Home*A*Syst
NORTH CAROLINA

Environmental Stewardship for Homeowners — #1

Protecting Water Supply

What shape is your well in?

One of the easiest ways to protect well water from pollution is to make sure that the well is in good shape and placed in the best location. A poorly built or maintained well can allow pollutants to enter drinking water directly. The closer the well is to sources of pollution, the more likely the well will become polluted. For instance, if the well casing is cracked and pesticides that are being mixed near the well are spilled, the pesticides can easily leak into the well and pollute your drinking water.

How can we help?

We have prepared this publication to help you focus on potential problems with your drinking water that may be caused by a poorly placed, constructed, or maintained well. Read this publication before you begin answering the questions. Gather any records you have about your well. Walk around the area near the well and look at it closely. If you have more than one well, focus on the well that provides drinking water for your family and then on the others. Fill out a separate form for each well.

Each of the following sections deals with different topics. Next to each topic is a question for you to answer. Your answers will help you to see where you have potential problems.

- If you answer a question either a or b, you have few problems with your drinking water.
- If you answer a question either c or d, there may be potential problems with your drinking water.
- If you answer a question either c or d, you will want to consider making changes in order to protect your drinking water.

If you would like further help in assessing the condition of your well, please visit your nearest Cooperative Extension Service Center and talk with your Extension agent.

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COOPERATIVE EXTENSION
Helping People Put Knowledge to Work

College of Agriculture and Life Sciences, NC State University
School of Agriculture and Environmental Sciences,
NC A&T State University

What is the North Carolina Home*A*Syst Program?

The North Carolina Home*A*Syst program has a series of publications that can help you to be a good environmental steward and also protect the health and well-being of your family. This publication leads you through an evaluation of your home and property to determine the pollution and health risks of your water supply protection practices. If there is a problem or a potential problem, the Home*A*Syst publications have information about how to solve the problems. The publications also list the North Carolina state agencies responsible for helping you solve your particular problem.

The goal of the North Carolina Home*A*Syst program is to help protect your families' and your health and the environment of North Carolina.

How safe is your drinking water?

If you drink water, it comes from a well or spring (groundwater sources) or a river or lake (surface water sources). Drinking water in North Carolina is generally safe, but it can become polluted if we are not careful. Many of the things we do at home can pollute our water and the environment. Poorly maintained or designed septic and animal waste systems can pollute surface and groundwater. Pesticides, fertilizers, fuels, and cleaning products can contaminate our water when they are not stored and handled properly.

It is nearly impossible to get pollutants out of water once they get there. Expensive treatments or new wells would be required to get safe drinking water again. Clearly, it is much more effective to keep pollutants out of water than to try to clean it up afterward.

People who have their own wells or springs for drinking water need to be especially aware of pollution sources because their water is not tested for contaminants as is city water. This is called wellhead protection and involves careful attention to the activities near your well to be sure the water remains safe. However, everyone is responsible for protecting drinking water supplies, whether it is their own or their neighbors'.

North Carolina Home*A*Syst Publications

- *Protecting Water Supply,* #1
- *Improving Fuel Storage,* #2
- *Improving Storage and Handling of Hazardous Waste,* #3
- *Improving Septic Systems,* #4
- *Improving Lawn Care and Gardening,* #5
- *Stormwater Management for Homeowners,* #6
- *Indoor Air Quality: Reducing Health Risks and Improving the Air You Breathe,* #7
- *Lead In and Around the Home: Identifying and Managing Its Sources,* #8

We are discussing wells in this publication, but much of this information applies to springs. For more specific information about springs, see the Cooperative Extension fact sheet, *Protecting Water Supply Springs*, AG-473-15.

Drinking Water Well Condition

1. Where is the well located?

A well's location is important. Stormwater runoff (water that flows over the land during a storm) can carry pollutants such as bacteria, oil, and pesticides. Wells in the path of stormwater runoff can become polluted if stormwater runoff flows into a well that is not properly sealed. A well that is downhill from pollutants such as a livestock yard, a leaking gasoline tank, or a failing septic system runs a greater risk of becoming polluted than a well that is uphill from these sources of pollution.

