by Doug Guenther

Water well drawdown impacted by drought and other issues

Continuing drought conditions have had a significant impact in north-central and northwestern Kansas. Municipal and rural water district water wells have experienced varying effects. Water levels in some aquifers have lowered significantly while others have not.

As Technical Assistant for KRWA, I have been asked many times by systems to check wells for drought impact. Systems use this information to establish triggers in water conservation plans. In other cases, the city or RWD has some fear that the well may fail and the system's water supply will be in jeopardy.

One of the most important reasons for measuring drawdown is to make sure that the source water is adequate and not being depleted. The data collected used to calculate drawdown can indicate if the water supply is declining. If that is the case, the system may need to consider additional wells or other water supply options. Drawdown measurements give important information about the performance and efficiency of wells. Drawdown data can be combined with the yield from the well to evaluate the efficiency and performance of a well or pumping unit.

Doug Guenther
Tech Assistant

Measuring drawdown

The process to measure drawdown in a water well should only begin after the well has not pumped for at least 30 minutes. The first goal is to determine the static level of the water. Here's where good well log records are important. It's very helpful to know what the static water level was at the time of construction, or other time in history so that a comparison of today's water level can be made.

The Kansas Department of Health and Environment (KDHE) prefers the air line method because it reduces the potential for contamination for the well. Using this method the well does not have to be opened and a foreign device inserted (such as a well sounder, measuring tape, string and weight).

Experience shows that wells with air lines attached to the pump shafts along with the gauges at the surface have leaks or the gauge ends up frozen in one position after a few years of use. When working properly, the air line method is excellent for monitoring well performance. The material for air lines is usually made of plastic, copper or brass, and is 1/8

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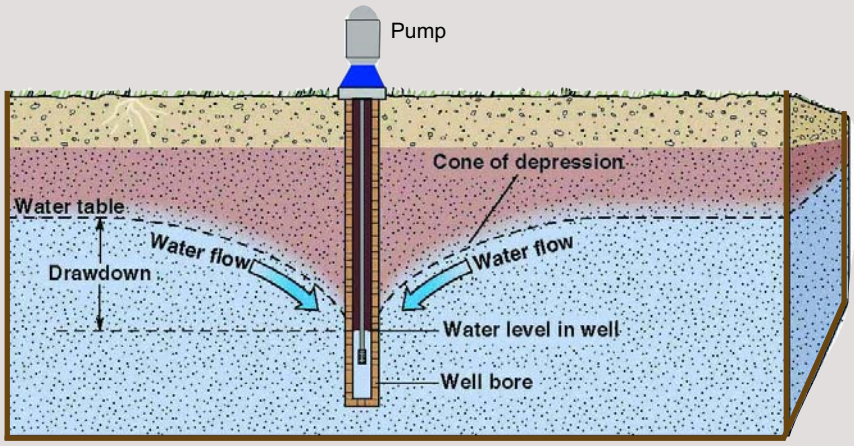
Understanding the cone of depression or well drawdown



to 1/4-inch in diameter. The line must be airtight with fittings at the surface for an air gauge and valve stem for air introduction.

For a known depth of an air line, attach an air pump, air bubble at the tee with gauge and fill with air until gauge pressure is constant. Record the pressure. Subtract this from the length of the air line to find the depth to water. Some gauges have depth on them. If the gauge measures in PSI, the reading can be converted to feet of water by multiplying the number of pounds by 2.31.

Example:
Air line: 150 feet
Gauge reading: 80 feet, or
34.6 psi
Static water level: 70 feet

Many times a well has an air line installed but the record or known depth has been lost. Line length can be determined by pressuring the line to show depth and then sound the well for static level. Add static level and depth to determine the air line length.

Example:
Static level: 145 feet
Gauge reading: 16 psi
16 psi x 2.31 = 37 feet
145 ft. + 37 ft. = 182 feet
of air line tube

After establishing static level, then the drawdown can be determined. This is done by starting the well pump and after reaching a known pumping rate or gpm (against system pressure), the water level can be monitored at regular intervals (five to 15 minutes) until the water level stops lowering. I have seen some wells pump as long as 64 hours for the water level to stabilize. The pumping level is determined when the level stabilizes at the lowest depth. This depth is subtracted form the static level to determine drawdown.

Example:
Static level: 65 feet
Pumping level: 72 feet
72-65 = 7 feet of drawdown

When no air line is present I use an electric sounder. An electric sounder works by lowering an electrode into the water. When the electrode contacts the water a light and buzzer alerts me then at 5-foot increments on the cable. With a tape measure, I determine the last mark to get the depth. The same procedure for the air line method is used. When going to a different well it is prudent to disinfect the sounder with a 50-ppm solution of sodium hypochlorite to ensure no bacteria are not introduced to the well.

Water system operators need to also be aware of the hydraulics of the distribution system. When a

KRWA Technical Assistant Doug Guenther uses a tape measure to determine the last mark on the sounder to get the depth. Make sure to disinfect before using the tools on the next well.

well pumps without much water in the storage tank, there will be a lower head pressure than when the tank is full. The result often is that when the tank is full, the well pump will produce less water.

Doug Guenther drops the sounding cable into the well after disinfection with a 50-ppm solution of sodium hypochlorite.

Often operators fail to take into account the head pressure that the well pump is operating against and then incorrectly assume that the well pump is failing.

Due to extreme ground water level declines for some systems, I've helped numerous cities and RWDs to reduce their well pumping rates to ensure that the drawdown is not in excess of the level of the pump. If the level is exceeded, the well will pump air. The result is pump damage, poor meter performance, erratic chlorination, discolored water, customer complaints and in some cases water hammer in the distribution system due to large air pockets forming in mains.

Monitoring your water well depths and drawdown is also useful in determining pump and well screen problems. I have found that a plugged screen will have the same effect as a severe drought. I have also encountered several wells where the pump out produces the well capacity. In those cases, production has to be reduced.

I would be pleased to provide assistance to any system interested in determining static and operating levels in their wells. This information is critical to documenting the system's operating characteristics. Give KRWA a call at 785/336-3760 or send an e-mail to me at: dougg@krwa.net and I'll get a visit to your system scheduled.

Terms associated with well drawdown

Static level – Static level is the level of water in a well when no water is being taken from the well pumps. It is usually expressed as the distance in feet or meters from the ground surface to the water level.

Pumping level – Pumping level is the level of water in the well during pumping. This too, is usually expressed as the distance in feet or meters from the ground surface to the water level.

Drawdown – Drawdown is the drop in level of water in a well when water is being pumped. drawdown measurements record the difference (in feet or meters) between the static level and the pumping level.

Well yield – Well yield is the volume of water per unit of time that is produced from the well pumping. Usually, well yield is typically measured in terms of gallons per minute (gpm).

Specific capacity – Specific capacity is expressed as the well yield per unit of drawdown. For example, if the well yield is 100 gpm and the drawdown is 10 ft., the specific capacity of the well is 10 gpm per foot of drawdown.

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