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Arizona Domestic Water Wells

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Arizona has stringent permit requirements for submitting a notice of intent to drill a new water supply well for domestic use. The construction diagram and geologic log of all wells in the state are recorded with the Arizona Department of Water Resources (ADWR).

*The ADWR website – **www.AzWater.gov/AzDWR/** —provides a wealth of information for the private domestic well owner. Well owners are responsible for the registration, repair, maintenance and up to-date record-keeping of their own wells and to monitor water quality to assure safe drinking water.*

See also Extension publications #az1581 and #az1663 for detailed information on Well Maintenance and troubleshooting, and well registration and record-keeping in Arizona.

For the proper maintenance of domestic wells, it is important to have a basic understanding about the different components that comprise a home water supply system. The following sections present some information about well casings, well caps, well screens, and pitless adapters; basic components that, when combined with a pump, provide water for a household. Please refer to the Figure below for the location of these well components. See also Extension publication #az1581 for a more detail diagram of well components and tips on how to maintain and trouble-shoot your well components.

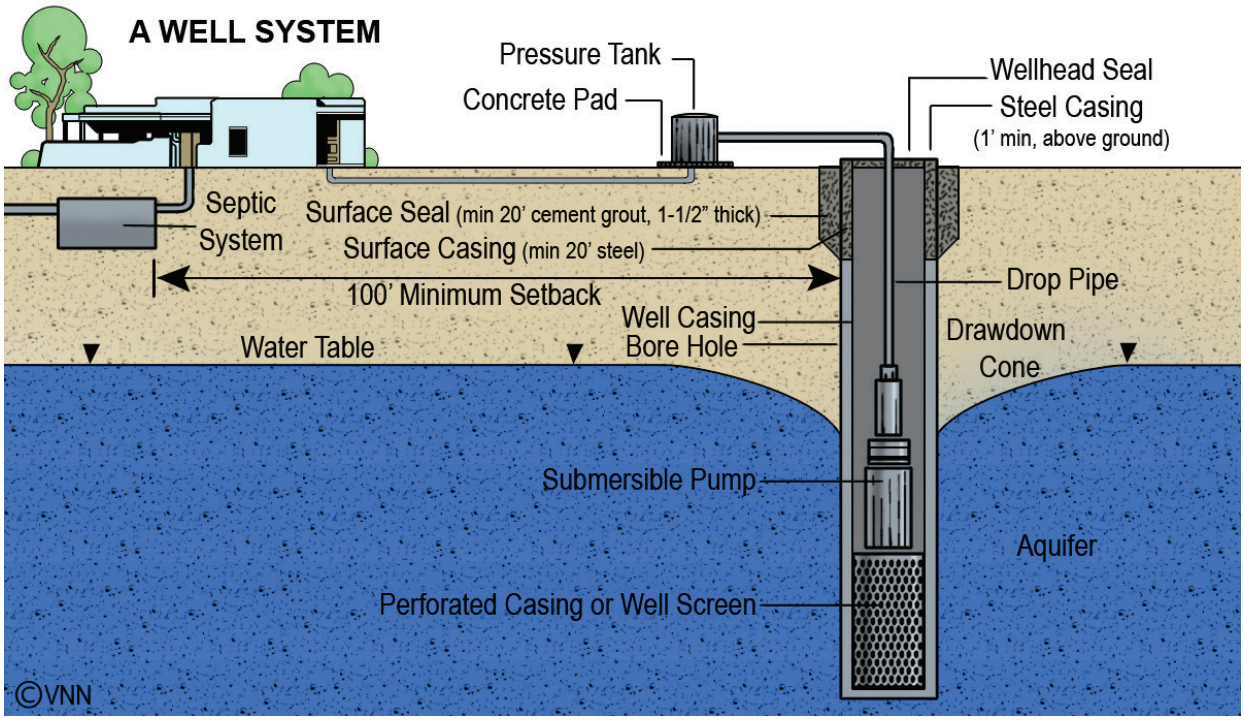

Figure 1. Domestic Well Diagram (adapted from ADWR Well Owners Guide)

