American Ground Water Trust

# Water Well Basics
## Fundamentals Of An Individual Home Water System

### TRANSCRIPT OF VIDEO NARRATION



Video run time 15 minutes. Videos can be ordered on line at www.agwt.org

### THIS VIDEO IS ABOUT GROUND WATER, WATER WELLS AND HOME WATER SYSTEMS

### GROUND WATER IS A PRECIOUS NATURAL RESOURCE

*"Water is one of the most precious resources on earth. We may not think about it very much. Most of the time it is something we take for granted. All plants and animals depend on water, a vital substance that has been a part of planet Earth for billions of years. Water is especially remarkable because it can occur as a liquid, solid or gas and is naturally cycled as rain and snow, moisture in the ground and rocks, rivers, lakes or oceans.*

*The constant movement of water from the atmosphere, to the ground, to rivers and back to the ocean, is called the hydrologic system. One of the most important parts of this vast system occurs beneath the ground as the movement of water through the pores, cracks and fissures in rocks. Water in this part of the hydrologic system is called ground water. Ground water flows naturally to replenish rivers and springs, but the water stored underground also provides a very important supply resource for drinking water and irrigation. Wells can be drilled into saturated underground formations, called aquifers.*

*Ground water supplies more than 50% of drinking water in the U.S., and in rural areas more than 90% of the population use aquifers for their source of water. There is more fresh water stored in America's aquifers than in all the rivers and lakes (including the Great Lakes).*

*A drilled well may find ground water almost anywhere, however not all parts of the country have ground water adequate to supply the needs of a home, either because of low yield or because it is not of good drinking quality.*

*Decisions about water supply for homes and communities need to consider quality, reliability and cost. In many areas where geological conditions are favorable, a water well for each individual home, or a central well to serve a small cluster of homes is the most cost effective way to supply domestic water.*

*In communities where there are many homes, or where local ground water is not suitable, water is usually supplied from a central or regional system. Water in centralized systems is usually treated, chlorinated, stored and then piped to individual users. Pipelines may be many miles long and the source of the water may be from a lake, reservoir, river or large well.*

*Water wells are a very important supply source for municipalities, as well as for individual homes and farms. Six thousand new water wells are drilled in the U.S. each week! The water supply for more than fifteen million homes in America is from their own well.*

*In an independent, or private well system, water can move from deep underground in the aquifer to the tap in the home in just a few minutes and so most home wells don't need the chlorination process that is necessary to protect water quality in the pipelines of centralized water supply systems.*

*Some people prefer the independence of owning and controlling their water supply. There are no monthly water bills, and in most areas, home wells are not subject to fees or restrictions during periods of drought.*

*Not many people know how wells and water systems work, so let's take a look at the key parts that make up a typical home water system. First is the well itself, a shaft, or deep hole in the ground extending down into the water bearing formations. The average well is about 200 feet deep, and most are drilled by specialized drilling equipment. Casing must always be placed in the top part of the drilled hole to prevent the risk of surface water getting into the well. In some types of rock formations, casing may extend much deeper to prevent the hole from caving in. Some wells use a well screen to let water in and to keep sand out of the well. A pump is needed to get water out of the well and into the home. Water from the aquifer is pumped from the well into a pressurized tank which stores water for use when the pump is not running. From this distribution point, water is piped to individual use points in the home.*

*The planning, design and construction of a water well and home water system needs to take account of the geology and environmental conditions at the building site.*

*The first step is proper planning. How much water is required to meet the needs of expected water usage in the home and garden? Where should the well be drilled? What well yield will we get? What water system equipment may be needed to provide a reliable supply?*

*The builder or home-owner should get expert advice about the availability and reliability of local ground water and the safest place for drilling ..... before the first dirt is disturbed.*

*This is the time most prospective well owners turn to experts. The drilling contractor will have current information on any state and local environmental restrictions and permits required for drilling as well as mandatory construction standards for water wells.*

*The driller can recommend the best place for a well based on the character of the soil and bedrock and the required distance from other structures and possible sources of contamination. A water well contractor with extensive experience in the area will have records of previously drilled wells. These records provide helpful information on the location, depth, and typical water yields from nearby wells. In low yielding rock formations a well probably will need to be several hundreds of feet deep in order to provide adequate supply. A well yielding as little as ½ a gallon a minute can still provide 700 gallons a day! More than enough for a family's needs. Home-owners need to know the capacity of their well. Virtually all wells will provide enough water for in-house needs but not all wells can support garden and lawn irrigation systems.*

*Back in the early days of rural settlement, water wells may have just been hand dug holes in the ground. Today's water wells use modern technology to efficiently reach the aquifers and contractors use accepted well construction methods to ensure that the well is safe from any surface contamination risks and will give the best yield available from the formations. Several techniques are used to drill water wells, the most common is the rotary drilling method. Other methods are cable tool, jetting and driven well points.*

*In rotary drilling, a drill bit is attached to a string of drill pipe. As the drill string is rotated, the bit acts as a grinding machine. Cuttings are flushed upward and out of the hole by circulating a special drilling fluid (called drilling mud) down through the drill pipe and back to the surface. This drilling fluid also serves to cool and lubricate the drill bit and by stabilizing the wall of the hole, it can prevent possible cave-in before the casing is fitted into the hole.*

