

In rural areas, many homes do not have connections to municipal water and sewer lines. Homeowners rely upon privately owned or communal (shared) wells as their drinking water source, and individual septic systems to treat and discharge their wastewater. Homeowners must ensure that their well water is safe to drink, and that their well and septic system are properly maintained. A malfunctioning well or septic system can pose a health risk to your family and neighbors, and can be expensive to repair or replace. It is therefore important to conduct a detailed inspection of both the well and septic system prior to purchasing a home. This document will describe how wells and septic systems function and how to inspect them.

Wells

When you are purchasing a home with a private water supply (a well), there are three key items to consider:

- well system
- water quantity
- water quality

Well Systems

There are three common types of wells: dug, bored and drilled.

Dug and bored wells (60-120 cm/24- 48 in. diameter) are commonly used to produce water from shallow surface aquifers (less than 15 m/50 ft. deep); and, they are prone to contamination from surface water infiltration and to water shortages (see Figure 1). An aquifer is an underground formation of permeable rock or loose material, which can produce useful quantities of water when tapped by a well. Another type of well used in surface aquifers is a sand point well (2.5-5 cm/1-2 in. diameter), which is a pointed well screen connected to a small diameter pipe driven into water-bearing sand or gravel.

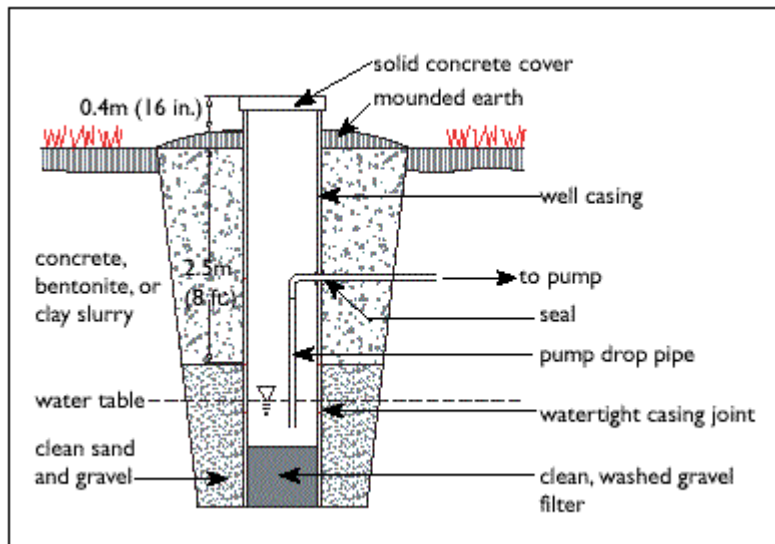


Figure 1: Dug well

Drilled wells (10-20 cm/4-8 in. diameter) are commonly used to penetrate deeper aquifers (15 to greater than 60 m/50 to greater than 200 ft. deep), are more costly to construct, but generally provide a safer source of drinking water (see Figure 2).

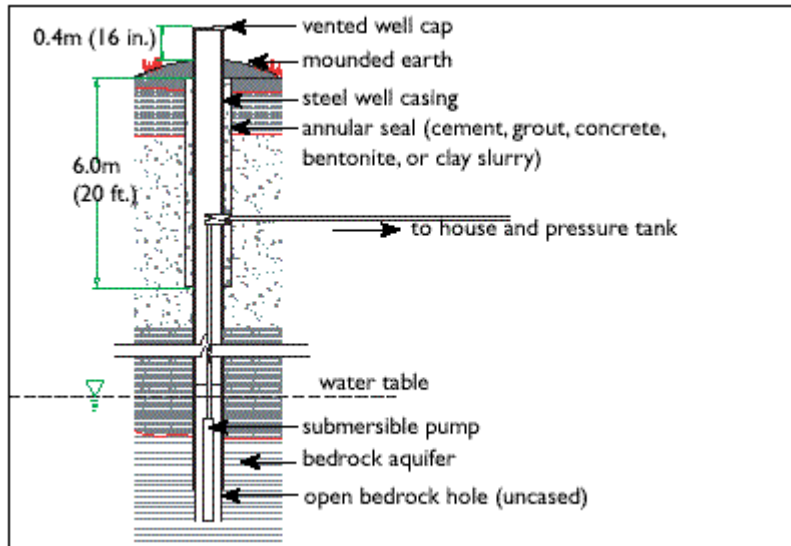


Figure 2: Drilled Well

Common features of well systems include:

casing –structure around the well hole, which keeps it from collapsing. It could be a steel casing, concrete rings or an open hole in bedrock.