Well Casing

A domestic well typically has two well casings. The outer casing is a tubular structure or large diameter steel pipe that encircles the actual well casing, and is considered part of the surface seal. The length of this steel pipe is specified by Arizona Revised Statutes and Rules, as regulated by the Arizona Department of Water Resources, as a minimum of 20 feet in length, one foot of which must extend above land surface. The final length of the steel pipe is dependent on the local geology and may extend to a greater depth to seal the well from contact with a shallow aquifer. The intent of the steel pipe is to prevent surface contaminants from entering the well.

An example of a surface seal is a concrete apron or graded pad, sloped away from the steel pipe, to reduce the potential for standing water to pool at the well head. At a minimum, the land surface or soils near the well head should slope away from the steel pipe if a concrete apron is not present.

The steel pipe is placed in a drilled borehole. The borehole must be at least two inches larger in diameter than the steel pipe or three inches larger if the well is to be drilled inside or within one mile of a know area of contamination. The purpose of the pipe is to maintain the well opening and contain the drop pipe and electrical wiring to the pump. Along with the cement grout that seals the upper twenty feet of the borehole to the steel pipe, the surface seal prevents vertical cross-contamination of multiple aquifer zones and may extend to the full depth of the well. In rock aquifers, the well casing may only extend a hundred feet or more through broken rock, leaving an open rock borehole as the well. There are no statutory limitations on the extent of casings other than the minimal length of twenty feet.

The most common materials for well casings are carbon steel, Acrylonitrile Butadiene Styrene (ABS) or PVC plastic, and stainless steel. PVC is lightweight, resistant to corrosion, and relatively easy for contractors to install although it is brittle and breaks easily. (Note: To minimize exposure to residual solvents, PVC casing sections should be joined without glues that contain solvents.) Although more expensive, when possible, mechanical couplings or threaded pipe fittings are recommended. Steel, although stronger, is susceptible to corrosion, can develop scale in hard waters, and is more costly. Some older well casings may also be constructed of concrete, fiberglass, and asbestos cement, although these materials are not currently allowed under Arizona's regulatory framework. Older wells may also be hand-dug and cased with hand-placed bricks or stone.

Caps

On the top of the surface seal casing, and sometimes on the well casing itself, should be a wellhead seal or cap. Well caps are usually aluminum or a thermoplastic, and include a vented screen so that the pressure difference between the inside of the well and the outside atmospheric pressure may equalize when water is pumped from the well. The cap should fit snugly so debris, insects, or small animals cannot find their way into the well system.

Well Screens and Gravel Packs

Well screens are filtering devices used to prevent excess sediment from entering the well. Attached to the bottom of the well casing, the screens allow water to move though the well while keeping out most sand and gravel. The most common screens are slotted or perforated pipe.

Perforated pipe is a length of casing with holes or slots drilled into the pipe. It is not efficient for aquifers that contain fine-grained materials because it has wide openings that allow sand to fall into the well. A continuous slot screen is made of wire or plastic wrapped around a series of vertical rods, whereas slotted pipe features machine-cut slots into steel or plastic at set distances.

Well screens are manufactured with specified openings and hole diameters to match their screen filtering capabilities to the geologic conditions. Well screens are designed to be placed only within the saturated portion of the aquifer. If the ground water elevation drops and air is allowed to enter the well screen, the well may be damaged by oxygen-induced metal corrosion.

During well design and installation, a gravel pack is typically placed in the annular space outside the screen casing yet within the drilled borehole. The gravel pack consists of sand or gravel that has been designed with a grain size finer than the adjacent soils or unconsolidated aquifer material, yet larger than the screen slot size. The gravel pack acts as a filter to prevent sediment from entering the well, and also to manage the velocity of the water passing through the aquifer and into the well. High-speed water velocity, due to excessive pumping or improperly sized gravel pack, results in erosion of the aquifer as sediment is pulled into the well. Above the gravel pack and the well screen, the annular space between the well casing and borehole wall is backfilled with grout and/or concrete to prevent surface water from draining into the aquifer.