*In areas of hard rocks many drillers prefer to use a rig that operates by compressed air to operate a down-hole air hammer to break up the hard rocks. The compressed air also blows the crushed rock fragments to the surface and any water that flows in the well during drilling.*

*Another drilling technique uses a "pounder" machine, usually referred to as a cable-tool drilling rig. With this method, a heavy bit is attached to the end of a wire cable, is raised and dropped repeatedly, pounding its way downward. Periodically, cuttings are bailed out of the hole. The method is slow and in most places has been replaced by rotary drilling. The cable tool method is responsible for millions of successful wells around the world.*

*No matter which method of drilling is used, the hole is usually lined with steel or plastic pipe called well casing. The type of casing used is determined by local geological conditions and the chemical quality of the ground water. In most states there are recommended well construction standards.*

*The diameter of the drilled hole is usually an inch or two wider than the diameter of the casing. The space between the drilled hole and the casing has to be filled to prevent surface water from migrating downward along the outside of the casing and contaminating the aquifer. This filling is called "grout" and it may be either cement or a special clay called bentonite. Sometimes most of the space is filled with the fine rock pieces from drilling and then the top 20 feet is "grouted" with cement or bentonite.*

*If the well is drilled into rocks that are crumbly, or into sands and gravels, a well screen probably will be needed. The well screen is a "sieve" or "strainer-like" cylinder attached to the bottom of the casing. It allows water to flow into the well while preventing fine rock particles or sand from entering. Well screens are not all the same and the well driller will select the opening size of the screen depending on the size of the rock fragments or sand that make up the aquifer.*

*With the casing and well screen or other intake in place, a flushing, or back washing, of the well may be performed to eliminate loose fragments and stabilize the area immediately adjacent to the well intake. This is called developing the well.*

*Water is pushed from the well to the surface by a pump. For deeper wells, and those at least three inches in diameter, an electric submersible pump is usually installed directly in the well. The electric motor turns impellers in the pump which cause water to be "pushed" upward out of the well. In some wells, especially in narrow diameter holes where the depth to water is less than 25 feet, a shallow-well jet-pump may be used. Above ground deep-well jet-pumps, also driven by electric motors, cause water to be pushed out of the well. Jet-pumps have to be protected from frost, and in northern states are often placed in a home's basement.*

*Most home water systems include a water storage pressure tank, usually located in the basement or utility room. An important purpose of the pressure tank is to keep the supply of water to the home's taps and fixtures at a fairly even pressure. The pressure tank also stores several gallons of water, so if you only use a small amount, for example just filling a glass, the pump doesn't have to run during that time. A pressure switch controls the starts and stops of the pump whenever water pressure drops below a preset level. The pressure in the tank is restored each time the pump runs.*

*To show how a typical water system works, lets follow a drop of water on its journey from the aquifer to the home.*

< *Here is the water drop deep underground. It has been moving slowly through the formations for a few years since it first entered the ground as a raindrop. Right now there is very little movement of ground water in this aquifer.*

*Now what happens when the tap is turned on?*

< *At first, the water comes from the pressure tank where it is stored, but as more is used, the pressure switch starts the submersible pump.*

- *When the pump switches on, our water drop moves from cracks and fissures in the formation, through the well screen, and into the well.*
- *Once in the well, the drop is slowly drawn upwards towards the pump.*
- *It passes through the pump intake and is swirled around by the pump impellers and pushed up a pipe.*
- *It travels up the pipe into the house.*
- *Once it enters the house it goes into the pressure tank. Then it may temporarily stop if the people in the house have turned off the tap because no more water is needed at the time.*

*Now the tap has been turned on again.*

- *The water drop flows out of the pressure tank and through any water conditioning equipment. In this case a water softener.*
- *The water drop passes through the softener, enters the plumbing system and emerges at the kitchen tap.*
- *From aquifer to coffee maker in the space of a few minutes!*

*Home-owners need to check their water systems from time to time. An annual water test is a good idea and most water labs will provide sample bottles and instructions. Every few years a professional contractor should be called in to check that the pump, pressure tank and conditioning equipment (if you have any) is working efficiently. Like any other mechanical equipment, it makes good sense to have a water system serviced from time to time.*

*An independent user-owned water system is really just a part of the endless natural water system. Rain and snowmelt replenish and add to stores of ground water. A water well enables us to use some of this store of underground water and after we have used it , and the waste water has been treated by a septic system or municipal waste-water plant, it returns to the hydrologic system. Our water drop could soon be back as water vapor in the clouds, as fluid water in a lake or ocean, or back underground in an aquifer. It could perhaps fall as snow on an ice cap and remain as ice for thousands of years!*

*Through the hydrologic system, nature has provided us with a constant renewal process for our supply of life-sustaining ground water. Some places have more water than others, so it makes good sense not to use more ground water than is naturally replaced. To ensure that we have safe reliable ground water resources for years and years we need to:*

- *use ground water responsibly*
- *recognize that it is a resource worth protecting, and*
- *make sure it is managed properly by our local communities and decision makers.*

*Ground water is America's priceless natural resource. The more we understand the natural hydrologic water system and know how home water wells and water systems work, the better we will be able to ensure that our grandchildren and great grandchildren will be able to enjoy ground water's benefits."*

**GROUND WATER: A PRICELESS NATURAL RESOURCE**



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