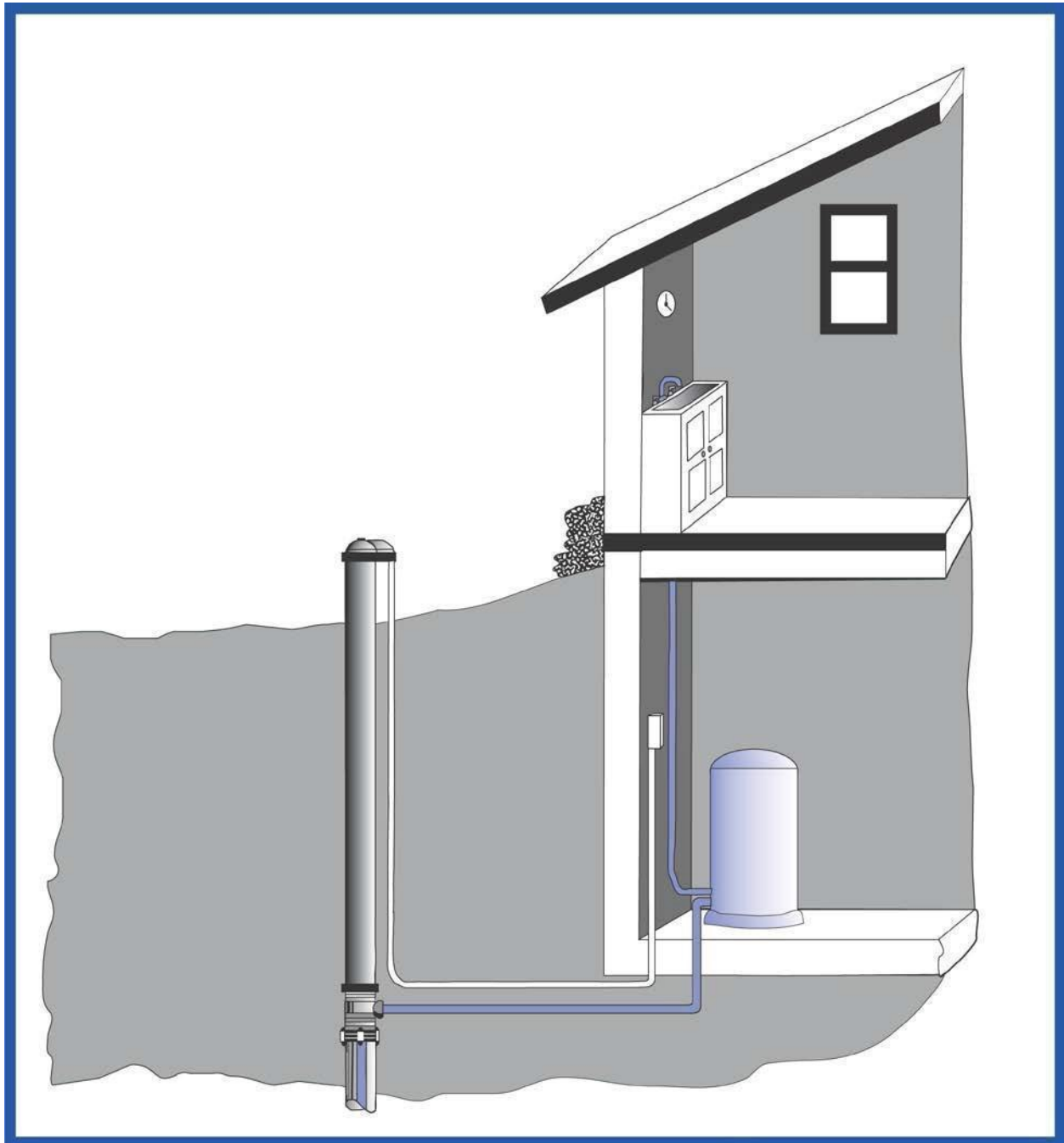


# Well Owner's Handbook

## A Consumer's Guide to Water Wells



Northern Illinois Public Health Consortium  
Well & Septic Subcommittee

This publication is a modified version of the Fourth Edition of the Well Owner's Handbook by the Well Management Section of the Environmental Health Division of the Minnesota Department of Health.

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# WELL OWNER’S HANDBOOK

## A Consumer’s Guide to Water Wells

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# Introduction

## **Are you thinking about having a new water well drilled? Do you have questions about an existing well?**

Perhaps you are building a new home or replacing an existing water supply. Perhaps you have previously lived in a city with a public water supply system and you now have moved to a home in a rural area that uses a private well for its water supply. Whatever the case, this handbook contains important information you should know about:

- Groundwater basics
- Well construction and protection.
- Well operation and maintenance.
- Well water safety and testing.
- Sealing unused wells.

## **What is Most Important?**

- Learn about your well and the components of your water system. Wells don't last forever. If your well is old, have it inspected by licensed water well contractor (pages 6-17).
- Collect a water sample from your well at least once per year. Have your well tested for total coliform bacteria and nitrate. If you are having a new well constructed, a water sample is required to be collected and analyzed by a certified water laboratory.
- Test your well water at least once for radon, arsenic and volatile organic compounds (VOC's). Check with your local county health department about other contaminants of local concern. Some of these items may be naturally occurring or could exist due to contamination of groundwater.
- Maintain your well in a sanitary condition. The well should have a waterproof cap, and the well casing should extend at least eight inches above the surface of the ground or finished grade. Do not bury your well in landscaping. The well system is vented and air must move in and out of the well. Keep septic systems, fertilizers, gasoline, fuel oil, chemicals and other household hazardous waste away from your well. Contact with your local health department to discuss proper disposal or recycling options for these items.
- Have any wells that are no longer in use permanently sealed by a licensed well driller. Abandoned water wells are a threat to groundwater and Illinois law requires that they be property sealed in order to prevent them from becoming a conduit for contaminants to reach the groundwater supply.

# Groundwater and Wells

Groundwater obtained from a well is usually safe to drink without treatment, if the well has been properly constructed and maintained.

Groundwater and surface water are both part of the “hydrologic cycle,” which is illustrated in Figure 1. Water rises from the earth’s surface as **evaporation** and falls to the earth as **precipitation**, in the form of snow or rain. Water that falls on the ground either moves over the ground as **runoff** or down through the soil to the saturated zone through **infiltration** — and then through an aquifer to an **area of discharge**, such as a river, lake, or pumping well.

