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Fact Sheets
Greenhouse Management / Engineering

Drilled wells – a clean water source

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Drilled wells are a source of water for many greenhouse operations. They provide clean water with very few impurities. The yield is usually limited and as additional greenhouse space is built, an additional well may have to be drilled.

Groundwater is found in aquifers that are located below the earths crust. As rainfall occurs, some of it evaporates, some of it is removed by plant transpiration and the remaining water filters down through the topsoil and overburden and flows into sand, gravel and fractured rock. The upper level of groundwater is called the water table. The height of this varies with the amount of rainfall and the formation of the aquifer zone. Artesian wells (natural flowing) are formed when the aquifer uphill creates a water pressure that forces the water out of the top of the well.

Aquifers can take many forms

A common type aquifer is the gravel deposits found along many rivers. These hold large amounts of water and may be hundreds of feet deep. As the water can move fairly rapidly, a gravel type aquifer can have a yield of 50 to 100 gallons per minute (gpm).

Another type of aquifer is formed from veins of sand or gravel. The water flows through these from one area to another. By tapping into a vein, a good supply of water can be had. The problem comes in locating these below ground areas although sometimes the vein will intercept the soil surface and water flows out by gravity. There are referred to as springs.

A third type of aquifer is in the fractured bedrock deeper below ground. The water flow depends on the size of pores and cracks in the rock and is usually slower. As most of the bedrock has cracks, almost anywhere you drill a well you will get some water although the yield may be much smaller.

The flow of water that can be obtained from a well depends on the permeability and size of the aquifer, its recharge area and the amount of rainfall. To some extent, the diameter and depth of the well also influence yield. In some areas of the country, a well may be 1000 feet deep and yield less than 1 gpm. Depending on the type of aquifer, hitting water with a well is like the lottery. A well in one location may provide a very low yield, whereas moving over 10 feet may intercept a good vein and give 30 gpm. In most areas, well drillers keep an accurate record of the depth and yield of wells they drill. In some states the Department of Health maintains this record that is available to well drillers.

Well drilling

There are two main methods of drilling a well. The older method, cable-tool drilling, uses a drill bit attached to a cable that is continually raised and then dropped. The drill breaks up the rock, water is added and then the debris is removed with a bailer. This is a slow method but the advantage is that there is less chance of sealing up the pores and cracks. Cable drilling is limited to several hundred feet deep.

In rotary drilling, a drill is attached to a hollow shaft that is rotated by an engine and transmission. Drill mud is pumped down through the pipe and out through perforations in the drill. The mud and ground up rock flows up through the bore hole and into a settling pit where the solids settle out. Depending on the soil or rock being drilled, the drill is rotated at 30 to 150 revolutions per minute and is faster than cable drilling. Rotary drilling can make a well that is several thousand feet deep.

Both drilling methods can be modified to use compressed air instead of water for lubrication and debris removal. This reduces sealing of the pores. An air hammer device can also be added to increase the drilling speed.

When drilling a well, a steel casing is commonly placed in the earth to the point where the well reaches the bedrock. It is hammered into the bedrock to create a tight seal that keeps surface impurities, such as, clay, fine sand, fertilizer and pesticides out of the well. The casing may also be grouted to get a good seal. A typical well is 6" diameter but to get greater yield, a larger diameter is often drilled.

Hydrofracting is sometimes recommended to increase the flow in a low-yielding well. In this process, the well is filled with water and a high pressure is built up. This may open up some additional pores. In most wells, there may be a slight increase in yield but it doesn't work in all wells. The cost is usually $1500 to 2000.

Location of the well
Local and state regulations need to be considered. A permit may be needed. There is usually a minimum distance from a septic system or sewer and may be a minimum distance to a property line. Another consideration is access for the drill rig. These are heavy pieces of equipment often weighing over 35 tons so solid ground is needed. The location of trees and landscaping plants should also be considered. Finally, try to pick a location where the trench for the pipe to the greenhouse can be conveniently placed.

Testing
Once the well is drilled and pumped to clean out the debris, yield, static water level and location are usually recorded and reported to the state agency. Following local codes, the well should be disinfected with chlorine bleach. After pumping and when there is no more odor of chlorine, a sample of the water should be taken and sent to a laboratory for quality testing. Besides chloroform bacteria, tests should also be run for soluble salts, carbonate hardness, mineral content and pH, factors that affect plant growth. Having values for these will help in adjusting fertilizer levels in irrigation water.

Contracting
Some well drillers will contract to provide a well having a minimum yield. They usually have extensive experience of drilling in the area and know the underground soil structure and typical yield. Other drillers will quote on a per linear foot basis, a figure for the casing section and a lower cost for the portion of the well in bedrock where casing is not needed. It is best to get quotes and references from more than one driller.

Drilled wells are a dependable water source for many greenhouse operations. Getting an adequate yield to supply the needs can be a problem in some areas. Conserving water through drip, ebb and flood and flooded floor irrigation can help to make the water supply go farther.