Well to Drought?

Dramatic changes have occurred to the landscape in many rural areas of Pennsylvania. Increasing development and rural population growth will likely continue in the future. Existing rural residents often worry that these changes may create competition for groundwater that might increase the susceptibility of their well to drought. It is unlikely that small numbers of new homes will cause significant changes in groundwater levels. However, more dramatic changes in land use that tap large amounts of groundwater or prevent recharge from occurring over a wide area could make existing wells more susceptible to drought. This is especially true in

areas where mining is occurring or where large paved areas prevent rainfall and snowmelt from recharging groundwater.

### How Can I Monitor Groundwater Levels?

Direct determination of the groundwater level in your well is difficult and usually requires the use of a water level meter. These meters are comprised of an electrical probe attached to the end of a measuring tape. The probe is lowered into the well until a display or light indicates that it has reached water. The depth to water is then read directly from the measuring tape. These instruments generally cost \$300 or more depending on the anticipated length of tape needed.

There are other less direct but more practical methods to determine the status of your well water supply. In recent years, the U.S. Geological Survey (USGS) has developed a Web-based system to access water levels from a group of monitoring wells in Pennsylvania. The USGS presently measures wells in every county of the state. They have developed a Web page that allows viewers to access current and historic water levels in each of their monitoring wells. An example from the Adams County monitoring well is shown in Figure 2. Each graph shows the actual water level in the well (black line) along with color shaded areas to indicate

normal levels (green), drought watch conditions (yellow), drought warning conditions (orange), and drought emergency conditions (red). This information, although not specific to your well, will allow you to observe the general trend in groundwater levels in your area. A list of the available monitoring wells by county is available at:

[http://pa.water.usgs.gov/durplots/well\\_duration.html](http://pa.water.usgs.gov/durplots/well_duration.html)

Once you access this page, choose the well nearest to your house and select the "30-Day Graphs" to view the up-to-date groundwater conditions in your area.

You can also view current groundwater levels and data for the past seven days for each monitoring well by selecting "Current Conditions" from the Web site listed above.

You may also be able to learn more about your local groundwater conditions by contacting local well drillers and neighbors. Well drillers are continually drilling new wells and, therefore, may have knowledge of groundwater levels near your well. They may also have installed new submersible pumps in nearby wells that would allow them to document the existing groundwater level. Similar discussions with neighbors that have had new