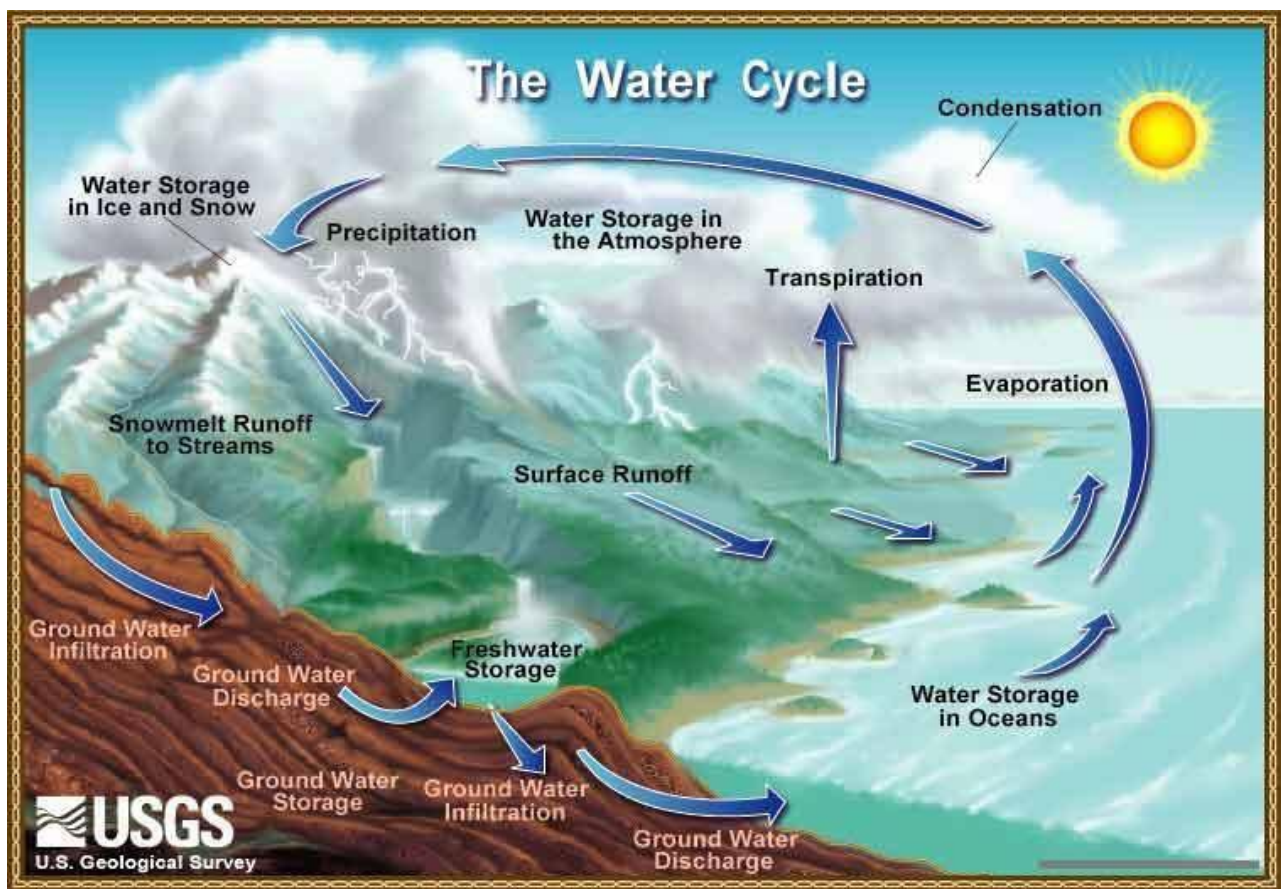


FIGURE 1 - The Hydrologic Cycle

SOURCE: USGS

## Groundwater

As the name implies, **groundwater** is found beneath the land surface — in cracks and crevices in bedrock, or in **pore spaces**, which are the small spaces between soil or rock particles in sand and gravel deposits. Surface water becomes groundwater when it seeps downward to the saturated zone. The **saturated zone** begins at the point where the pore spaces and cracks in the soil, sediment, or rock become completely filled with water. The top of this zone is called the **water table**. An **aquifer** is a layer of sediment, such as sand or gravel, or a layer of rock, such as sandstone, that stores and transmits water to a well. A **confining layer** is a layer of sediment or rock that slows or prevents the downward movement of water — a thick layer of clay is an example of a confining layer.

Geologic conditions vary greatly in different parts of Illinois. As a result, well depth, well construction, and natural water quality also vary.

The quality of groundwater depends on the type of soil, sediment, or rock through which the water is moving, the length of time water is in contact with geologic materials, and whether any contaminants are present. Gases, minerals, and other chemicals may dissolve into water as it moves underground.

The quality of Illinois' groundwater as it relates to human health is generally very good. Bacteria, viruses, and many chemical contaminants are removed or filtered from the water as it moves downward through silt, sand, and gravel deposits.

If groundwater contamination does occur, several entities are involved to investigate the source of contamination and to plan for the remediation of the contaminants when that is the appropriate action. If you have specific questions about groundwater contamination in your area, please contact your local county health department or the Illinois Environmental Protection Agency.

## Water quality

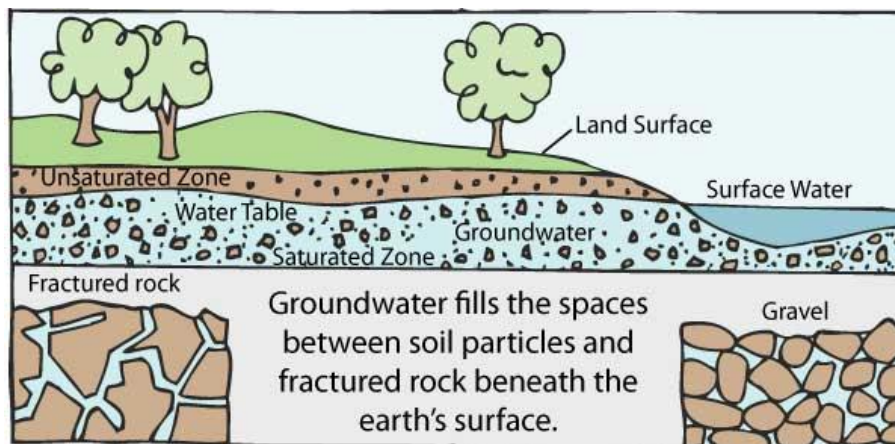


FIGURE 2 – Groundwater  
Source: The Groundwater Foundation

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# Well Construction

A well is the most common way to obtain groundwater for household use. A well is basically a hole in the ground, held open by a pipe (or **casing**) that extends to an aquifer. A pump draws water from the aquifer for distribution through the plumbing system. The depth to which wells are constructed is determined by factors such as 1) depth to groundwater, 2) the groundwater quality, and 3) the geologic conditions at the well site.

Wells in Illinois range in depth from 15 feet to over 1,000 feet. Wells that are drilled very near each other often have similar depths. However, the depth of wells in glacial deposits can vary greatly — even if they are located next door to each other.

Illinois' rules governing well construction are administered by the Illinois Department of Public Health. The rules establish minimum standards for the location, construction, repair, and ultimate sealing (closure) of wells and borings in Illinois, to protect public health and the state's invaluable groundwater.

## Types of Wells

### Drilled wells

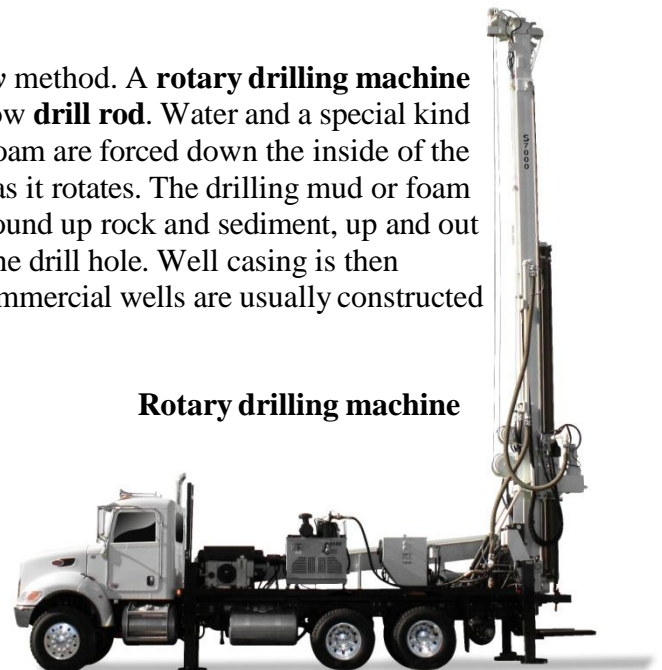
Most new wells constructed in Illinois today are **drilled wells**. One of two methods is typically used to construct a drilled well. One method is called the **cable tool** method. A cable tool drilling machine uses a steel cable to raise and drop a heavy chisel-shaped bit, which breaks up sediment and rock into small pieces called **cuttings**. The cuttings are removed from the hole with a **bailer** — a hollow tube or pipe with a valve on the bottom. Steel well **casing**, is pounded into the ground as the hole is deepened.

A second method is known as the **rotary** method. A **rotary drilling machine** uses a **rotating bit** on the end of a hollow **drill rod**. Water and a special kind of clay slurry (called **drilling mud**) or foam are forced down the inside of the drill rod and out of openings in the bit as it rotates. The drilling mud or foam carries the cuttings, which consist of ground up rock and sediment, up and out of the space between the drill rod and the drill hole. Well casing is then lowered into the hole. Domestic and commercial wells are usually constructed using the rotary method.

**Rotating drill bit**  
(enlarged to show detail)



**Rotary drilling machine**





A **drive-point well** — also known as a *sand-point* or *well-point* — is constructed using a pointed screen on the end of a series of tightly coupled lengths of steel pipe. The well casing pipe, which is usually 1¼ inches in diameter, is driven into the ground with a heavy hammer or well driver until the point is below the water table. Water then flows into the pipe through screened openings in the well point.

**Drive-point wells**

A **bored well** is constructed using an earth auger, which bores a hole into the earth. The bore hole is then lined — or cased — with masonry, concrete curbing, or casing. A **dug well** is constructed by excavating or digging a hole, generally several feet in diameter, down to the water table. Rock, brick, wood, pipe, and other materials have been used in the past to line the walls of dug wells. This type of well construction is common in central Illinois.

**Bored wells**

**Dug wells**

Dug wells, bored wells, and drive-point wells are often less than 50 feet deep, and are more likely to be contaminated by surface water, sewage from septic systems, or chemical spills. Many of the techniques used in the past for constructing dug or bored wells are not sanitary and are no longer legal under the state rules.

CONTACT YOUR LOCAL COUNTY HEALTH DEPARTMENT FOR LOCAL REGULATIONS REGARDING WATER WELLS CONSTRUCTION & MAINTENANCE.

## **Who May Construct a Well**

**Licensed water well contractors**

In Illinois, contractors who construct, repair, or permanently seal (remove a well from service and completely fill it with approved sealing materials) wells must be licensed by the Illinois Department of Health (IDPH). Contractor may be licensed to perform pump installation work or licensed to drill water wells, or both. If you plan to have a new well constructed, you should begin by getting estimates, or bids, from more than one licensed water well drilling contractor. As with any other construction project, it is a good idea to have a written agreement with the contractor listing in detail the materials and services to be provided.

If you have specific questions related to why a well needs to be so deep or why one well construction method might be proposed over another, consult your local health department's environmental health professionals. In northeastern Illinois, all local county health departments require permits for new well installations and staff can answer questions about well construction.

**Permit  
required**

**Required Permit and advanced notification**

In Illinois, the delegated county health department must issue a well permit before well construction begins. Construction may not begin until a permit has been assigned to the contractor and associated permit and/or inspection fees have been paid.