inlet –allows water to enter the well from the bottom. There might be a screen at the inlet to prevent fine particles from entering the well and a foot-valve (check valve) to maintain system prime and pressure.

pumping system –includes pump, piping and necessary electrical connections to pump water from the well into the house, and a pressure tank to maintain constant water pressure in the house. Submersible pumps are usually used in drilled wells, while shallow wells usually use centrifugal pumps, which are located out of the well, most likely in the basement or in a pump house.

surface protection –prevents surface water and contaminants from entering the well. Includes: watertight seal placed around the casing (annular seal), well cap 0.3–0.4 m (12-16 in.) above the ground, and mounded earth around the top of the well casing to divert rainwater.

Well Inspection Checklist

The well should be inspected before the house is purchased. If there is a problem with the physical state of the well (for example, cracked seals, settled casing) contact a licensed well contractor to correct the problem. Check the Yellow Pages™ under “water well drilling and service” to find a local licensed well contractor.

Well Record —Obtain a copy of the well record from the owner or the Ministry of the Environment. This should include: location of well, date of well drilling, depth and diameter of well, static water level, pumping water level, recommended pumping rate and the recommended pump setting.

Location —(Figure 3) A well should be located at least 15 m (50 ft.) from any source of contamination if the casing is watertight to a depth of 6 m (20 ft.); otherwise, the separation distance should be at least 30 m (100 ft.). Sources of contamination include: septic systems, manure storages, fuel storages, agricultural fields (manure or fertilizer runoff), roads (salt runoff). Wells should be located at least 15 m (50 ft.) from a body of water.

Well Cap —The cap should be at least 0.3 m (12 in.) above the ground. The well cap and seal should be securely in place and watertight. A locking cap would give some added security against tampering. Well caps are on drilled wells and well covers are on dug wells. Both types should be inspected.

Well Casing —No cracks or settling of the casing should be visible. The ground should slope away from the casing.

Drainage —Surface water should drain away from the well and water should not pond around the well casing.

Well Pump —The well pump and distribution piping should be in good condition.

Grass Buffer —A permanent grass buffer of a minimum 4 m (12 ft.) width should be maintained around the well head. Fertilizers and pesticides should not be applied to the grass buffer.

Abandoned Wells —All abandoned wells on a property must be decommissioned (plugged) by a licensed well contractor. Ask the owner if there are any abandoned wells on the property and if they have been properly decommissioned.

Inside the House —Check for sand or grit in the faucet strainer which indicates a corroded well screen. Verify that the pressure tank reads between 250 to 400 kPa (40 and 60 psi). Ensure that the check valve (or foot valve) is able to sustain the system pressure by drawing no water for 30 minutes to an hour and monitoring the pressure. The pressure should not drop nor should the pump start up during this dormant period.

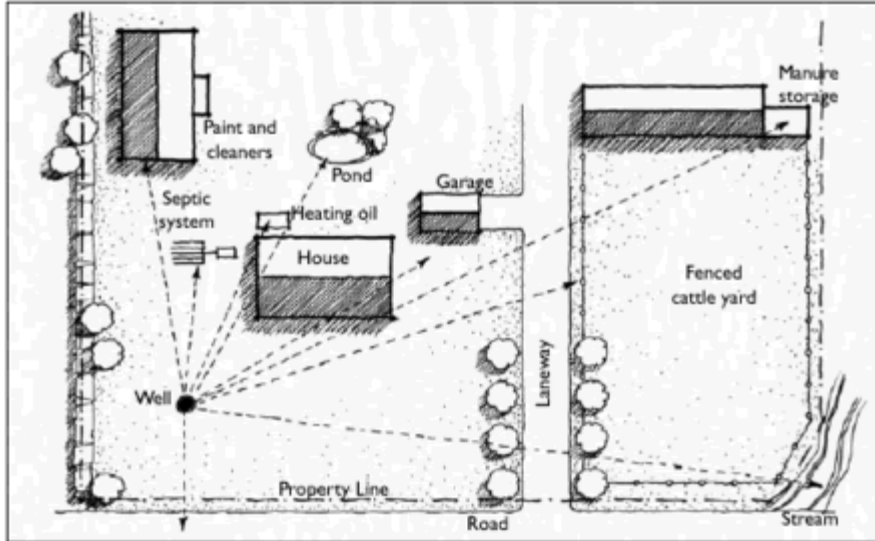


Figure 3: Well Separation Distances

Water Quantity

Wells draw water from aquifers, which are zones of saturated permeable soil or rock. Some types of soil make for good aquifers, such as gravel and fractured bedrock that can support high water pumping rates, while other types of soil make for poor aquifers, such as silty sand and clay that cannot support high water pumping rates.