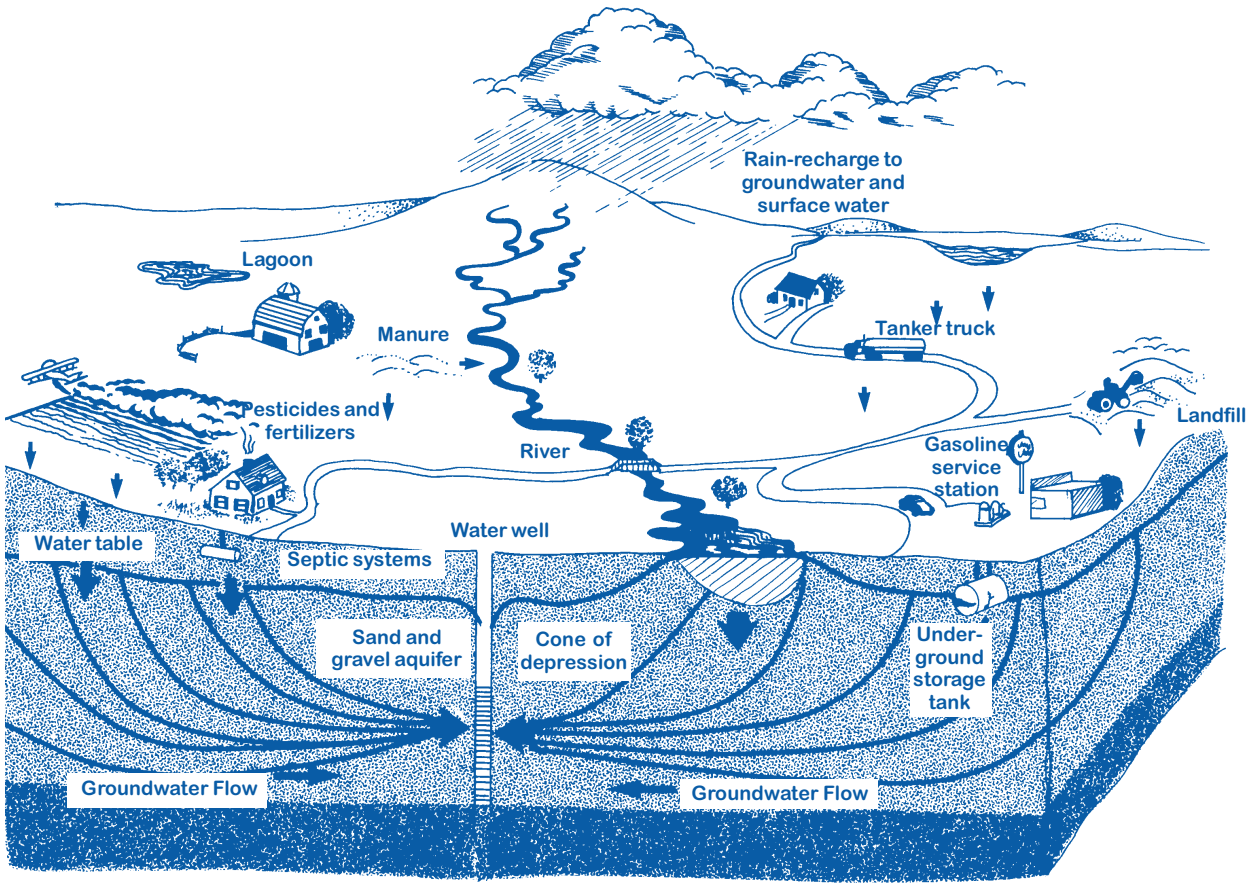
1. Circle the answer that best describes the position of your well.

a. Uphill from all pollution sources. No surface water runoff reaches well. Surface water flows away from the well.

b. Uphill from most pollution sources. No surface water runoff reaches the well if drainage is working correctly.

c. Downhill from many pollution sources, or from any one especially hazardous source. Some surface runoff may reach well.

d. Settling or depression around casing. Surface water runoff from feedlot, pesticide or fertilizer mixing area, fuel storage or home dump collects near the well; OR do not know.