**Advanced  
notification**

Any person who constructs, deepens, modifies or seals a water well for which a permit has been issued (approved by the local health department, or approved by the unit of local government) shall notify said department by telephone or in writing at least two days prior to start of the work.

**Locating  
your new  
well**

**Well Location**

A well must be located so that it meets the minimum isolation distances (also known as “setback” or “separation” distances) required by the local county health department and the IDPH. These distances, some of which are shown on the next page, are between the well and utilities, buildings, and potential sources of contamination on your property or neighboring properties. *Before* construction begins, the *best* location on the property should be identified by considering the land elevation and the location of proposed or existing buildings, buried utilities and potential sources of contamination. Ideally, the well should be at a higher elevation than contamination sources such as septic systems or feedlots. New wells are not allowed to be constructed in basements, well pits, or in buildings. A licensed water well contractor can help you choose the best location for your new well.

**Isolation  
distances**

The isolation distances are based on the ability of soil and bedrock to remove certain types of contaminants from the groundwater before they reach the well. A well may be more susceptible to contamination if it has less than 50 feet of watertight casing — or if it passes through less than 10 feet of a **confining layer** (see page 5).



SOURCES OF CONTAMINATION OR EXISTING WATER WELL	MINIMUM LATERAL DISTANCES FOR CLAY AND LOAM SOILS (FEET)	
	WATER WELL	CLOSED LOOP WELL
Cesspool	150	150
Closed Loop Well <sup>1</sup>	200	NA
Water Well <sup>1</sup>	NA	200
Water Well (when the owner of the closed loop well and a water well serving a private water supply is the same) <sup>1</sup>	N/A	75
Leaching Pit	100	100
Pit Privy	75	75
Subsurface Seepage System, Distribution Box, Sand Filter, Waste Stabilization Pond, Effluent Receiving Trench	75	75
Manure Pile	75	75
Septic Tank, Aerobic Treatment Plant, Surface Discharge Effluent Line, Treated Effluent Discharge Point	50	50
Barnyard or Animal Confinement Lot	50	50
Footing Drains (No connection to a sewer or sump handling sewage is allowed.)	10	10 <sup>2</sup>
Pump House Floor Drain	2	2 <sup>2</sup>
Pit, Crawl Space or Basement	5	5 <sup>2</sup>
Lake, Pond or Stream	25	25 <sup>3</sup>
Potential Primary Source, Potential Secondary Source, or Potential Route	200	200
Potential Primary Source, Potential Secondary Source, or Potential Route (when the owner of the source or route and a water well serving a private water supply or closed loop well is the same)	75	75
Abandoned Wells	200	200
Sewers (Sanitary or Combined)	50 <sup>4</sup>	50 <sup>4,5</sup>
Storm Sewers	10	10 <sup>6</sup>

FIGURE 3 - Minimal Lateral Distances in Feet

<sup>1</sup> A closed loop well utilizing USP food grade propylene glycol may be located to within 25 feet of a water well.

<sup>2</sup> These setback distances do not apply when the closed loop well is installed prior to the construction of the building.

<sup>3</sup> The 25 feet separation distance from a pond does not apply to a closed loop well when:

1. The borehole is grouted the same day that it is constructed;
2. The top 20 feet of the borehole is bored to a diameter at least 3 inches greater than the total diameter of the heat exchanger; and
3. The enlarged top 20 feet of the borehole is grouted with bentonite chips manufactured for well sealing within 24 hours after the construction of the borehole.

<sup>4</sup> A water well or closed loop well may be located to within 10 feet of a sewer provided the sewer consists of cast iron pipe with mechanical joints or rubber gasket sealed joints that meet ASTM Standard C564-11, SDR 26 PVC pipe or schedule 40 PVC pipe or heavier with solvent welded watertight joints or elastomeric seals (gaskets) used for push-on joints that meet ASTM Standard F477-10.

<sup>5</sup> If the sewer pipe material is unknown, the 50-foot separation distance may be reduced to 25 feet if the following conditions are met:

1. The borehole is grouted the same day that it is constructed.
2. The top 20 feet of the borehole is bored to a diameter at least 3 inches greater than the total diameter of the heat exchanger; and
3. The enlarged top 20 feet of the borehole is grouted with bentonite chips manufactured for well sealing within 24 hours after the construction of the borehole.

<sup>6</sup> The 10-foot separation distance for a storm sewer does not apply to a closed loop well when:

1. The borehole is grouted the same day it is constructed.
2. The top 20 feet of the borehole is bored to a diameter at least 3 inches greater than the total diameter of the heat exchanger; and
3. The enlarged top 20 feet of the borehole is grouted with bentonite chips manufactured for well sealing within 24 hours after the construction of the borehole.

## How a Well is Constructed

### Well Casing

#### Well casing

New household wells are lined with steel or plastic pipe known as *well casing*, which is illustrated in Figures 3 and 4. The casing is typically 4 to 6 inches in diameter and extends from above the ground surface into the **aquifer**. The casing provides a connection to the groundwater and a pathway for bringing the water to the surface. The casing also prevents loose soil, sediment, rock, and contaminants from entering the well. The casing may also house and protect the pump and related equipment. In order to prevent contaminants from entering the well, the well casing must be properly vented and have a cap that is weatherproof and insect-proof.

#### Steel vs. plastic casing

The type of casing chosen depends on the drilling method, local geological conditions, and natural groundwater quality. Steel casing is installed when the cable tool method is used to construct the well, or when high strength is needed. Plastic casing is lighter in weight and resistant to the corrosive effects of some groundwater, as well as the effects of chemicals that may be used to treat the system. Whichever type of casing is installed, it must be watertight, extend at least 20 feet below the ground surface, and meet the minimum standards specified in the Illinois Department of Public Health Water Well Construction Code.

### Well Screen

#### Well screen

If a well pumps water from a sand or gravel aquifer, a **well screen** is attached to the bottom of the casing (Figure 3). The screen is a sieve or strainer-like cylinder that extends into the aquifer and allows water to move through it, while preventing sand and gravel from entering the well. The screen openings — or *slot size* — are selected by determining the size of the sand or gravel particles comprising the aquifer. A well screen is generally not necessary if the bottom of the well has been drilled into solid bedrock — such as sandstone, limestone, or granite — that can remain open on its own. The screen is typically made of stainless steel, carbon steel, plastic, or brass. Stainless steel or plastic screens are most often used if the groundwater is corrosive. The screen is typically 3 to 5 feet in length for residential wells but may be tens of feet long for municipal, industrial, or irrigation wells. It is usually slightly smaller than the diameter of the well casing. It may be

threaded or welded to the casing. It may also be **telescoped** — that is, inserted inside the well casing and sealed to the casing with a neoprene **packer**. An envelope of sand or gravel — called a **gravel pack** or a **filter pack** — may be placed outside the well screen, between the screen and the bore hole wall. The filter pack keeps fine sediment from entering the screen and also promotes the movement of water into the well.

**Gravel pack**

## **Grouting**

The rotary drilling method produces a bore hole which is larger in diameter than the casing. The space between the outside of the well casing and the bore hole wall is called the **annular space**. After the well casing has been placed in the bore hole, it is necessary to fill the annular space to keep surface water and other contaminants from entering the well. The material used to fill this annular space is called **grout**, a specific mixture of water and cement, or water and “bentonite” clay, and sometimes other permitted additives such as sand.

**Grout**

According to Illinois law, the grout must be pumped in from the bottom of the well upward, to assure a complete seal around the casing. The usual method is to insert a ¾- to 1¼-inch diameter pipe (known as a **grout pipe** or **tremie pipe**) down to the bottom of the space between the well casing and the bore hole. The grout is then pumped in until it comes to the ground surface. **The grout must not be poured from the surface.** All rotary-drilled wells must be grouted the full length of the well casing. There may be other grouting requirements in your area. Please consult your local county health department.

## **Developing a Well**

After a well is drilled, it is necessary to remove drilling mud, cuttings, and loose sediment from the bottom of the well and from around the screen. This process, which promotes the movement of water into the well, is called **development**. A number of techniques can be used to develop a well. Air or water can be injected into the well, or water can be pumped out of the well at higher than normal rates. A properly constructed and developed well should not normally produce sand. If you notice sand in your water, you should call your well contractor. The sand can damage or plug up your well pump, water softeners, plumbing, faucets, and many household appliances, such as dishwashers.

**Sand in  
your water**

# The Water System

A **water system** is needed to pump the water out of the well to the surface and deliver it under pressure to the place where you will be using it. A typical home water system, as indicated in Figure 3, consists of a **pump**, a **pitless adapter or unit**, and a **pressure storage tank** and *control devices* that allow the system to operate automatically.