It is common for wells constructed in hard, stable bedrock to remain as an open borehole. In these cases, a screen or gravel pack is not necessary. Since ground water entering an open borehole in a bedrock well typically travels through narrow cracks and fissures, no sand pack to filter sediments is necessary. See Extension publication #az1605 on what well owners should know about well shock chlorination.

Pitless Adapters

In higher elevations where frost may penetrate the ground, pitless adapters provide wells with a sanitary – and frost proof – seal between the well casing and the water line running to the well system owner's house.

After a frost depth is determined for the area where the well is being installed, the adapter is connected to the well casing below the frost line. Water from the well is then diverted horizontally at the adapter to prevent it from freezing, and the plumbing continues beneath land surface to the well system owner's house.

Storage Tank

Most home-owner water well systems include a

pressurized storage tank to store water for use during periods of heavy usage. The pressure tank is designed to have extra water on reserve so that small demands do not require the pump to switch on. However, a tank cannot compensate for demand greater than your pump or well capacity. See Extension publication #az1586 for details about how to clean and disinfect water storage tanks.

Well Log / Report

Wells drilled on Tribal Reservations are not required to be registered with the Department of Water Resources. Outside of the Reservations, every well in Arizona is required to be registered with the Arizona Department of Water Resources (ADWR) and a well log must be submitted by the well driller. If the log is not provided to the well owner by the driller, the log is available to the well owner through the ADWR. The well log identifies the type of geology of the aquifer, the construction materials used to construct the well, the well depth, casing length, screen length, the presence (or absence) of a gravel pack, depth to ground water at the time of installation, and the capacity of the well at the time of well installation. Every well owner should have a copy of his or her well log. See Extension Publication #az1663 for more details and how to register your well and maintain well records.

At the time of construction and pump installation, the licensed well driller pumps the well to test the capacity of the well to yield water and to remove any fluids (such as chemical drilling muds to facilitate drilling) from the aquifer. This pumping also develops the gravel pack around the well, flushing out fine-grain silts and sands from the pack to allow water to flow freely into the well. For an exempt domestic well, well pump capacity is restricted to 35 gallons per minute (gpm), but some aquifers are not able to yield water at that rate. It is not uncommon for wells constructed in consolidated bedrock or finer-grained alluvium to yield 3 to 5 gpm.

The Arizona Department of Water Resources publishes and makes available to the public "A Practical Guide to Drilling a Domestic Water Well in Arizona" that is continually updated as rules and statues are passed. Please visit the ADWR website – www.AzWater.gov/AzDWR/ – for current regulations.

Other Publications for Arizona Well Owners:

Artiola, J.F. and K. Uhlman. 2009. Arizona Well Owner's Guide to Water Supply. University of Arizona Cooperative Extension Publication #az1485.

Artiola, J.F., K. Uhlman, G. Hix. 2012. Arizona Wells: Maintaining and Troubleshooting Wells. University of Arizona Cooperative Extension Publication #az1581.

Artiola, J.F. and G. Hix. 2015. And Arizona Guide to Well Regisration and Record-keeping. University of Arizona Cooperative Extension Publication #az1663.

Artiola, J.F., C. Rock, and G. Hix. 2012. Water storage tanks, disinfection, and maintenance. University of Arizona Cooperative Extension Publication #az1586.

Artiola, J.F.,G. Hix, C. Gerba and K. Farrell-Poe. 2013. What Well Owners should Know about Shock Chlorination. University of Arizona Cooperative Extension Publication #az1605.

Uhlman, K, J. F. Artiola, and G. Hix. 2013. Arizona Well Owners Video Series. University of Arizona Cooperative Extension Publication #az1595(a,b,c,d), available on YouTube. http://www.youtube.com/playlist?list=PLk4rXk_uk7PkbZivdzVaZRbOM0lwhVd5Q .

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