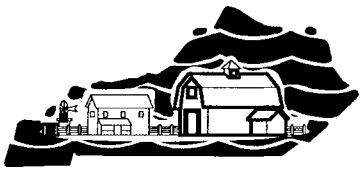


KY•A•Syst

Home and Farmstead
Water Quality Assessment

Assessing and Reducing the Risk of Groundwater Contamination from

DRINKING WELL WATER CONDITION

Why should I be concerned?

Kentucky's groundwater is one of its most vital resources. It supplies drinking water for hundreds of thousands of Kentuckians. Groundwater is the source of water for drinking water wells, springs, and some municipal, or "city," water supplies. All of us do things at our homes every day which can possibly pollute the groundwater. Nobody wants to pollute the groundwater, but if we are not careful and educated about how we manage our day-to-day home or farmstead activities, we can do just that– pollute the groundwater that serves as drinking water for many families. Even if nobody in your community uses groundwater for drinking water, you need to be concerned. This is because groundwater that underlies your home may travel a long way and eventually end up as another family's drinking water.

People who use a water well for their drinking water can help prevent the contamination of their well water (and the groundwater) by ensuring that their well is in good condition. If improperly constructed and maintained, wells can allow bacteria, pesticides, fertilizer, or oil products to contaminate groundwater. These contaminants can put family and livestock health at risk.

The condition of your well and its closeness to contamination sources determine the risk it poses to the groundwater. For example, a cracked well casing allows bacteria, nitrates, oil, and pesticides to enter the well more easily. A spill of pesticides being mixed and loaded right near the well could result in the contamination of the groundwater. Preventing groundwater contamination is very important. Once the groundwater supplying your well is contaminated, it is nearly impossible to clean up. The only options for new drinking water would be to treat the water, drill a new well, or get water from another source. These options would be expensive and inconvenient. A contaminated well may also affect your neighbors' water source, posing a serious threat to their health. Your best option is to **prevent** groundwater contamination.

The goal of KY•A•Syst is to help you protect the groundwater that supplies drinking water for many families.

How will this publication help me protect the groundwater?

Part I of this publication will help you protect the groundwater by asking you questions about the condition of your water well. These questions will help you identify activities or structures on your property which may put groundwater at a high risk of being contaminated. Part II of the publication will give suggestions on how to reduce the risk of groundwater contamination by improving the condition of your well.

The KY•A•Syst program is for your benefit only. No information from this publication needs to leave your home. KY•A•Syst does not attempt to offer legal advice or solutions to individual problems but rather to raise general awareness about groundwater protection strategies. Questions about individual problems should be addressed to the appropriate professional.

Part I. *Assessing* the Risk of Groundwater Contamination from Drinking-Water Well Condition

Instructions:
Circle the number in front of the appropriate item that **best** describes your home or farmstead. (Skip and leave blank any categories that don't apply to your home or farmstead.)

LOCATION

Where is your drinking water well in relation to pollution sources?

4 Uphill from all pollution sources. No surface water runoff reaches well.
3 Uphill from or at grade with pollution sources. Surface water runoff might reach well.
2 Downhill from most pollution sources. Some surface water runoff may reach well.
1 Settling or depression near well casing. Surface water runoff from livestock yards, pesticide and fertilizer mixing and loading area, fuel storage, or farm dump reaches well.

How far is it between your well and pollution sources?

4 Exceeds all recommended minimum separation distances given in Part II of this publication.
3 Meets recommended minimum separation distances given in Part II of this publication.
2 Meets minimum separation distances only for sources recommended to be at least 100 feet from well (see Part II).
1 Does not meet all minimum separation distances for sources recommended to be at least 100 feet from well (see Part II – existing wells must meet separation requirements in effect at the time of construction).

CONDITION

What is the condition of the well casing and well cap?

4 No cracks or holes. Cap tightly secured. Screened vent.
3 No visible defects. Well vented but not screened.
2 No holes or cracks visible. Cap loose.
1 Holes or cracks visible. Cap loose or missing (violates Kentucky regulations).

What is the well casing made of?

4 Casing made of PVC or steel.
3 Casing made of concrete tile.
2 Casing made of clay tile.
1 No casing (hand-dug well).

How high is the well cased above the land surface?

4 4 inches above ground level. (If well is in a floodplain, the casing must be 24 inches above the highwater mark.)
3 Between ground level and 4 inches above ground level (violates Kentucky regulations).
2 Casing stops at ground level (violates Kentucky regulations).
1 Below ground level, in pit, basement, or buried (violates Kentucky regulations).

How old is the well?

4 Less than 10 years old.
3 11 to 20 years old.
2 21 to 50 years old.
1 More than 50 years old.

What type of well is it?

4 Drilled with grout (neat cement, cement/bentonite, or bentonite).
3 Drilled with backfill (drill cuttings).
2 Driven-point (sand point).
1 Dug well.

MANAGEMENT

Does your well have any physical protection around it (fence, etc.)?

4 Well has permanent protective enclosure (well house with roof or cover).
3 Well has no protective enclosure, but it is located far from activities which could damage it (driveway, road, etc.).
2 Well has no protective enclosure, is located near activities which can damage it (driveway, road, etc.), but it has protective posts or a fence around it.
1 Well has no protective enclosure, is located near activities which can damage it (driveway, roads, etc.), and has no protective posts or fence around it.

Do you use anti-backflow devices?

4 Anti-backflow devices (such as check valves) installed on all outdoor faucets. If both well and "city" water are used on property, no cross-connections exist between those sources (see Part II of this publication for description of cross connections).
3 Anti-backflow devices on some outdoor faucets. No cross connections between well and "city" water supplies.
2 No anti-backflow devices used. Air gap maintained between hose and water level when filling a container (such as pesticide mixing tank). No cross connections between well and "city" water supplies.
1 No anti-backflow devices used. Air gap not maintained. Cross-connection between well and "city" water supplies (violates Kentucky regulations – see Part II).