Potential groundwater pollutants

2. How close is the well to sources of pollution?

North Carolina law does not allow wells to be built near sources of pollution. The state sets minimum allowable distances, which are called "separation distances." These minimum distances are set in order to make use of the natural protection soil provides. However, state well codes do not mention every homestead activity and structure. When no distances are mentioned for the specific activity or structure you have in mind, provide as much separation as possible between your well and any potential source of pollution. If your homestead is located on soils that soak up water very quickly (such as sandy soils) or on thin soil that lies over bedrock, maximum separation is needed. If the source or activity presents a high risk of pollution, keep it as far away from your well as possible. The law requires that existing wells meet only the distance requirements in effect at the time the well was built. For your own sake, you should meet current regulations and exceed them if you can.

Minimum Separation Distances Between Well and Potential Farmstead Sources of Contamination

Sanitary landfills	500 ft.
Any source of sewage, such as septic tank and drainfield, cesspools and privies, sewer lines that are not watertight, and any sludge-spreading or wastewater irrigation operations	100 ft.
Any source of animal waste, such as animal feedlots or manure piles, animal barns, or lagoons	100 ft.
Any source of chemical contamination, including fertilizer, pesticide, herbicide (insect and weed killers), or other chemical storage areas; buried gasoline and oil tanks	100 ft.
All other potential sources of groundwater contamination not specifically listed	100 ft.
Building foundations	50 ft.
Streams, lakes, ponds, etc.	50 ft.

For a well serving a single-family dwelling, minimum North Carolina state separation distances can be reduced where lot size or other fixed conditions make this necessary. In this case, the distance should be as great as possible, but at least 50 feet from sources of sewage listed above, and 25 feet from building foundations and watertight sewage lines. Your county may require distances greater than these.

2. Circle the answer that best describes the position of your well.

a. All separation distances are greater than minimum requirements.

b. All separation distances are at least 3/4 the minimum requirements.

c. All separation distances are at least 1/2 the minimum requirements.

d. Some separation distances are less than 1/2 the minimum requirements; OR do not know.

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3. How well does the soil filter out pollutants?

Soil can filter pollutants picked up by stormwater runoff as it travels down to groundwater. The ability of soil to filter your water depends on the type of soil around the well. Water passes quickly through sand, so sandy soil cannot filter out pollutants. Water and pollutants move more slowly through clay, so clay soils have more time to filter out pollutants. Soils high in organic matter also filter pollutants.

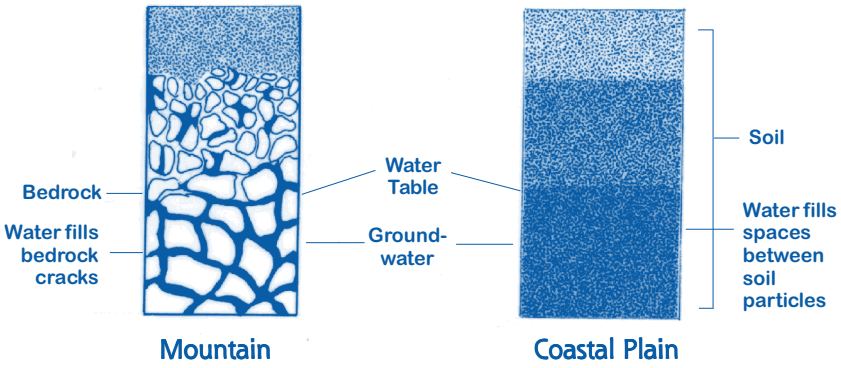
3. Circle the answer that best describes the soil near your well.

a. Fine-textured soils (clay loams, silty clay).

b. Medium textured soils (silt, loam) with high organic matter.

c. Medium or coarse textured soils with low organic matter.

d. Coarse textured soils (sands, sandy loam); OR do not know.



Groundwater storage in different North Carolina soils

4. How quickly does water reach your well?

Another factor that influences groundwater pollution is the depth from the soil surface to the water table or to fractured bedrock. The water table is the top of the groundwater. Groundwater can be stored in soil or rock. Groundwater reaching fractured bedrock can move quickly down to wells. The farther water and pollutants have to move through the soil to reach the top of the water table, the longer the soil will have to filter the groundwater. Water table depth varies in North Carolina.

Groundwater can be stored in soil or rock until it enters the well. The top of this stored water is called the water table. One factor that influences groundwater pollution is the depth from the soil surface to the water table or to fractured bedrock. The farther that water and pollutants must move through the soil to reach the top of the water table, the longer the soil will have to filter pollutants from the groundwater. Once groundwater reaches fractured bedrock, it can move quickly to wells.

