HELPING COMMUNITIES, RESIDENTS, BUSINESSES AND FARMS, THAT USE WATER WELLS, MAINTAIN SAFE, RELIABLE, COST-EFFECTIVE WATER SUPPLIES AND ENSURE A SUSTAINABLE LOCAL ENVIRONMENT.
California, Nebraska, Arkansas, Texas and Idaho accounted for 63 percent of total irrigation water obtained from ground water. Kansas, Arizona, Florida, Colorado and Missouri rounded out the top 10 states. Application rates range between 1 and 2 acre-feet per acre for states that utilize ground water from the High Plains (Ogallala) aquifer (Nebraska, Texas, Kansas, and Oklahoma) or the Mississippi River alluvium (Arkansas, Missouri, Mississippi, and Louisiana) for irrigation. Application rates are much higher and can exceed 5 acre-feet in regions where surface water is combined with flood-irrigation methods (Arizona, Montana, and Idaho).

Public supply refers to water distributed through pipes to at least 25 people or a minimum of 15 connections. Between 1995 and 2000 the growth in the water volume obtained through public water supply ground water sources matched the eight percent growth in the population served by public systems. The largest ground-water withdrawals were in California (257 Mgal/d) and Florida (239 Mgal/d), and combined with Texas and New York, represented 59 percent of the 16,000 Mgal/d of ground water withdrawals by public water systems in 2000. The remaining states in the top 10 are Ohio, Arizona, Washington, New Jersey, Utah and Illinois (131 Mgal/d).

Domestic water use is water used for indoor and outdoor household purpose. The source of domestic water is (98 percent) ground water obtained with a private well. Fifteen percent of the United States population relies on wells for their household activities. Water use from private wells between 1995 and 2000 is estimated to have risen by 6 percent and the population on private wells by only 2 percent. The USGS estimates that a total of 3,590 Mgal/d was used for domestic needs in 2000. The top ten states for domestic water use from ground water account for 1,689 Mgal/d and include in decreasing order California, Michigan, Florida, North Carolina, New York, Illinois, Virginia, Ohio, Pennsylvania and Texas.

For the first time in 30 years, the US Census Bureau did not collect information on domestic water sources during the 2000 census. Based on 1990 data, the top ten states for well ownership are Maine (42 %), New Hampshire, Vermont, Texas, New York, Nebraska, Michigan, Idaho, Minnesota and Indiana (25 %). The states with the largest total number of wells also have some of the largest populations and large regions of rural character with minimal development that cannot be served economically by centralized public water utilities. Michigan has the largest number of wells (1,121,000) followed by Pennsylvania, North Carolina, New York, Florida, Ohio, Wisconsin, Texas, Indiana and Virginia (539,000).

Ground water obtained through private wells will always be an important component of water supply delivery in America and the world. The cost to develop and maintain infrastructure for public supplies is frequently prohibitive in all but densely populated areas. Individual private wells can access ground water economically and sustainably by using sanitary well construction methods, efficient pumps and withdrawal patterns that do not exceed the safe yield of the recharge to the aquifers.

and are known as bacteriophages (“eater of bacteria”).

There are no convenient standard water tests to identify viruses in water samples, such as exist for coliform bacteria. The isolation and identification of viruses is difficult and usually requires a large water sample on the order of 50 or more gallons that is analyzed with special techniques. These identification methods are not able to detect all viruses. The combined sampling and analytical methods are effective for most viruses less than 75 percent of the time compared to over 90 percent for standard coliform bacteria testing procedures.

Viruses and bacteria may enter a well through similar pathways found in poorly constructed wells that lack adequate casing, grouting and/or a sealed well cap. This common pathway may allow a private well owner to infer that a well is likely free of viruses if the coliform and fecal coliform bacterial tests are negative. It is important for a well owner to test the well water annually for bacteria to monitor for biological contamination. If there are fecal coliform bacteria, then there may also be viruses from a human/animal waste stream source.
At some depth below ground level any “empty” spaces in the underlying geologic formations are filled with water. Different rocks will have different amounts of “space,” with sands and gravels having up to 25% space, and solid rocks such as unweathered granite, having less than 1% or zero. When wells are drilled, the first strike of water is when the well reaches the water table. After “striking” water, drillers will typically continue a well for a considerable distance further down in the saturated rocks because they know that water table levels can rise and fall. When the well is finished, the water level in the well will usually be at the same level as the surrounding water table.

When rain or snowmelt soaks down to the water table, the table level will rise. If there is no recharge, then the water table will slowly fall because ground water is constantly moving towards rivers and springs. When wells are drilled into saturated rocks then pumping will also result in a lowering of the water table as water is pumped out. At any time, the level of the water table in a particular location is a balance among recharge, natural discharge and pumping.

The rate of change in the level of a water table is very strongly influenced by the amount of space available in the rocks. For example, for the same amount of either recharge or pumping, the water table in rocks with 5% of space filled with water will rise and fall four times the vertical height of a water table in rocks with 20% of space.

Most places experience seasonal changes in water table levels because of peak months of rain or snow and because trees, bushes and grass use water in the growing season that would otherwise raise the water table level. In suburban areas, pavement and roofs can reduce ground water recharge, and additional wells can also help to lower water tables.

One of the challenges in calculating how much ground water is available for use is to work out if changes in water table levels are related to natural causes or to pumping and land use changes.

Plotting graphs of water table levels over a long period of time can be very useful for predicting future water levels. All well owners should keep records of information for their wells, and at any time a well is serviced, or the well cap needs to be removed, the contractor should be asked to measure the depth to the water table.

[In some areas, the water in a well may be under artesian pressure and the water level could be higher than the level where the driller first struck the water.] Whether a well’s water level is at the water table or at an artesian level, keeping records of the date and the water level can really be helpful for estimating long-term reliability of supply.
Viruses and bacteria are both words that bring to mind discomfort and disease. Both entities can be transported in water and can make us sick. Diseases related to bacteria and viruses were described in history as early as the 10th century and medical practitioners as far back as the 13th century began to postulate that an “invisible” organism was the cause of disease and decay.

We know today that bacteria are one-celled organisms that reproduce through cell division (binary fission), and produce and store energy using enzymes contained within their own structure. Viruses are not “cells” and are not classified as living organisms because they must rely on a host to reproduce or to create energy to live. Viruses have extremely simple structures that include a protective outer shell made of protein (the capsid) that surrounds the viruses’ nucleic acid (either ribonucleic acid [RNA] or deoxyribonucleic acid [DNA], but not both). A tail may attach to the 20-sided polygon shaped capsid giving the virus the appearance of an angular light bulb. Some viruses are rod-shaped, wheel-shaped or spherical and do not contain a capsid.

Viruses are the smallest life forms known ranging between 20 to 400 nanometers (nm) in longest dimension (One nanometer is one-billionth of a meter). It would take 1.3 million of the smallest viruses laid end-to-end to make one inch. The smallest bacteria are 100 nanometers, but most are over 2,000 nanometers and may be as large as 13,000 nanometers (13 microns). Viruses are too small to be removed by filtration.

Bacteria may live on their own without a host, but viruses are parasites. Viruses must invade and live in host cells of plants, animals or bacteria and subjugate the cell’s life-sustaining mechanisms to create food (synthesize proteins) and reproduce (manipulate RNA and DNA). Many viruses attack bacteria as a specialty.