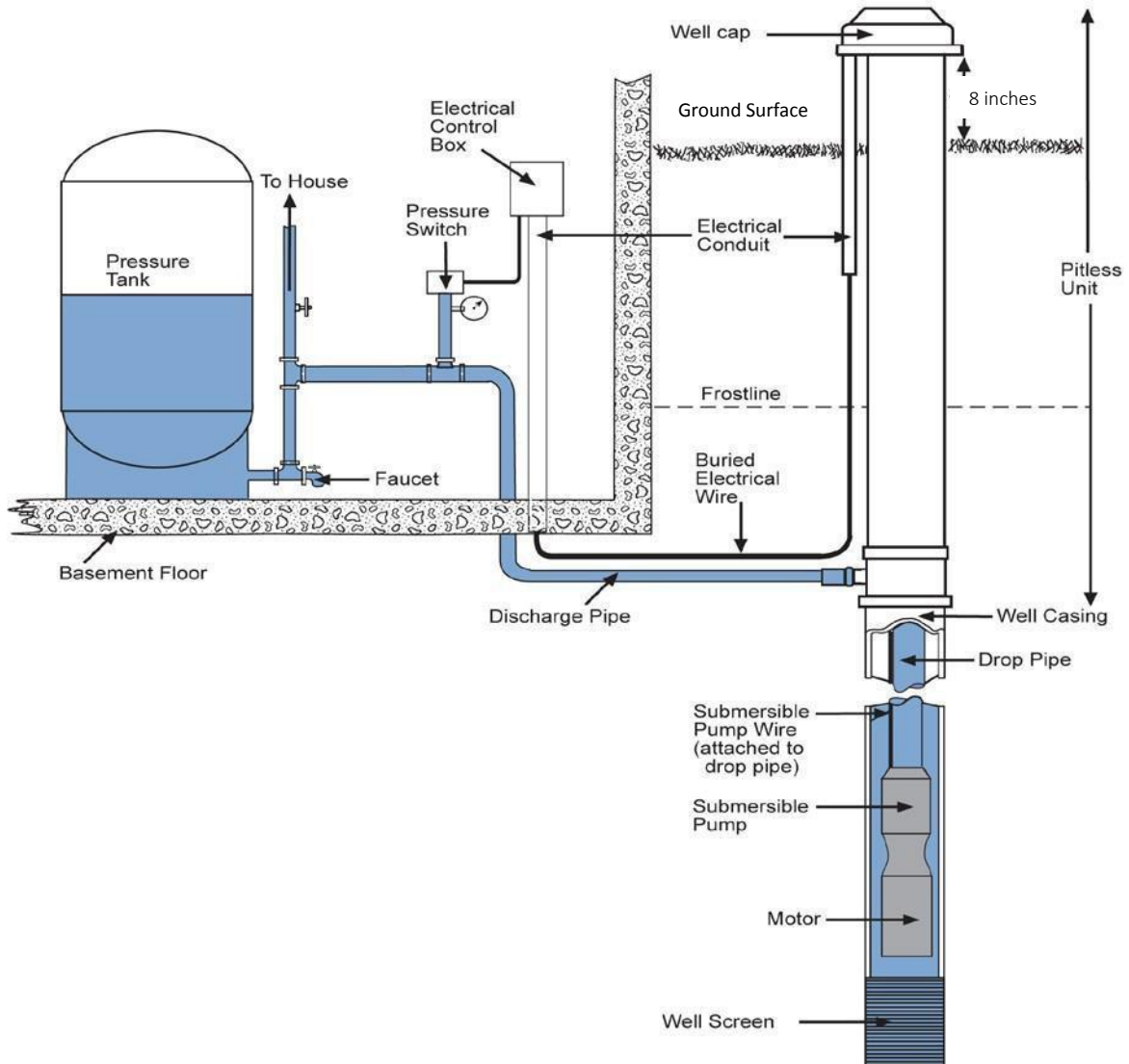


FIGURE 4 - Well and Water System.

## Well Pumps

A pump is used to push or lift water from the well into your household plumbing. The correct size of pump and pump motor depends on the well diameter, the water level in the well, the number of plumbing fixtures, the amount of water use, and the peak water *demand*. Peak demand usually occurs during the morning and evening hours. Pumps are rated in *gallons per minute* (gpm) or *gallons per hour* (gph), and pump motors are rated in *horsepower* (hp). A typical pump for domestic use might have a 10 gpm pump with a ½ or ¾ hp motor.

Special water needs — such as for irrigation, heat pumps, or livestock — can increase peak demand and require a larger pump. If the required rate of flow to meet the peak water demand exceeds the rate that the well can produce water, the difference can often be made up by increasing the storage capacity of the pressure tank.

## Types of Pumps

A **submersible pump**, which is the type most often used in drilled wells, consists of a pump and motor unit, typically 3½ inches in diameter and 2 to 3 feet long. The pump is placed directly into the well, below the water level, as indicated in Figure 3. Most submersible pumps are used in wells 4 inches or more in diameter, but some pumps are available for wells that are 3 inches in diameter.

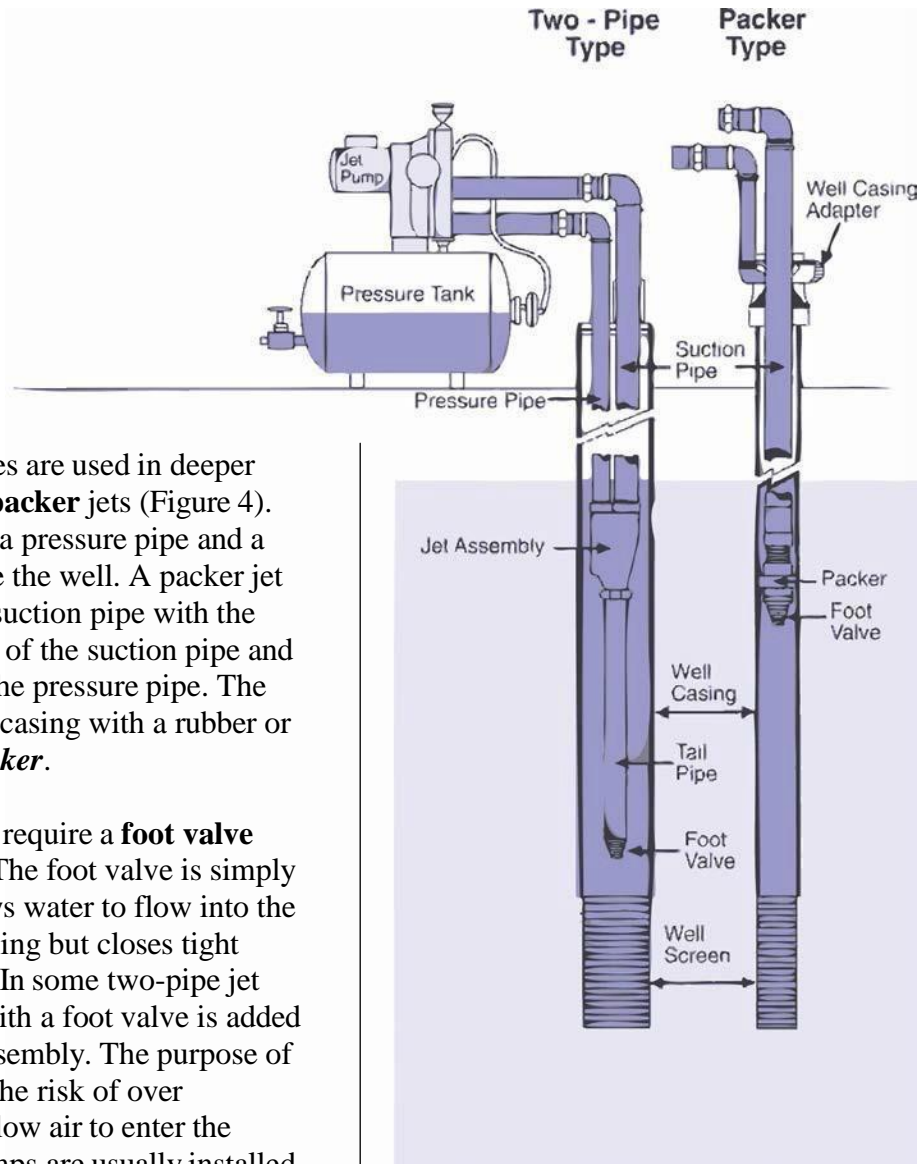
**Jet pumps** are most often used on wells that are 3 inches or less in diameter, such as drive-point or other shallow wells. The pump may be located on top of the well — or it may be offset from the well in a pump house, and connected to the well with piping. Jet pumps typically have a lower operating pressure and a lower water yield than submersible pumps. Jet pumps operate by forcing water through a jet or *venturi* — a narrow, cone-shaped device which creates a partial vacuum (suction) and draws water from the well into the pumping system. **Shallow well** jet pumps — which are used where the water is less than 25 feet below the surface — have the jet located in the pump itself. For deeper wells, the jet is located inside the well below the water level.

**Pump size**

**Special water needs**

**Submersible pumps**

**Jet pumps**



Two types of jet assemblies are used in deeper wells: **two-pipe** jets and **packer** jets (Figure 4). The two-pipe jet has both a pressure pipe and a suction pipe located inside the well. A packer jet uses a single pipe for the suction pipe with the space between the outside of the suction pipe and the well casing acting as the pressure pipe. The inner pipe is sealed to the casing with a rubber or leather gasket called a *packer*.