Water table depth varies in North Carolina. You can tell where the water table is in your area by thinking about these two questions: When you drill a new well, how far down must you go before you strike water? If you do not draw down your existing well by using any water, how far down would the surface of the water be?

5. What is the condition of your well casing and cap?

When wells are drilled, the driller installs a steel or plastic lining pipe called a "casing" to keep the borehole from collapsing. Wells cased below the water table offer greater protection from pollution since they help ensure that surface water is filtered through soil, sand, or rock before entering the well.

You can inspect your well casing for holes or cracks at the surface and, using a light, check the inside of the casing. If the well casing moves when you push on it, the casing might not keep out pollutants. In areas of shallow (less than 20 feet from the surface), fractured bedrock, listen for water running down the well when the pump is not on. If you hear water running, there could be a crack or hole in the casing, or the well is not cased down into the water table. Both conditions are bad for your water quality because a poor casing may not keep out contaminants.

4. Circle the answer that best describes the depth of the water table.

a. Water table or fractured bedrock deeper than 50 feet.

b. Water table or fractured bedrock deeper than 25 feet.

c. Water table or fractured bedrock deeper than 10 feet.

d. Water table or fractured bedrock shallower than 10 feet; OR do not know.

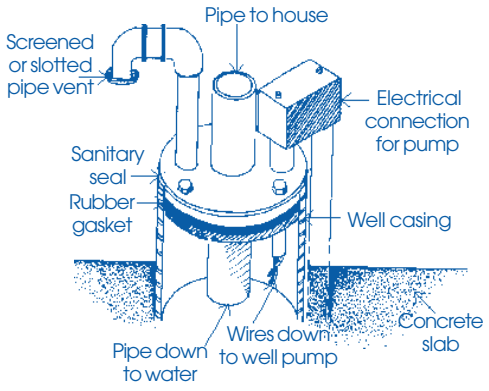
5. Circle the answer that best describes the construction of your well.

a. No holes or cracks. Cap tightly secured. Screened vent.

b. No defects visible. Well is vented but not screened.

c. No holes or cracks visible. Cap easily removed.

d. Holes or cracks visible. Cap loose or missing. Can hear water running; OR do not know.



Typical well cap

To prevent pollutants from flowing into the well, the driller should install a tight-fitting cap. This cap prevents insects or surface water from entering the well. A screened vent in the cap allows air to enter the well. The cap should be installed firmly so that children cannot remove it easily. Check the well cap to see that it fits tightly. Electrical wiring should be enclosed in the conduit to protect you from being shocked. If the well has a vent, make sure it faces the ground, is tightly connected to the well cap or seal, and is properly screened. The well code requires that all private wells have a seal.

Not all wells have caps. Some wells may have pumping equipment attached at the surface.

6. Are casing and grout deep enough?

The space between the casing and the sides of the well hole provides a direct channel for stormwater runoff to reach the groundwater. To seal off that channel, the driller fills the space with grout, such as cement, concrete, or a special type of clay called bentonite. Both the grout and the casing prevent pollution from getting into the well.

In addition, grout must extend far enough down to seal off any layers of poorer quality water that make contact with the well casing. Because of the varied soil and geologic conditions in North Carolina, required well casing and grout depths will vary.

Below is a map that shows the required depths.

In the Outer Banks, casing and grout depth must be at least 10 feet. In the shaded area, casing and grout depth must be 35 feet. The remainder of the state has a depth requirement of 20 feet.