Wells can run dry for the following reasons:

- The pumping rate is higher than the groundwater recharge rate.
- The water table (level of saturated water in the soil) has dropped to below the pump suction or inlet.
- The well screen has become plugged by fine sand, chemical precipitation, bacterial fouling or corrosion.
- If a well vent becomes blocked, a negative pressure may occur (in the well) during draw down and reduce or stop the pump from drawing water.

If there is a water supply problem, a licensed well contractor should be consulted. Solutions may include: water conservation in the home, digging a deeper well, unplugging a fouled well screen or replacing a corroded well casing or screen. The cost of fixing the problem should be considered when negotiating the sale price for the home.

There are three sources of information to help determine if a well can produce a sufficient quantity of water:

- local knowledge

- well record
- water recovery test

Local Knowledge: The best indication of whether there is sufficient water supply is to ask the owner, neighbors or local well drillers if there have been any problems with wells running dry on the property and in the area. Generally, shallow wells are more likely to have problems with water shortages than deep wells, as shallow wells draw water from surface aquifers, which can fluctuate greatly depending upon the amount of precipitation.

Well Record: Obtain a copy of the well record from the previous owner or the county. The pumping water level indicates if the well is shallow or deep (less than 15 m/50 ft. is considered a shallow well). The recommended pumping rate should be greater than 14 L/min (3.6 US gal/min).

Water Recovery Test: A licensed contractor can be hired to conduct a recovery test which involves pumping water out of a well and then giving it time to recharge. This can help you determine how much water you can draw from the well. A well should be able to pump 14 L/min (3.6 US gal/min) for 120 minutes or 450 L/person/day (119 US gal/person/day) (Source: MOE, Procedure D-5-5, 1996). A recovery test can cost \$200-\$300 (Source: Gilles Bourgeois Well Drilling Ltd., St. Albert, ON, 2003).

Water Quantity Checklist

Ask the owner, neighbors or a local well contractor if there have been any problems with the well or area wells running dry.

Verify the depth of the well and pumping rate from the well record. A surface well is more likely to run dry in times of drought.

Have a licensed well contractor conduct a recovery test, if necessary.

Water Quality

The quality of the well water is very important. Poor water quality can lead to health problems, unpleasant taste and odor, and costly treatment systems and/or the costly use of bottled water. Well water can be contaminated with bacteria and chemicals. Common sources of contamination include infiltration from septic systems, manure runoff, pet waste, or road chemicals as well as dissolved chemicals naturally present in the groundwater such as calcium, sulphur, chloride or iron.

Water Sampling

Your offer of purchase should always include a requirement that closing is conditional upon an acceptable water quality evaluation. It would be ideal to take three water samples, about a week apart, with one of the samples taken after a rainstorm when surface water contamination is most likely. If possible, take the water samples yourself. The three samples should be analyzed for: total coliform, E. coli, and nitrate (\$30 each time) while one of the samples should also be analyzed for: sodium, hardness, sulphate, chloride, lead, iron, manganese and pH (\$80). Ask the laboratory to indicate the drinking water standards along with the results. Additional analyses can be conducted including: metals scan (\$70), pesticides if the well is in an agricultural area with heavy pesticide use (\$250), or gasoline and solvents if the well is near a gas station or industrial area (\$70).

Contact your local public health office for instructions on where to obtain appropriate sterile sampling bottles and where to submit water samples for testing. Bacteria and nitrate are analyzed free of charge in some states through local public health, while the additional parameters will have to be analyzed at a private analytical laboratory.

If possible, samples should be taken from a tap between the well pump and any water treatment units and/or pressure tank. Follow the directions on the sample submission form for proper water sampling procedures.

Assured Home Inspections Drinking Water Sampling as an Optional Fee-based Service

We provide the optional service for you of taking drinking water samples and sending them to a laboratory. Within a few days, results of the test will be sent to you - indicating levels of chemicals (nitrates and nitrites), PH, chlorine, bacteria and lead. Reported levels are compared to EPA safe level designations. Inform the inspector of your choice for this service prior to the home inspection.