Deep well jet installations require a **foot valve** below the jet in the well. The foot valve is simply a check valve which allows water to flow into the jet when the pump is running but closes tight when the pump shuts off. In some two-pipe jet installations, a **tail pipe** with a foot valve is added to the bottom of the jet assembly. The purpose of the tail pipe is to prevent the risk of over pumping, which would allow air to enter the system. Deep well jet pumps are usually installed on wells with water levels less than 200 feet deep.

All jet pump systems have some portions of the piping that operate under suction. In systems where the pump is located some distance away from the well, the suction pipe is usually buried. If a buried section of suction pipe between the well and the pump developed a leak, contaminants could be drawn into the water supply system.

FIGURE 5 - Deep Well Jet Pump Installations.

SOURCE: Modified from *Water Systems Handbook*, 10th ed., Water Systems Council, 1993.

**Turbine pumps** are typically used for municipal, industrial, or irrigation wells, which produce a large volume of water. They have a motor which is placed on top of the well and a turbine shaft extending below the water level. The bottom of the shaft is connected to impellers which push water to the discharge pipe at the top of the well.

**Turbine pumps**

**Cylinder pumps**, which are used in windmills and hand pumps, have largely been replaced by jet pumps or submersible pumps. They consist of a cylinder on a pump rod, which moves up and down and forces water to the surface.

**Cylinder pumps**

### **Pitless Adapters and Pitless Units**

Years ago, wells were completed in pits, below ground level, so the pump and water pipes would not freeze in cold weather. Well pits, however, represent a serious health hazard, because contaminated flood water and runoff can easily flow into a well pit and get into the well itself. Well pits are also a safety hazard. Children and animals may fall into the pit due to missing or deteriorated pit covers. Farming equipment may fall into a pit when driven over it. Toxic gases can also build up inside a well pit, making it a dangerous place to enter and work.

**Well pits**

Current well construction rules prohibit the construction of well pits. If you have an older well located in a well pit, it is recommended that you upgrade your well installation. Have a licensed well contractor extend the casing above the ground level, and install a pitless unit or pitless adapter. For safety reasons, the pit should then be filled in with clean earth.

The invention of the **pitless adapter** and **pitless unit** have made well pits unnecessary. Pitless adapters and pitless units are special fittings that attach to a well casing below ground, usually 6 or 7 feet down, and discharge water to the house or other building through a buried water service pipe. Because the water service pipe is buried deeper than the frost line, the water will not freeze. The well casing extends above ground and is fitted with a proper well cap or well seal, allowing safe and easy access to the well for service work, and minimizing the risk of flooding.

**Pitless adapter**

**Pitless unit**

The water service pipe is usually 1 to 1½ inches in diameter, and made of copper, iron, or plastic. Most new installations use polyvinyl chloride (PVC) pipe. Pitless adapters are small fittings that can be inserted through a hole in the well casing. Pitless units are more complex assemblies, which completely replace the well casing between the frost line and the ground surface (Figure 3).



## Pressure Tanks

### Pressure tanks

Most water systems include a water storage container called a *pressure tank* or *hydropneumatic tank* (Figures 3 and 4). The pressure tank is usually located in the basement or a utility room, although some types of tanks may be buried underground. The pressure tank has three purposes:

- To store water and provide water under pressure when the pump is not running.
- To build up a reserve supply of water each time the pump runs, so the pump has to start and stop less often. This serves to prolong the life of the pump.
- To provide a reserve supply of water for use during times of high demand.

As the name implies, a **pressure tank** contains water under pressure. As water is pumped into the tank, it compresses the air in the tank until the pressure reaches a preset level — typically from 40 to 60 pounds per square inch (psi) — which automatically shuts off the pump. When a faucet is opened, the air pressure in the tank forces water through the pipes until the pressure drops to another preset level — usually from 20 to 40 psi — which starts the pump again. A **pressure switch** starts and stops the pump at the preset pressure levels, and allows the system to work automatically (Figure 3).

### Drawdown

The size of the tank usually depends on the amount of water produced by the pump in 1 to 2 minutes. The amount of water delivered by the pressure tank between the time the pump shuts down and the time it starts up again is called the *drawdown*. The drawdown is typically much smaller than the overall size of the tank. Common pressure tank sizes range from 10 gallons to over 200 gallons. Tanks holding 20 to 44 gallons, which have a drawdown of 5 to 16 gallons, are the most frequently used. Larger tanks, or more than one tank, may be needed for low-yield wells or systems with high water demands. The most common type of pressure tank design has a diaphragm or bladder, which provides a permanent separation between the air and the water in the tank. If the air and water are not separated, the water can eventually absorb all the air in the tank, a condition called **water logging**. The pump will then rapidly turn on and off, which is called “cycling.”

### Flushing the tank

On new wells, it is a requirement to have a down turned smooth nose faucet near the pressure tank for flushing the tank and collecting water samples for testing. This sample tap shall be no less than 18” off the floor to aid in ease of sampling.

# A Safe Well

Water in nature, whether surface water or groundwater, is never pure “H<sub>2</sub>O.” Instead, it contains a variety of dissolved minerals and gases that are usually harmless and give the water most of its taste. Some natural minerals, like iron, magnesium, or calcium can make well water aesthetically objectionable, but usually are not harmful. But water can sometimes be contaminated with things like bacteria, viruses, or chemicals that can harm our health. Contaminated water can often look, smell, and taste fine, so there is no substitute for periodic testing of well water. Proper well construction, disinfection, system maintenance, and regular water testing all help to assure safe drinking water.

## Well Disinfection

Harmful bacteria or viruses can enter a well through holes or other defects in the casing. They can also enter a well when it is first constructed, or later when it is repaired or serviced. **Every new well must be disinfected after it is drilled and before the water is used for drinking or cooking.** A well must also be disinfected whenever it is opened for repairs. If a well is flooded, you should assume that it has become contaminated, and both the well and the plumbing system need to be thoroughly disinfected. Disinfection should eliminate potentially harmful bacteria and viruses from the water. Disinfection should be repeated if water testing reveals that indicator bacteria are still present. If these organisms are still present after several attempts to disinfect the well, the source of the contamination in the well or water system should be located and removed, and the well should be checked for any defects.

The simplest and most effective product for disinfecting all parts of your water system is plain chlorine bleach with no additives. Whenever the pump is primed, chlorinated water should be used. With proper precautions, chlorine solutions are safe and easy to use. After disinfection, the chlorinated water should be flushed from your well and plumbing system. **The chlorinated water should not be discharged directly into your septic system. An outside faucet and hose should be used to discharge the chlorine solution to a location away from lawns and gardens.** After the chlorine has been flushed from the well, the relatively small amount of chlorine solution still in the plumbing can be drained directly into the septic system. The National Ground Water Association recommends that disinfection procedures be completed by a licensed water well contactor.

## Property Owners Responsibility

If you own and operate a private water well you essentially own and operate your own private water system. That water well system is your responsibility and proper care and maintenance is required to maintain a safe drinking water supply.

**Licensed well contractors are familiar with proper disinfection procedures**

## Water Testing

Drinking water should be free of disease-causing organisms, and should not contain harmful levels of chemicals. Two standard tests — for **coliform bacteria** and **nitrate** — should be performed at least annually on every well. Testing for other contaminants may also be advisable (see page 23).

**When is a water test required?**

**When a new well is constructed, Illinois law requires that the water be tested for coliform bacteria and nitrate. These water samples for a new well must be analyzed by an EPA certified laboratory.**

**How often should a well be tested?**

A water test tells you only about the water quality at the time the sample was taken. Groundwater pumped from some wells may vary in quality during the year, especially after heavy rainfall or melting of snow. This may be more common in shallow wells and older wells. More frequent testing of shallow wells or wells less than 50 feet deep is recommended. **At a minimum, private wells should be tested for coliform bacteria at least once a year and for nitrate every two or three years.** If nitrate has been detected previously, the well should be tested for nitrate every year. Whenever a well is opened up, test the water afterward for coliform bacteria. Anytime that you notice a change in the quality of the water, test the well for coliform bacteria and nitrate. Before collecting a water sample for testing, contact the water laboratory at your local health department or a certified private laboratory for bottles and instructions.

**Certified testing laboratories**

Water testing services are available from both county health departments and private laboratories, but not all laboratories are **certified** to test drinking water, and many laboratories are only certified to perform one or two drinking water tests. Make sure that the laboratory you choose is certified to perform **each test** that you need or want. A list of Illinois certified water testing laboratories can be found on the Illinois EPA website.

Many private water testing laboratories are listed in the Yellow Pages under “Laboratories-Testing.” Keep in mind that you can also contact your local health department or the Illinois Department of Public Health for a list of certified laboratories or to ask questions concerning test results.

### **The Total Coliform Bacteria Test**

**Waterborne diseases**

Waterborne diseases can be spread by drinking water that has been contaminated with infected fecal wastes from humans or animals. Examples of these diseases include salmonellosis, dysentery, and hepatitis. It may take only a small number of disease organisms to make someone sick. The symptoms of these diseases often include diarrhea, nausea, vomiting, and sometimes fever. It is not unusual for people to mistake a case of water-related disease for “food poisoning” or a “24-hour flu bug.” Remember, contaminated water can often look, smell, and taste fine.