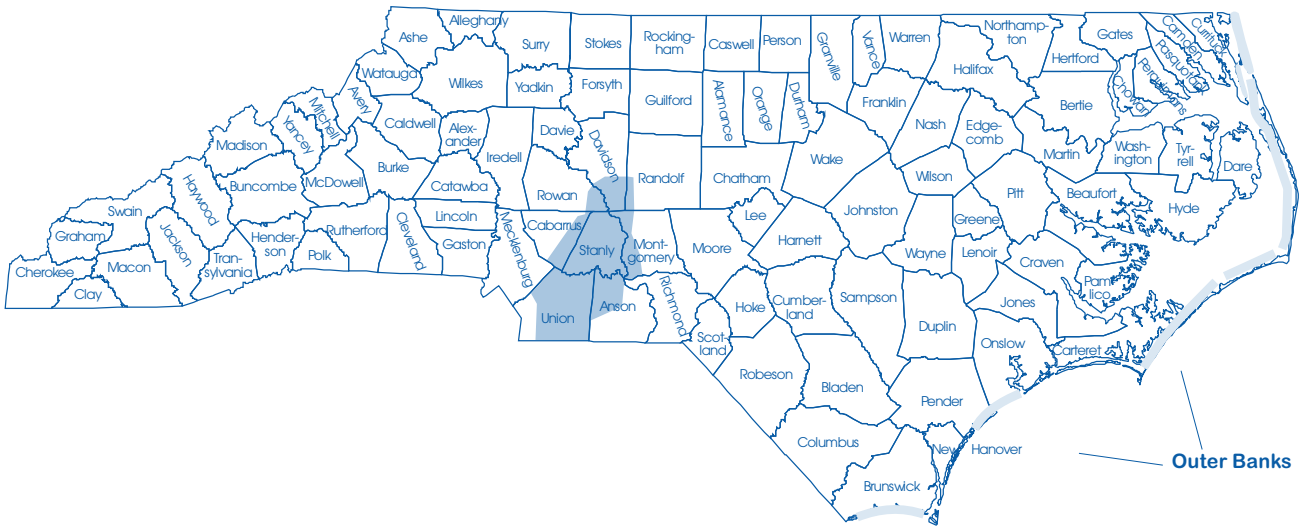
6. Circle the answer that best describes the casing and grouting of your well.

a. Cased and grouted to required depth.

b. Cased and grouted below water table of well.

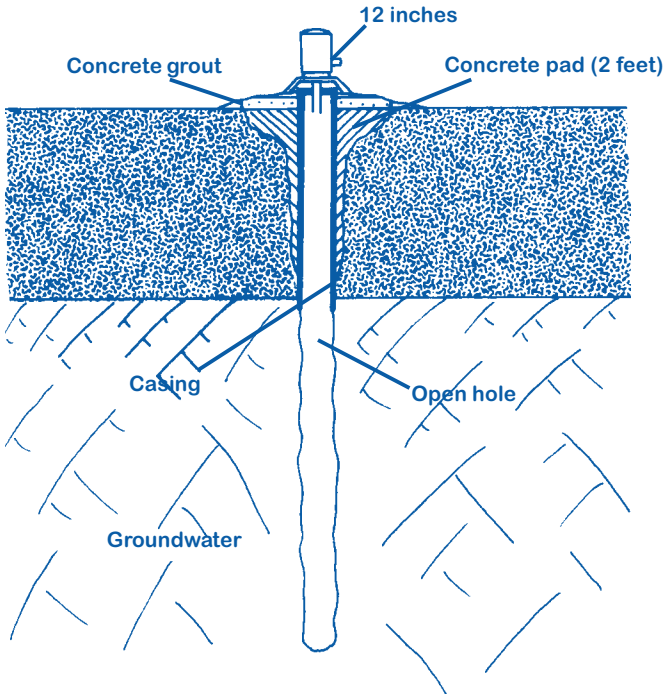
c. Cased, but not grouted.

d. No casing. No grout; OR do not know.



7. Is the well protected at the ground surface?

The well casing extends above the ground to prevent stormwater runoff from entering the well directly. The private well code requires that at least 12 inches of casing pipe extend above the ground after the final grading of the surrounding land. The wellhead should be surrounded 2 feet in all directions by a concrete pad, which should slope away from the well. The concrete pad stabilizes the casing and the soil around it, and the slope of the pad keeps stormwater runoff from entering the well.



Typical drilled well

7. Circle the answer that best describes your well-head.

a. Casing extends more than 12 inches above surface and concrete pad extends 2 feet in all directions.

b. Casing above ground level and concrete pad 1 to 2 feet in all directions.

c. Casing above ground level and no concrete pad.

d. Casing below ground level or in pit or basement and no concrete pad; OR do not know.

We are discussing wells in this publication, but much of this information applies to springs. For more specific information about springs, see the Cooperative Extension fact sheet, *Protecting Water Supply Springs*, AG-473-15.