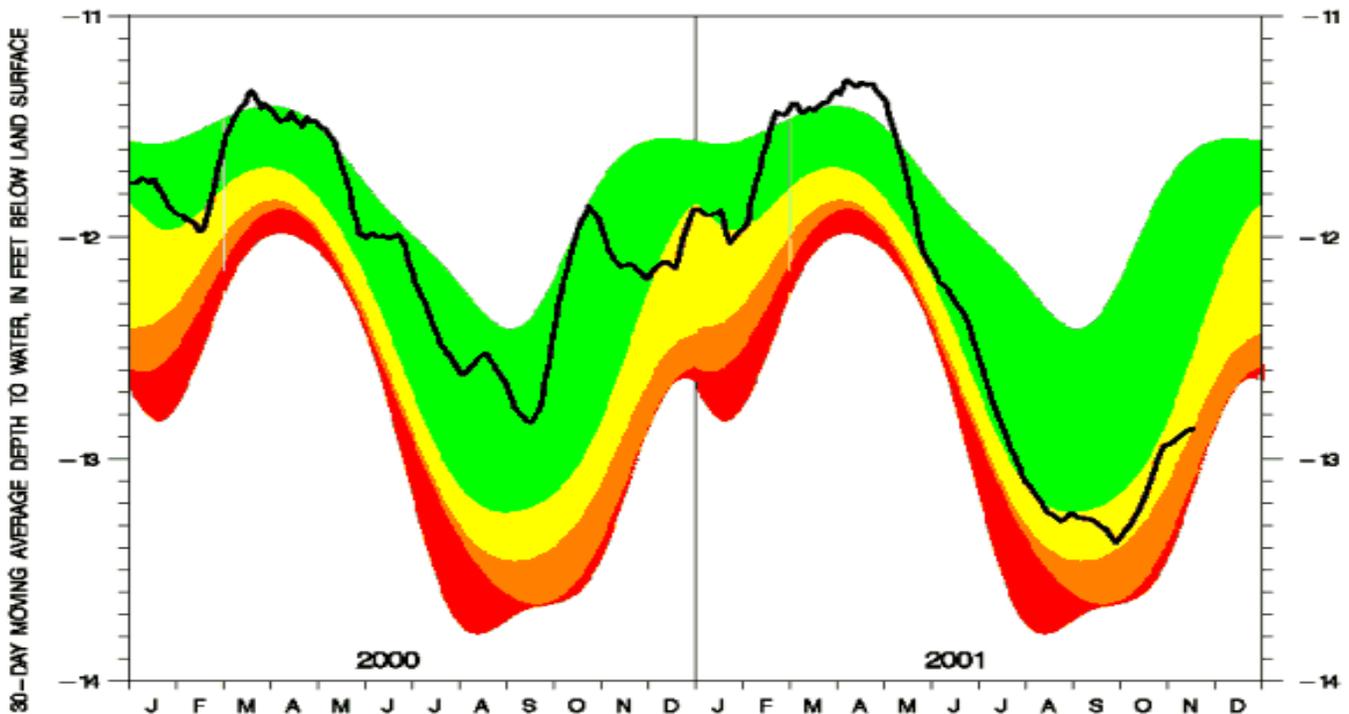


Figure 2. An example graph of groundwater levels in the Adams County USGS monitoring well during 2000 and 2001 ([http://pa.water.usgs.gov/durplots/well\\_duration.html](http://pa.water.usgs.gov/durplots/well_duration.html)).

pumps installed or had new wells drilled may provide valuable information about the groundwater level.

### **How Can I Conserve Water?**

Water conservation measures become critical during times of drought. Homeowners relying on private wells should begin to conserve water as soon as drought conditions occur. Water use within the home can be significantly reduced through changes in habits and by installing water-saving devices. In emergency situations, changes in water use habits can provide quick reductions in water use. Examples might include flushing the toilet less often, taking shorter showers, only washing full loads of dishes or laundry, and collecting water from roof gutters for outside use. It is also important to note that certain drought declarations may also require water use reductions or restrictions on water use. For example, a “drought emergency” declaration bans the nonessential use of water such as car washing and lawn watering. These regulations apply to everyone, including homeowners with private wells. For more information on ways to save water around the home, consult the Penn State Cooperative Extension publications entitled *22 Ways to Save Water in an Emergency* and *Household Water Conservation*. These publications are available from the Web site listed at the end of this fact sheet. Free copies can also be obtained from your local cooperative extension office or from the College of Agricultural Sciences Publication Distribution Center at 814-865-6713 or <http://pubs.cas.psu.edu/>.

### **What Can I Do If My Well Runs Dry?**

There are a number of reasons why a well may quit producing water. The most frequent cause is a malfunctioning or worn-out submersible pump. Other electrical problems such as a malfunctioning electrical switch at the pressure tank may also cause a loss of water. Pressure tanks also need to be replaced from time to time. Water quality problems like iron bacteria and sediment may also clog the well and severely restrict water flow from the well. A well driller or competent plumber should be consulted to determine the exact cause of the problem.

Under persistent dry weather conditions, the water level in your well may drop below the submersible pump, causing a loss of water. In some cases, the water level may only temporarily drop below the pump when water is being frequently pumped from the well during showers or laundry. Under these conditions, you may be able to continue using the well by initiating emergency water conservation

measures and using water only for essential purposes.

If the water level permanently drops below the submersible pump, it may be possible to lower the submersible pump within the existing well. In most cases this will only provide a short-term solution to the problem. More permanent solutions require either deepening the existing well or drilling a new well. Be aware that deepening an existing well may not increase the well yield and could produce water of different water quality characteristics. You should consult with a local well driller or a professional hydrogeologist to determine the best solution for your situation.

Proper management of private wells during droughts will become more important as competition for water in rural areas of Pennsylvania increases. By monitoring nearby groundwater levels online you may be able to detect potential problems early and implement water conservation strategies that may prevent your well from going dry.

### **Additional Resources**

For further information on management of wells and springs in Pennsylvania, visit our Web page at:

**[www.sfr.cas.psu.edu/water](http://www.sfr.cas.psu.edu/water)**

or contact your local cooperative extension office.

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