It is not practical to test water for every possible disease-causing organism. Instead, water is usually tested for one particular group of bacteria known as the **total coliform group**. These organisms serve as *indicator* bacteria — they indicate how sanitary your water system is.

## Coliform bacteria

Coliform bacteria can be found everywhere on the land surface but are usually not found more than a few feet below the soil surface. Coliform bacteria are also found in the intestinal tract (and fecal wastes) of all warm-blooded animals. Most coliform bacteria do not usually cause disease, but if they show up in a water test, they indicate that surface contamination has somehow entered the water and *disease-causing organisms may also be present*. Remember that waterborne infectious disease is caused by fecal contamination, which is usually found only on the ground surface (in the case of animal waste) or near the surface (in the case of contamination from sewers or septic systems).

## Indicator bacteria

Coliform bacteria are also good indicators of the sanitary quality of your water because they are killed in the same way that most disease-causing organisms are killed. With few exceptions, if a well is disinfected with a strong solution of chlorine, and the coliform bacteria disappear; disease-causing organisms in the well have also been killed.

Several different methods can be used to test for total coliform bacteria. Some methods report results as the actual number of coliform organisms detected in a specific volume of water. Other test methods report results not as a number, but only indicate the “presence” or “absence” of coliform organisms. The absence of coliform organisms indicates satisfactory sanitary water quality. If any coliform bacteria are detected, the well should be disinfected and sampled again.

## Tests for coliform bacteria

A second more specific bacterial test for either “fecal coliform bacteria” or “*E. coli*” may also be performed. If either of these tests is found to be positive, the water is contaminated with fecal matter, and should never be consumed without vigorously boiling for at least one minute.

Disinfection with a chlorine solution will usually eliminate bacteria and viruses if they entered the well during construction or repair of the well — when a new pump is installed, for example. **Disinfection or treatment will *not* provide a permanent solution if the contamination is caused by faulty well construction, a failing septic system, surface water contamination, or some other ongoing problem.** In that case, it will be necessary to repair the well, construct a new well, or remove the source of contamination. More information about disinfecting your well and plumbing system is on page 17.

## Disinfection

## The Nitrate Test

### Nitrate

Nitrate ( $\text{NO}_3$ ), a chemical containing nitrogen and oxygen, moves easily through the soil to the groundwater. Some nitrate occurs naturally in groundwater that is near the surface, but the levels are usually low, less than 1 milligram per liter (mg/L).\* Nitrate levels of 1 mg/L or greater in groundwater usually indicates contamination from fertilizers, animal wastes, or subsurface sewage treatment systems. In some wells, particularly drive-point wells or other shallow wells, nitrate may only be present during the spring or after a heavy rainfall when rapid infiltration of surface water occurs. Because nitrate can move rapidly down through the soil into the groundwater, the presence of nitrate may provide an early warning of possible problems and can sometimes indicate the presence of other contaminants.

### Blue baby syndrome

Nitrate levels above 10 mg/L (reported as nitrogen) can cause a condition known as *infantile methemoglobinemia*, or *blue baby syndrome*, in infants less than six months old. This condition occurs when **nitrate** is ingested and then converted to **nitrite** ( $\text{NO}_2$ ) by stomach bacteria. The nitrite then reacts with hemoglobin in the blood to form methemoglobin. The buildup of methemoglobin reduces the ability of the blood to carry oxygen. If the level of methemoglobin becomes high enough, the baby's skin will turn a bluish color and suffocation can occur. Untreated methemoglobinemia can be fatal, but it is reversible *with prompt medical attention*. After six months of age, the conversion of nitrate to nitrite in the stomach no longer occurs. **Water containing more than 10 mg/L nitrate-nitrogen should *not* be given to infants less than six months of age either directly or in formula. Blue baby syndrome has been known to occur after just one day of exposure to high nitrate water.**

### If nitrate is detected in your water

If your well water contains nitrate-nitrogen levels between 1 and 10 mg/L, you should test the well at least annually. If the level is above 10 mg/L, the well should be inspected to find out if it is properly constructed or if it is too close to a potential source of contamination, such as a septic system or feedlot. If possible, have the well repaired. If necessary, drill a new well. **Boiling the water will not remove the nitrate. It will actually increase the concentration of nitrate in your water, due to evaporation of some of the water.** Also it is not recommended to rely on a home water treatment device to remove nitrate from water fed to infants, because there is usually no way to immediately tell if a treatment device has malfunctioned. For infant feeding, use water from a source that is known to have low nitrate.

### \*What is a mg/L or a $\mu\text{g/L}$ ?

\* Some laboratories may report the results in parts per million (ppm) or parts per billion (ppb). A concentration of 1 milligram per liter (mg/L) is approximately equivalent to 1 ppm; 1 microgram per liter ( $\mu\text{g/L}$ ) is approximately equivalent to 1 ppb.

## Tests for Other Contaminants

Even if testing detects no nitrate or coliform bacteria, well water could contain other contaminants such as arsenic, lead, pesticides, or “volatile organic chemicals” (from petroleum products or solvents). There is no single test that covers all possible contaminants. To determine whether you should consider testing for other contaminants in your water supply, contact your local county health department or the Illinois Department of Public Health. Information on testing services is presented on page 18.

**Some of the more common substances that can be found in some wells are discussed below.**

**Arsenic** occurs naturally in the groundwater in many parts of Illinois, and about 10 percent of wells produce water which exceeds 10 micrograms per liter ( $\mu\text{g/L}$ ),\* the federal drinking water standard. Long-term consumption of arsenic above the drinking water standard may increase the risk of health problems of the skin, circulatory system, or the nervous system, including some cancers. Every private well should be tested at least once to determine if arsenic is present in the water, and at what levels. Arsenic levels in groundwater will not usually change much over time. Long-term consumption of well water with arsenic levels above 10  $\mu\text{g/L}$  should be avoided.

\* Some laboratories may report the results in parts per million (ppm) or parts per billion (ppb). A concentration of 1 milligram per liter (mg/L) is approximately equivalent to 1 ppm; 1 microgram per liter ( $\mu\text{g/L}$ ) is approximately equivalent to 1 ppb.

**Fluoride** is naturally present in the groundwater in some areas of Illinois, but usually in low concentrations, less than 1 milligram per liter (mg/L).

Fluoride concentrations of approximately 1.5 mg/L can be beneficial in forming human teeth and helping to prevent cavities. Discoloration or damage of teeth can occur if the concentration of fluoride in the water is too high. A test for natural fluoride will give your dentist useful information about whether children or adolescents should be using fluoride supplements.

## Additional information

### Arsenic

**\*What is a mg/L or a  $\mu\text{g/L}$ ?**

### Fluoride

**Hardness** is caused primarily by calcium and magnesium ions, but also by iron and manganese ions present in the water. The higher the concentration of these minerals, the greater amount of soap that is required to produce suds. The soap that is combined with the minerals leaves an insoluble scum, which causes laundry and staining problems. Hardness is reported by some laboratories and water conditioning companies as “grains per gallon.” One grain per gallon equals 17.1 mg/L. Water that has a hardness of more than 50 mg/L or 3 grains per gallon is considered hard. Testing for hardness can help you develop an effective water treatment program. Hardness in water does not cause detrimental health effects.

**“Hard water minerals”**

**Iron** is naturally present in some groundwater of Illinois. It is typically not a health concern, but concentrations above 0.3 mg/L cause an objectionable metallic taste. It can also cause reddish brown stains on plumbing fixtures and clothes during laundering, encrust well screens, and clog pipes. Water softeners can typically remove up to about 3 mg/L of iron. Manganese greensand iron filters, which are regenerated with potassium permanganate, can remove higher concentrations of iron.

**Iron**

Water that exhibits “swampy” or “oily” tastes or smells, or red, slimy growths in toilet tanks may indicate that you have **iron bacteria** in your well and water system. These bacteria do not cause disease. Iron bacteria can be treated using techniques, including physical removal, pasteurization, and chemical treatment, such as shock chlorination. Some laboratories can analyze water samples for iron or iron bacteria.

**Iron bacteria**

Water can dissolve **lead** from old lead pipes, lead-soldered copper pipes, or brass plumbing components when the water stands in the plumbing system for more than a few hours at a time. Infants, children, and pregnant women are especially vulnerable to the potential health effects of lead. Too much lead can damage the nervous system, red blood cells, and kidneys. The MDH recommends that the intake of lead be as low as possible. **You can minimize your exposure to lead in your drinking water by letting the water run until you feel the water getting colder (at least 30-60 seconds) before using it for drinking or cooking.** Avoid using water from the hot water tap for drinking or cooking, because hot water dissolves lead more quickly. If you have the water tested for lead, the sample(s) should be taken from a regularly used faucet after the water has been standing in the plumbing for at least six hours.