8. How old is your well?

The age of your well is an important factor in predicting whether your water might be polluted. A well constructed more than 60 years ago is likely to be located at the center of the homestead, which means it is probably surrounded by many activities that can cause pollution. It may also be more shallow than a newer well and may have a thinner casing that can corrode more easily. (Even wells with modern casings that are 30 to 40 years old can be corroded.) Older well pumps are more likely to leak lubricating oils into the well. All of these characteristics of older wells can contribute to the pollution of your well water. If you have an older well, you might wish to have it examined by a county health department representative, Division of Water Quality (DWQ) regional groundwater specialist, or a qualified well driller.

8. Circle the answer that best describes the age of your well.

a. Less than 15 years old.

b. 15 to 30 years old.

c. 30 to 60 years old.

d. More than 60 years old; OR do not know.

9. Is your well drilled or dug?

Wells that have been dug rather than drilled pose the highest risk of pollution because they are shallow and often poorly protected from stormwater runoff. A dug well is a large-diameter hole (usually more than 2 feet wide), which often has been constructed by hand.

Driven wells, also known as sand point wells, pose a moderate to high risk of being polluted. They can only be installed in areas of relatively loose soils, such as sand, because they are constructed by driving a small-diameter pipe into the ground.

Other types of wells include jetted wells, in which water under high pressure washes away the soil, and bored wells, in which an earth auger removes the soil. Drilled wells are made either by rotary drilling or by percussion drilling. (Some people refer to drilled wells as "punched.") Drilled wells for home use are commonly 4 to 8 inches in diameter. Bored wells are commonly 18-24 inches in diameter. Drilled, jetted, or bored wells are the safest types.

10. Are you preventing backflow?

Backflow occurs when water (and possibly pollution) flows backward through the pipes from the house to the well. There should be anti-backflow devices, also known as check valves, on all faucets with hose connections, or there should always be air gaps between hoses or faucets and the water level. Without check valves, you risk having polluted water from laundry tubs, sinks, washing machines, pressure washers, outside hydrants, or swimming pools flow back through the plumbing into your well water.

If a vacuum forms in a water supply pipe, the backflow that can result is called backsiphoning. Backsiphoning from pesticide mixing tanks or pressure washers allows chemicals to flow back into the well through the hose. Check valves should be used when filling pesticide sprayer tanks. This prevents the chemical mixture from flowing back into the well and polluting groundwater. If you don't have check valves, the hose must be kept out of the tank when filling the pesticide sprayer. Another option if you don't have check valves is to use an inexpensive plastic container. The container is filled with water at the well and then used to fill the sprayer away from the homestead and the well.

Water supplies that have cross connections between them (connections between two otherwise separate pipe systems) also put your drinking water at risk. The water in one pipe system can become polluted by the other system.

9. Circle the answer that best describes how your well was installed.

a. Drilled

b. Jetted or bored.

c. Driven (sand point).

d. Dug; OR do not know.

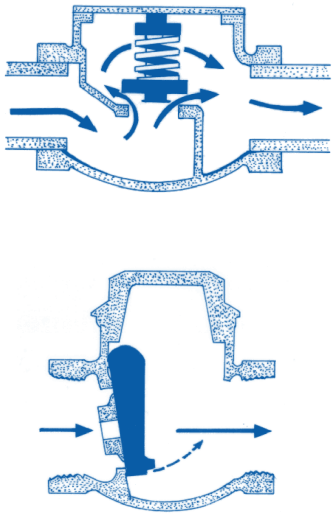
10. Circle the answer that best describes anti-backflow (check valve) devices attached to your well.

a. Check valves are installed on all faucets with hose connections and there are no cross-connections between water supplies.

b. Check valves are installed on some faucets with hose connections, or one check valve at well pump.

c. No check valves installed. Air gap maintained.

d. No check valves installed. Air gap not maintained. Cross-connections between water supplies; OR do not know.



Examples of check valves

11. Do you have any unused wells?

Many homes have old, unused wells on the property. No one knows how many of these unused wells exist in North Carolina, but estimates range in the hundreds of thousands.

If unused wells are not properly filled and sealed, they can provide a direct route to the groundwater for stormwater runoff carrying pollutants. These wells can allow pollutants to move from one groundwater system to another, as well. Wells should also be filled so that children and animals cannot fall into them.