Note: We do not provide septic system services at this time.

Test Results –What They Mean

If concentrations are higher than the limits described below, consult a water treatment systems supplier to determine if a water treatment technology is appropriate. It is preferable to get several quotations.

Health Indicators

Escherichia coli (E. coli) or faecal coliform: These bacteria are found only in the digestive systems of humans and animals. Their presence in your well water is usually the result of contamination by manure or human sewage from a nearby source such as a septic system or agricultural fields. Drinking water contaminated with E. coli or faecal coliform causes stomach cramps and/or diarrhoea as well as other problems and can even cause death. The drinking water standard for both E. coli and faecal coliform is 0 counts/100 ml. A value of 1 or more indicates that the water is unsafe to drink.

Total coliform: This group of bacteria is always present in manure and sewage, but is also found naturally in soil and on vegetation. The presence of these bacteria in your well water may indicate that surface water is getting into your well. A total coliform value of 1-5 suggests that the safety of the water is doubtful, while a value of greater than 5 indicates that the water is unsafe to drink.

Nitrate: The presence of nitrate in your well water is usually the result of residential yard or agricultural fertilizers, or seepage from septic systems. Infants less than six months old can become sick from drinking formula made with water high in nitrate (greater than 10 mg/L). If you have an infant less than six months old, it is recommended to use bottled water.

Sodium/Potassium Chloride: Individuals who are on a sodium- (salt) reduced diet should consult with their physician if the level of sodium in their well water exceeds 20 mg/L. Domestic water softeners typically use sodium chloride and this increases the level of sodium in the drinking water. Potassium chloride is an alternative to sodium chloride for softening water. However, individuals suffering from hypertension, kidney disease or congestive heart failure should consult their physician prior to using drinking water containing high levels of sodium or potassium. A separate, unsoftened water supply (by-passing the water softener) can be installed for drinking and cooking purposes if sodium or potassium is a health concern.

Sulphate: At concentrations above 500 mg/L, sulphate can have a laxative effect and give a bitter taste to the water.

Lead: Lead concentrations in water are likely due to lead piping. Concentrations as low as 0.01 mg/L could cause longterm health problems.

Aesthetic indicators

Hardness: Hardness is a measure of calcium and magnesium in water. These elements precipitate with carbonate in boilers and pots to form scale. Hardness also makes it difficult to form lather, requires more soap, and creates a soap scum. Many homeowners decide to purchase a water softener, which replaces calcium and magnesium ions with sodium or potassium ions. Hardness (as calcium carbonate) above 80 mg/L could require a water softener.

Chloride: Chloride concentrations above 250 mg/L can give a salty taste to the water and may corrode piping.

Iron and Manganese: Well water with iron concentrations above 0.3 mg/ L and manganese concentrations above 0.05 mg/L could stain plumbing fixtures and clothing; water may appear rust coloured or have black specks in it; can also cause a foul taste in the water and bacterial fouling of the well screen.

pH: pH values of less than 6.5 or greater than 8.5 may cause corrosion of piping.

Water Quality Checklist

* Water sampled on three different dates—preferably a week apart—from a tap between the well pump and any water treatment units and/or pressure tank for: total coliform, E. coli and nitrate.

*Water sampled once for: sodium, hardness, sulphate, chloride, lead, iron, manganese and pH.

*Obtain copies of previous water quality test results from the homeowner. Ask if there have been any water quality problems: frequent stomach illness (bacteria), odors (hydrogen sulphide, methane), rust spots (iron), scale (hardness), slime growth in faucets (iron or manganese), salty taste (chloride), bitter taste (sulphate).

*Review with the owner the operation and reason for any water treatment systems (water

softener, disinfection system, reverse osmosis system, chlorination unit, etc.). Ask to see all treatment device operating manuals.

*Sample a glass of water for taste (salty, bitter), odors (hydrogen sulphide, methane), cloudiness (small particles) and color (a rusty color can indicate a high iron content). Remember you will be drinking this water every day.

*Look for scale on fixtures or around the faucets indicating hard water. Lift the lid and inspect the back of the toilet tank (the cistern) for sand, sediment, rust particles, scaling, biological growth and any other visual clues which may indicate water problems.

*Is there a "rotten egg" smell from the hot water heater? This indicates hydrogen sulphide gas, which can corrode piping.