**Lead**



## Manganese

**Manganese** is naturally present in some groundwater. Manganese is considered a trace beneficial nutrient. Our bodies require small amounts of manganese to maintain health. Adults and children typically get enough manganese from the foods we eat. Infants and children younger than one-year old get enough manganese from breast milk, food, or formula. Excessive amounts of manganese in drinking water may affect learning and behavior in infants and young children. The guidance value for manganese in drinking water is 100 µg/L for formula-fed infants and children less than one year of age who drink tap water. The manganese guidance value for children over one year old and adults (including nursing mothers) is 300 µg/L.

Manganese, like iron, can cause an objectionable metallic taste at concentrations above 50 µg/L. It can also cause brownish-black stains on plumbing fixtures, and clothes during laundering, encrust well screens, and clog pipes. Treatment techniques for manganese are similar to those used for removal of iron.

## Pesticides

When **pesticides** are found in Illinois wells, the levels are usually low. But there are exceptions. Wells most at risk of pesticide contamination are shallow or old, located close to areas of pesticide use or storage, and located in geologically sensitive areas such as sand plains or “karst” (weathered limestone) bedrock areas. Wells that have high levels of nitrate are also more likely to have detectable levels of pesticides. If you have an old or shallow well and you live in an agricultural area, or if your well has a high level of nitrate, consider testing your well water for one or more of the pesticides used most frequently in your area.

## Radon

**Radon** is a naturally occurring radioactive element that exists as a gas dissolved in some Illinois groundwater. It can be released to the air when you run water inside your home, but well water usually contributes only a small fraction of the total amount of radon in indoor air. Exposure to radon increases your risk of developing lung cancer. Simple, low-cost detectors for radon gas are available. If the air in your home has annual radon concentrations at or above 4 picocuries per liter (pCi/L), steps should be taken to reduce the radon level.

## Sulfate

**Sulfate** is a naturally occurring ion present in groundwater. Sulfate concentrations above 250 mg/L can act as a laxative. Most people become acclimated to sulfate after a couple days and the symptoms disappear. **Infants should *not* be given water with a sulfate concentration above 400 mg/L.**

A “rotten egg” smell in well water may indicate the presence of **hydrogen sulfide** gas, which can be produced by **sulfur bacteria**. They often occur together with iron bacteria. Treatment techniques for sulfur bacteria are similar to those for removal of iron bacteria.

**Sulfur  
bacteria**

**Volatile organic compounds** or “VOCs” are common components of gasoline and other fuels, as well as products such as solvents, paints, cleaners, and degreasers. Long-term exposure to VOCs above state health limits may damage the central nervous system, liver, or kidneys; and some VOCs are known to cause cancer. If you live near a commercial or industrial area, a gas station, or a landfill, and especially if your well is old or shallow, you should consider having your water tested for VOCs.

**Volatile  
organic  
chemicals**

## **Water Treatment**

In most of Illinois, it is possible to construct a well that will provide an adequate supply of drinking water that is both naturally safe and aesthetically acceptable. Some well water will contain “aesthetic contaminants,” substances that can cause hardness, objectionable tastes or odors, staining, or other non-health related effects. Water treatment can often reduce or remove these contaminants.

**When  
treatment is  
needed**

Some well water can also contain contaminants that can adversely affect health. These can either occur naturally, as in the case of arsenic, or as the result of human activities such as chemical spills, improper waste disposal, or failing septic systems. Wells that are old shallow, in disrepair, or are not properly located and constructed are more likely to have unsafe water. It is always preferable to have naturally safe well water, rather than relying on treatment. Drilling a well deeper often gives additional protection from surface contaminants such as nitrate and spilled chemicals.

## **Treating Private Well Water for Safety**

As discussed in the previous section on *Water Testing*, there are a number of drinking water contaminants that can adversely affect the health of you and your family. The most common include bacteria, viruses, nitrate, arsenic, lead, and synthetic chemicals such as fuels, solvents, and pesticides.

**Health  
related  
contaminants**

**If testing does indicate the presence of a health-related contaminant, treatment should be considered only if no other options are possible.**

Options may include a new well, repair of the existing well, or removal of the source of contamination. For example, the presence of **coliform bacteria** in the water often does not indicate that the groundwater is contaminated, but that there is a problem with well construction, operation, or maintenance, allowing surface water or contaminants to enter the well. If multiple thorough well disinfections do not solve the problem, the well probably needs to be repaired, upgraded, or replaced.

**Coliform  
bacteria**

**Nitrate**

If your well has **nitrate** contamination, a deeper well can often solve the problem. Treatment by reverse osmosis (RO), ion exchange, or distillation, can remove nitrate. However, a treatment system should not be trusted to remove nitrate from water given to an infant or other vulnerable person, because systems can fail without warning, and high nitrate water can affect infants in a matter of hours or days. If your well has high nitrate, give your baby water from a known safe source, or use bottled water. Also, the presence of nitrate may indicate the presence of other contaminants.

**Lead**

If your water has **lead**, it is most likely coming from the plumbing system itself, not from the groundwater. Lead may be dissolved from metal water pipes and plumbing fixtures as the water sits idle in the pipes. Flushing the system in the morning, or after other periods of nonuse, can significantly reduce lead levels. RO or distillation can remove lead.

**Arsenic**

If your water contains **arsenic**, it may be possible in some cases to drill a deeper, or shallower, well that will solve the problem. If low arsenic water cannot be obtained, arsenic can be removed by RO with preoxidation, distillation, anion exchange with pretreatment, or with one of the newer “adsorption media” systems now offered by many companies.

**VOC’s**

If your water contains **volatile organic chemicals (VOCs)** or **pesticides**, a deeper well may reduce or eliminate the problem. Many of these contaminants can often be removed from the water by granular activated carbon.

**Pesticides**

Again obtaining a naturally safe water supply, without the need for treatment for health-related chemicals, should be the goal. If treatment is used, it is critical to install the correct treatment device, do proper maintenance, and test the water on a regular basis to make sure that the treatment system is still functioning properly.

**Treating Private Well Water for Aesthetic Contaminants****Aesthetic  
contaminants**

“Aesthetic contaminants” cause tastes, odors, scaling, or staining, but do not typically cause adverse health effects. Common aesthetic contaminants include calcium and magnesium, which cause hardness; iron, which causes staining; and hydrogen sulfide, which causes the “rotten egg” odor. The previous section on tests for other contaminants provides more information on specific aesthetic contaminants. Water treatment systems can reduce the levels of these contaminants and can often improve the taste and odor of your water.

## Choosing the Correct Type of Treatment

There are a number of types of water treatment systems that can remove health-related and aesthetic contaminants from drinking water. The table at the end of this section lists the types of water treatment systems that are suitable for removing each contaminant. Treatment may be provided at either the “point of use” (POU) or “point of entry” (POE) of the water supply. POU treatment units are designed to treat small amounts of water, usually for drinking or other consumption. They are typically located on the counter, attached to the faucet, or installed under the sink. POE treatment units are designed to treat all of the household water and are installed at the location where the water enters a home. Contact a reputable water treatment dealer in your area for information about water treatment systems.

It is very important to choose a unit that will remove the specific contaminants of concern. Proper installation by a qualified plumber or water conditioning contractor is also important. It is recommended that treatment units meet the standards of NSF International and the American National Standards Institute (ANSI). These organizations establish independent standards of quality and performance for treatment units and other equipment.

**Note:** Manufacturer’s recommendations must be followed in order for a treatment unit to work properly. If the unit is not properly maintained, it will not be effective in removing contaminants and may actually make a problem worse. The treated water from any unit should be tested periodically to make sure the unit is still working properly.

**Some common treatment techniques are described in the following paragraphs.** Water treatment companies can provide you with more information. Check the water treatment table (see page 29) to find out the appropriate unit for a particular contaminant.

**Activated carbon filters** contain a type of “adsorption” media consisting of material such as coal, charcoal or carbonized wood to “adsorb,” or remove, many organic contaminants, including organic contaminants that cause offensive tastes and odors. These types of units are less expensive to purchase than many other types of treatment units and do not waste water. However, some filters can stimulate bacterial growth, so regular maintenance and replacement of the filter cartridge is necessary. Depending on the concentration of the contaminants, some large carbon filters have been known to last for years, while some small filters may last for only weeks or even days. They can be either POU or POE units.

**POU and  
POE**

**Standards  
for  
treatment  
units**

**Importance  
of proper  
maintenance**

**Activated  
carbon  
filters**

**Specialty adsorption media**

**Specialty adsorption media** products have recently been developed specifically for the removal of arsenic. They typically use “ferric (iron) hydroxide,” “ferric oxide,” or iron-enhanced ion exchange resins. Some have been tested to verify compliance with NSF/ANSI standards. They can be either POU or POE units.

**Reverse osmosis**

**Reverse osmosis (RO)** is a water treatment process that removes most dissolved, inorganic contaminants from water by forcing the water through a cellophane-like plastic sheet known as a “semi permeable membrane.” A small counter top RO unit will produce about 3 gallons per day. Slightly larger units that are usually installed under the sink will produce 5 to 20 gallons per day. RO units typically produce only 1 gallon of water from every 4 to 10 gallons of water treated. The remaining water goes to waste. The RO unit should be checked regularly because the membrane can deteriorate over time. This is a POU unit.