You cannot always see unused wells. A depression in the ground may indicate an old well. Pipes sticking out of the ground around existing or past homesteads are the most obvious signs of an unused well. Other places to check for unused wells include in basements of houses, under front steps of houses, or near old cisterns.

A well that has been permanently closed by approved methods is considered an abandoned well. A license is not required to properly abandon a well, but you must meet the minimum well code requirements for abandonment. Use of unacceptable materials and methods can lead to well settling, well collapse, and groundwater pollution.

North Carolina regulations include the following requirements for well abandonment:

- The pump, piping, and any other obstructions must be removed from the well. Casings and screens should be removed if doing so will not cause or contribute to groundwater pollution.
- Any casing that is not properly grouted must either be removed or properly grouted.
- The well must be chlorinated to disinfect it before it is sealed.
- The entire depth of the well must be filled with cement, grout or clay. Specific requirements vary according to well type and local geological characteristics.

12. Has your well been tested recently?

Well water should be tested once a year. You can have your water tested by either a public or a private laboratory. A list of certified labs is available from the North Carolina Cooperative Extension Service. In some cases the North Carolina Department of Agriculture will test your water for a small fee. Although it would be expensive and difficult to test your water for every possible pollutant, some basic tests should be conducted. If you take the samples yourself, you must carefully follow the instructions that come with the collection bottle.

Water should be tested once a year for bacteria and nitrate, which can cause health problems. Yearly testing is necessary because groundwater travels and may pick up pollutants elsewhere. So even if you are doing everything you can to prevent your well from being contaminated, it may become polluted from other people's activities. If your water has high bacteria or nitrate levels, talk to a county health specialist. There may be problems with the location or construction of your well.

11. Circle the answer that best describes any abandoned wells located on your property.

a. No unused, unsealed wells.

b. Unused wells sealed and filled.

c. Unused well on property more than 100 feet from supply well. Not capped or filled.

d. Unused well less than 100 feet from supply well. Not capped or filled; OR do not know.

12. Circle the answer that best describes the tested water quality of your well.

a. Consistent, satisfactory water quality. Bacteria, nitrate, and other tests meet standards.

b. Occasional deviation from standards with bacteria, nitrate, and other tests.

c. Bacteria, nitrate, and other tests most often do not meet standards.

d. No water tests done; or water discolored after rainstorms or during spring melt; or noticeable changes in color, clarity, odor, or taste; OR do not know.

If your well draws from sandy soil or granite bedrock, testing once for corrosivity is also important. The tests to check for corrosivity include hardness, alkalinity, pH, conductivity, and chloride. Test once to find out how corrosive the water may be to your plumbing system.

Test for pollutants that are most likely at your homestead.

- Test for lead if you have lead pipes or soldered copper joints or brass fixtures.
- Test for volatile organic chemicals (VOCs) if you have an underground fuel storage tank, or if there has been a nearby use or spill of oil, petroleum, or solvent.
- Testing for pesticides can be expensive, but it is important if the potential for pesticide pollution is high, such as after a spill or if your well is downhill from fields where pesticides have been applied. Testing for pesticides may also be justified if your well has high nitrate levels or if your well is shallow or not properly cased and grouted.

It is important to record test results and to note changes in water quality over time. In addition to water analysis results, you should keep records of your well construction and of maintenance done on the well and pump.

For More Information:

If your county has a well permit program, you should contact the county health department before beginning any well construction or repairs.

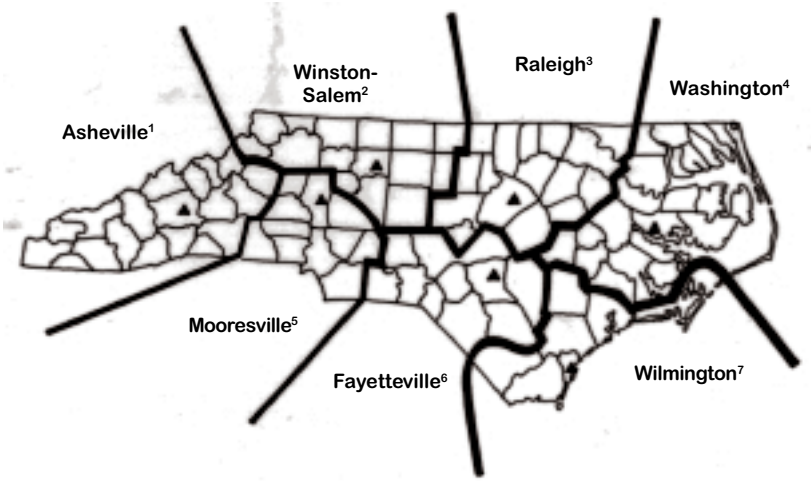
Your county health department or local Cooperative Extension Service Center can be a valuable source of information on the following topics:

- New well or spring construction and site selection
- Well inspection and maintenance
- Certified well drillers (or call the Division of Water Quality (DWQ) Groundwater Section, 919-733-3221; web site: http://gw.ehnr.state.nc.us/Drill1.asp)
- Unused well abandonment
- Construction records for existing wells (or call the DWQ, 919-571-4700; web site: http://gw.ehnr.state.nc.us/wellinfo.htm)
- Well water testing:
  - Advice on appropriate tests to run
  - List of certified testing laboratories
  - Assistance interpreting test results
  - Health risks

Your local Cooperative Extension Service Center can also provide information on:

- Backflow prevention
- Water pollution and health risks
- Water treatment devices
- Groundwater (or call the DENR DWQ Groundwater Section regional office nearest you, listed as follows)

To Find Your State DWQ Location



[1]Interchange Building, 59 Woodfin Place, Asheville, NC 28801; 828-251-6208
[2]505 Waughtown St., Winston-Salem, NC 27107; 336-771-4600
[3]3800 Barrett Drive, Suite 101, Raleigh, NC 27609; 919-571-4700
[4]1424 Carolina Avenue, Washington, NC 27889; 252-946-6481
[5]919 North Main Street, Mooresville, NC 28115; 704-663-1699
[6]Wachovia Building, Suite 714, Fayetteville, NC 28301; 910-486-1541
[7]127 Cardinal Drive Extension, Wilmington, NC 28405-3845; 910-395-3900

Other information sources:

Questions about:	**Call or write:**
Drinking water quality standard and health advisories	U.S. Environmental Protection Agency's Safe Drinking Water Hotline (between 8:30 - 5:00 Eastern time) 1-800-426-4791 http://www.epa.gov/safewater/protect.html *or* http://www.epa.gov/OGWDW/drinklink.html
Health risks	NCDHHS Division of Epidemiology, 919-733-3421 http://www.schs.state.nc.us/epi/
Soil information	NCSU Soil Science Dept. 919-515-2655 http://www.soil.ncsu.edu

Related publications available from the Cooperative Extension Service:

- *Health Effects of Drinking Water Contamination.* HE-393
- *Home Drinking Water Treatment Systems.* HE-419/WQWM-136
- *Nitrate in Drinking Water.* AG-473-1/WQWM-5
- *Protecting Water Supply Springs.* AG-473-15/WQWM-73
- *Questions to Ask When Purchasing Water Treatment Equipment.* AG-473-3/WQWM-7
- *Should You Have Your Water Tested?* AG-473-2/WQWM-3
- *Your Water Supply: Well Construction and Protection.* AG-469/WQWM-10
- *Diseases Carried by Drinking Water.* WQWM-145
- *Groundwater in the Piedmont at Blue Ridge Provinces of North Carolina.* AG-473-6/WQWM-6
- *Groundwater in the Coastal Plain at North Carolina.* AG-450
- *Radon in Water.* HE-396/WQWM-13
- *Metals in Drinking Water.* AG-473-1/WQWM-6
- *Lead in Drinking Water.* HE-395/WQWM-8
- *Volatile Organic Chemicals (VOCs) in Drinking Water.* AG-473-5/WQWM-16

These publications are available at your county Cooperative Extension Service Center. You may also order these publications from Communication Services, Campus Box 7603, North Carolina State University, Raleigh, NC 27695-7603.

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Prepared by

Dorothy L. Miner, Water Quality Extension Associate

Gregory D. Jennings, Water Quality Extension Specialist

Deanna L. Osmond, Water Quality Extension Specialist

Janet Young, Layout & Design Specialist

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