What, Exactly, is My Well, and How Does It Work?

If you own a home in Nicasio, you likely rely on groundwater as your source for drinking, *washing*, cooking, and garden irrigation water. Although some homes are served by groundwater-fed springs, most Nicasio residents have wells with electric pumps that move groundwater to the surface of their property where they can use it.

This paper discusses the basics of well operation. It is the first of several that will address some of the challenges commonly encountered in operating and maintaining a groundwater well system, and will identify some ways that you can maximize the efficient use of water available to your property.

1. Where is my well?

As a first step to learning more about your well, you must know where it is.

If you bought an existing home in Nicasio, the location of the well should have been provided as part of the transaction. If it wasn't, and if you can't otherwise find your well, the former owner should be willing to tell you where it is. (Note that you may have more than one well on your property.) If he/she is unavailable or uncooperative, consider asking a neighbor for help.

Whether or not you know the location of your well, it is a good idea to identify and contact the well drilling and maintenance company(ies) that work in our area (*e.g.*, Forster Pump & Well, Jerry & Don's Yager Well and Pump Service) and that have serviced your well in the past. They should be able to provide you with the location, type of construction, age, and other important background information concerning your well.

2. How is my well constructed?

A property owner is required to obtain permits from local environmental health agencies before constructing a well. A domestic well must be drilled by a licensed contractor, and must satisfy applicable local and/or state well standards, including those set by the California Department of Water Resources (DWR) and the State Water Resources Control Board (SWRCB).

A. Constructing the Well

In Nicasio, for domestic wells, drillers typically drill a 4- to 6-inch diameter boring to a depth of from 25 feet to more than 300 feet below ground surface. The boring will be advanced until water-bearing materials are encountered. Those materials may be unconsolidated coarse-grained materials or fracture zones in consolidated bedrock that produce water ("aquifers"). The driller may advance the borehole through upper shallow aquifers to find a deeper aquifer that produces more and/or better quality water. Typically, regulations prohibit domestic use of groundwater encountered shallower than 25 feet below ground surface.

Once the borehole has been drilled, the driller installs lengths of PVC plastic or steel pipe ("well casing") in the borehole. So that groundwater can enter the well, the well casing will contain sections of blank and slotted pipe ("well screen"). Some older wells may be both open at the bottom ("open hole") and have a well screen. The driller will surround the well screen with coarse sand ("filter pack") to keep fine sand, silt, and clay from entering the well, and install a pump towards the bottom of the casing.

The driller is required to install a concrete seal ("annular" or "sanitary" seal) in the gap between the outside of the upper 25 to 50 feet of the casing and the outside of the drill hole. That seal typically extends to the surface, where it forms a 3- to 4-foot square concrete pad. The blank well casing extends 8-to 12-inches straight up out of the middle of the pad (the "wellhead") and is capped with a removable well cap. The sanitary seal and cap are intended to protect the groundwater in the well from surface contamination. *See depiction below*.

Once the well casing and sanitary seal are in place, the driller installs a small electric pump (*e.g.*, ¾ - 2 horsepower) near the bottom of the casing. The pump moves water that enters the slotted casing or the open bottom of the well upward to the surface where it can be used. A well control box controls the operation of the pump. Although a well pump may last as long as twenty years, replacing a worn out pump and control box can cost as much as $4,000.

Throughout this process, the driller records information about the subsurface materials encountered, depth to groundwater, and well construction details. When the well is finished and operational, the driller submits a copy of this information, called a "Driller Log" or a "Well Completion Report," to the property owner, the local permitting agency, and DWR. If you don't have a copy of the Driller Log for your well, we strongly recommend that you obtain one from the prior owner of your property, the County, or DWR.

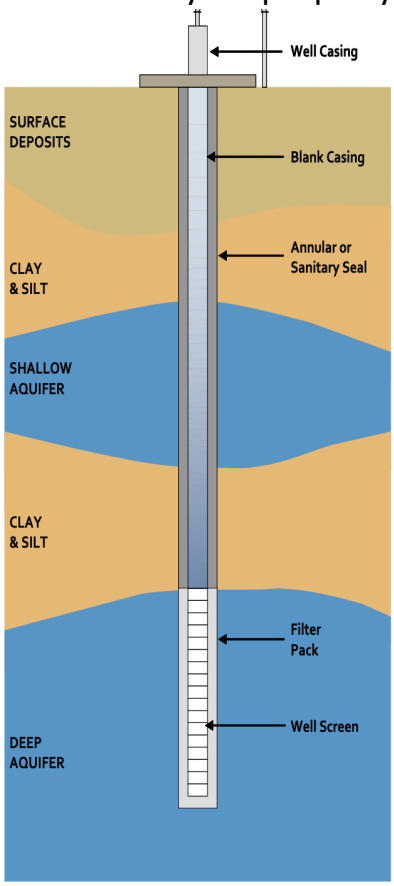

Figure 5. An example of typical well construction.

Source: https://www.waterboards.ca.gov/gama/docs/wellowner_guide

B. Using a Storage Tank or Pressure Tank

In Nicasio, the well pump typically directs the well water to either a storage tank that gravity feeds the water to the home, or to a pressure tank that routes the water into the home under pressure. [In rare cases, the property may have neither a storage tank nor a pressure tank, and the well pump may operate on demand as the result of, for example, someone in the home turning on a faucet.]

Storage tanks are much bigger than pressure tanks. While a domestic water supply storage tank may be twelve feet or more in diameter and hold 1,000 to 20,000 gallons, a typical pressure tank is less than two feet in diameter and may hold only forty gallons. If there is plenty of level space available on your property, installing one or more water storage tanks may present a higher initial cost but ultimately prove less expensive and more efficient than using only a pressure tank. If money or space is tight, and the demand for water from the well relatively small (*e.g.*, <200 gallons per day), a 40-gallon pressure tank may be sufficient.

In a storage tank system, when the water in the tank drops below a certain level (perhaps to 80% of capacity), a sensor in the tank activates a switch in the well control box to send power to turn on the well pump so that the well can begin pumping to refill the tank. Once the tank is re-filled, the sensor in the tank activates a switch in the well control box to turn off the pump.

A pressure tank system works differently. As noted, the pressure tank may hold only about 40 gallons of water. It contains a large bladder, almost like a waterbed filled with air, that keeps pressure on the water in the tank. Such a system uses a 20/40 pressure switch -- when the home draws water from the system and the pressure in the tank falls below 20 psi (pounds per square inch), the pressure switch sends voltage to the well control box, which then sends electricity to turn on the well pump. The pressure switch monitors the pressure and, when it hits 40 psi, the switch turns off the power sent to the control box and the well pump turns off. In this system, both the pressure switch and the well may turn on and off many times a day in their effort to maintain an adequate supply of pressurized water for domestic use.

Note: Due to the recent unprecedented rainfall, most people's wells are operating more reliably, and some concerns about the drought have been temporarily alleviated. So, the next few papers will suggest ways that well owners can capture, store and use rainwater, re-use "graywater," and seek public or other grant money to help defray the cost of such water conservation efforts.

If you have questions or comments, please contact one of the following NLOA members: Greg Dalton (Dalton.greg@gmail.com), Martha Davis (mlcmarthadavis@gmail.com), Steve Lewis (slewis@bargcoffin.com), Keith O'Brien (kobrien@pesenv.com) (January 2023, Issue 2)