**Distillation**

**Distillation** is a water treatment process that boils water, and then cools the steam until it condenses into a separate container. The dissolved contaminants are left behind in the boiling pot. Distillation units require about four hours to produce 1 gallon of water, so this type of treatment uses a considerable amount of energy in its operation. Distillation is not effective for removal of some organic contaminants, and may actually concentrate them. This is a POU unit.

**Ion exchange**

**Ion exchange (including water softening)** is a process where one or more chemical ions is switched or “exchanged” for others. One type of process exchanges “cations,” which are positively charged ions. An example of this type of unit is a standard water softener. Water softening works by passing “hard” water - water with calcium and magnesium - through a tank filled with a special resin saturated with sodium or potassium ions. The hardness minerals exchange with the sodium or potassium in the resin bed. Water softeners can often remove a small amount of iron. Another type of ion exchange process is “anion” exchange. It replaces anions, which are negatively charged ions, such as sulfate or arsenic, with chloride ions. Anion exchange uses different types of resins. When the resin in an ion exchange process is full to capacity, it must be “regenerated” with a salt solution. **Note: If not regenerated at the proper frequency, these devices can discharge contaminants into the drinking water at concentrations greatly exceeding the untreated water concentrations.** This is a POE unit.

**Oxidizing filters**

**Oxidizing filters** consist of media beds that change dissolved contaminants to solid particles that can be filtered out of the water. Oxidizing filters are commonly used to remove hydrogen sulfide or iron. The media must be periodically regenerated before the capacity is exhausted. One type of media consists of sand coated with manganese dioxide. Another type is manganese greensand, which consists of a natural mineral glauconite or a synthetic material. Potassium permanganate is used to regenerate a manganese greensand media. This is a POE unit.

**Oxidizing-filtration systems**

**Oxidizing-filtration systems** typically utilize a feed pump to inject an oxidizer, such as chlorine or air, into the water-supply line prior to a storage or mixing tank. When sufficient contact time is allowed, the oxidizer changes the hydrogen sulfide to sulfur, or oxidizes the iron to a form that can be removed by a particulate filter. These types of systems are commonly used for well water that contains high amounts of hydrogen sulfide, arsenic, or iron. Excess chlorine can be removed by activated carbon filtration. This is a POE system.

TABLE 1 - Water Treatment for Specific Contaminants.

WATER TREATMENT UNIT OR SYSTEM							
Contaminant or Substance	Adsorption Media		Reverse Osmosis (RO)	Distillation	Ion Exchange	Oxidizing Filter	Oxidation-Filtration System
	Activated Carbon Filter	Specialty Adsorption Media					
Arsenic <sup>1,3</sup>			X	X	X	X (Anion) <sup>4</sup>	X
Boron <sup>1</sup>			X	X			X
Fluoride <sup>1</sup>			X	X			
Hard Water Minerals <sup>2</sup>				X	X (Cation)		
Hydrogen Sulfide <sup>1</sup>	X					X	
Iron/ Manganese <sup>2</sup>				X	X (Cation)	X	X
Lead <sup>1</sup>			X	X			X
Nitrate <sup>1</sup>			X	X	X (Anion) <sup>5</sup>		
Radon <sup>1</sup>	X						
Sulfate <sup>1</sup>			X	X	X (Anion)		
VOCs <sup>1</sup>	X						

<sup>1</sup> Health related contaminant - use treatment only when other options not possible.

<sup>2</sup> Aesthetic contaminant.

<sup>3</sup> Pretreatments, such as oxidation, may be necessary. The best option may depend on the other contaminants present.

<sup>4</sup> Use strong base sulfate selective resin.

<sup>5</sup> Use nitrate selective resin.

# Routine Well Maintenance

Modern wells require remarkably little routine maintenance, but there are several steps that you can take to protect your well:

- When constructing new additions to your home, adding new buildings, or altering waste systems or chemical storage facilities, maintain the isolation distances shown in Figure 2 (page 9). Illinois law requires that isolation distances be maintained. Constructing any type of building or structure, such as a deck, other than a special well house over a well is prohibited. Contact your local county health department when planning building projects.
- When landscaping your yard, keep the top of the well at minimum of 8 inches above the soil surface. This will help keep surface water, insects, dirt, and other contaminants from entering your well. If you must grade within 8 inches of the top of the well, you should arrange for a licensed well driller extend the well casing. Keep in mind that a permit is required when wells are modified. Do not pile snow, leaves, or other materials around the well. Slope the soil away from the well casing to promote proper drainage. Illinois law does not allow a new well to be buried. Be careful when working around your well. Avoid **damaging the well casing**, which could jeopardize the sanitary condition of your well.
- Have any defective well parts repaired by a licensed well contractor or pump installer. Be sure the well cover or well cap on top of the casing is properly attached and in good repair. Any connections to the cap also should be watertight. Provide flood protection if the well is in an area subject to flooding.
- When working with household hazardous waste like chemicals, paint, fertilizer, pesticides, and motor oil, keep them away from your well. Dispose of these items properly to protect groundwater from contamination.
- Take steps to prevent **back-siphonage**, which occurs when a drop in water pressure causes potentially hazardous substances to be sucked back through your plumbing system — and into your well. When connecting a hose to a faucet, do not submerge the hose end in a laundry tub, chemical tank, container, or sprayer — or leave it lying on the basement floor. When filling pesticide tanks or containers with water, avoid placing the hose inside the tank or container. The nozzle of the fill hose should be secured at a distance above the container or tank opening, which maintains an air gap. The distance should be equivalent to at least twice the diameter of the delivery pipe.
- Be aware of changes in your well, the water from your well, and the area around the well. Changes in how often your pump runs, or in the smell or color of the water, can tip you off to potential problems. If necessary, seek the advice of an expert, such as a licensed well contractor or a well specialist from your local county health department or the Illinois Department of Health. Have your well inspected at the first indication of trouble.
- Have the water tested regularly for coliform bacteria and nitrate.



# Sealing Unused Wells

Unused or abandoned wells that have not been properly sealed can provide a direct pathway for contaminants to enter the groundwater. Contaminants from surface water, runoff, or sources, such as leaking sewers or septic system drain fields, can enter the well through casings that have deteriorated. An unused, unsealed well can potentially threaten water quality for new wells. Unused wells also pose a safety hazard, especially for children, pets, and livestock.

According to Illinois law, a water well must be sealed:

1. Within 30 days after it is abandoned or when the well is no longer used to supply water.
2. If the well is in such a state of disrepair that the well or boring has the potential for transmitting contaminants into an aquifer or otherwise threatens public health or safety.

A water well is properly **sealed** when it is removed from service and is completely filled with approved sealing material, usually bentonite clay. The contractor must seal the well in accordance with the Illinois Department of Public Health Water Well Construction Code and all local county health department ordinance requirements. A permit is required for each well being sealed.

**Abandoned wells are a safety hazard**

**Illinois law requires that abandoned wells be sealed**

## Record Keeping

**It is a good idea to keep all information and documents relating to your well in one place. Ideally, your water well file should include:**

- Your written **contract** with the contractor who constructed your water well.
- A copy of the **Illinois Department of Public Health (IDPH) water well construction log**, if available, for well(s) on your property.
- **Other documents** related to the well and water system that were provided by the well contractor who constructed your well.
- Records of **all water test results** for your well.
- **Maintenance records**, warranties, papers for any work performed on your well system.
- A copy of the IDPH or local public health department **water well sealing form** for any sealed well(s) on your property
- Your copy of the **Well Owner's Handbook**.

# Troubleshooting

If you are having problems with your pump or water quality, refer to the table below to determine the possible cause. If you would like more information, you can call a licensed well contractor, the Illinois Department of Public Health at one of the offices listed on page 35, or a delegated well program listed on page 36.

Problem	Possible Cause	Refer to Page
Sand in the water	Improperly constructed well or hole in the screen or well	11
Pump turns rapidly on and off (cycling)	Water logging in pressure tank	16
White/gray scale in cooking pots when water is boiled	Water Hardness	22
Red staining on plumbing fixtures, clothes during laundering	High iron concentration in water	22
Oily sheen on water in containers; slime in toilet tanks	Iron bacteria	22
Rotten egg smell in water	Sulfur bacteria and/or hydrogen sulfide gas	23/24
Change in color, taste, or odor of the water	Possible contamination of the water	17-29
Well damaged (cracked casing, loose or missing cap, or exposed wires)	Well struck by plows, snowmobiles, vehicles, or other heavy equipment	30

## Additional Information

The IDPH has brochures, pamphlets, and fact sheets regarding wells and water systems available online. If you have questions about water quality, well construction, well sealing, or licensing of well contractors, please contact your county health department or the Illinois Department of Public Health.

## Well Maintenance Record and Water Test Results

<b>Well Information</b>		
Well Permit Number:	Well Depth:	Date Well Constructed:
Company Name of Water Well Contractor(s):		

<b>Well Maintenance/Repair</b>		
Date	Company Name of Well Contractor	Type of Maintenance/Repair Performed

<b>Water Test Results</b>			
Date	Name of Certified Lab	Test (Coliform Bacteria, Nitrate, Arsenic, etc.)	Test Results