Do you have unused wells on your property?

4 No unused wells.
3 Unused wells capped and protected.
2 Unused, unsealed well in field. Not capped or protected (violates Kentucky regulations).
1 Unused, unsealed well on home or farmstead. Not capped or protected (violates Kentucky regulations).

How often do you have your water tested?

4 Once a year.
3 Regularly.
2 Periodically.
1 Never. (Skip next two questions.)

If you do test your water, what do you test it for?

4 Coliform bacteria, nitrates, pesticides, and other contaminants (volatile organic carbons).
3 Coliform bacteria, nitrates, pesticides.
2 Coliform bacteria and nitrates.
1 Coliform bacteria only (newly constructed wells are required to be checked for fecal coliform bacteria).

If you have tested your water, what were the results of the test?

4 All standards met for contaminants checked (see Part II of this publication).
3 Standards occasionally not met for contaminants checked (see Part II).
2 Standards regularly not met for contaminants checked (see Part II).
1 Standards never met for contaminants checked (see Part II).

SITE EVALUATION

What type of soil is on your property?

4 Fine-textured or "heavy" soils (clays).
3 Medium-textured soils (silt loam).
2 Medium- to coarse-textured soils (loam, sandy loam).
1 Coarse-textured soils (sands).

After a 1-inch rain in April, how long do you (or farmers in your area) have to wait to get into the field?

4 More than four days.
3 Four days.
2 Three days.
1 Zero to two days.

How sensitive is your region of the state to groundwater contamination (see map at end of publication)?

4 Low sensitivity.
3 Moderate sensitivity.
2 High sensitivity.
1 Very high sensitivity.

Does your property lie above or near any active/abandoned underground coal mines?

4 No underground mining is being done below or near your property.
3 Underground mining is currently being done.
2 An underground mine was abandoned underneath or near your property more than ten years ago.
1 An underground mine was abandoned underneath or near your property more than twenty years ago.

If your property does lie above or near any active/abandoned underground coal mines, what type of mine is it, and how deep is the mine? (See Part II for more information.)

4 No underground mining is being done below or near your property.
3 Underground mine is more than 400 feet deep.
2 Underground mine is 200 to 400 feet deep.
1 Underground mine is less than 200 feet deep. Mine is a "longwall" type mine.

What do I do with these rankings?

Take a look at your rankings for the individual questions you answered.

For Questions Where You Received A:	The Risk of Contaminating Groundwater Is:
4	Low
3	Low to Moderate
2	Moderate to High
1	High

Use this table to list any questions from Part I where you received a "1" (high risk activity or structure) or that were identified as being against Kentucky regulations. Next, write down the first step that can be taken to better the situation. Then read Part II of this publication, "Reducing the Risk of Groundwater Contamination by Improving Drinking Water Well Condition." This will help you to improve any problem areas (1's or 2's) which were identified.

Activity or structure identified as high risk ("1")	**What is the first step that can be taken to solve the problem?**
Example: well cap has a crack.	*Call well driller to price replacement of well cap; eventually replace well cap.*

Part II. *Reducing* the Risk of Groundwater Contamination by Improving Drinking-Water Well Condition

WELL LOCATION

The location of a well relative to surface drainageways is important in determining the potential for groundwater contamination from surface water flow, regardless of the depth of the well. Locating a well in a safe place takes careful planning and consideration. A well downhill from a potential pollution source runs a greater risk of contamination than a well on the uphill side of a pollution source. The well should be installed at a location that is uphill from any septic tank, livestock feedlot, or other potential contamination sources on your property or neighboring property.

Separation distances

The farther the well is from potential contamination sources on the home or farmstead the better. Although keeping potential pollution sources far from the well is very important and always recommended, it may not keep contaminants from reaching the well in areas which have a high sensitivity to groundwater contamination.

More than 50 percent of Kentucky has areas with large springs, sinkholes, caves, and "sinking" or "losing" streams. These areas are called karst and are especially sensitive to groundwater contamination because the sinkholes, caves, or other cracks in the bedrock may serve as a direct route from potential pollution sources to the groundwater. It is for this reason that garbage should not be dumped into sinkholes. Any garbage that is dumped into a sinkhole has a very high chance of contaminating the groundwater that serves as drinking water for many families.

Pit privy	75 feet
Manure piles	75 feet
Lateral fields	70 feet
Septic Tank	50 feet
Barnyard	50 feet
Sewers (depending on type)	15-50 feet
Footing drains	10 feet
Pump house floor drains	2 feet

Kentucky Minimum Separation Distances

In a karst area, keeping potential pollution sources far away from the well does not guarantee protection from contamination. In these areas, proper management of pollution sources and structures is extremely important. Look at the map at the end of this publication and find the county you live in. Then look to see if your county is in an area which has a very high, high, moderate, or low sensitivity to groundwater contamination. If you are in a moderate, high, or very high area, you need to pay attention to the following separation distances **and** pay especially close attention to how you manage your home or farmstead pollution sources. Use of the various KY•A•Syst publications can help you properly manage your home or farmstead pollution sources and avoid contaminating the groundwater. If you are not careful, you will risk contaminating the groundwater that provides many families with drinking water.

In Kentucky, minimum horizontal separation distances between a well and various home or farmstead

Silage storage, earthen trench or pit	250 feet
Liquid waste disposal systems	250 feet
Manure storage structure, earthen or excavated	250 feet
Fuel storage	100 feet
Pesticide or fertilizer storage area	100 feet
Manure storage structure, fabricated, liquid tight	100 feet
Filter strip	50 feet
Silo	50 feet
Cistern	8 feet

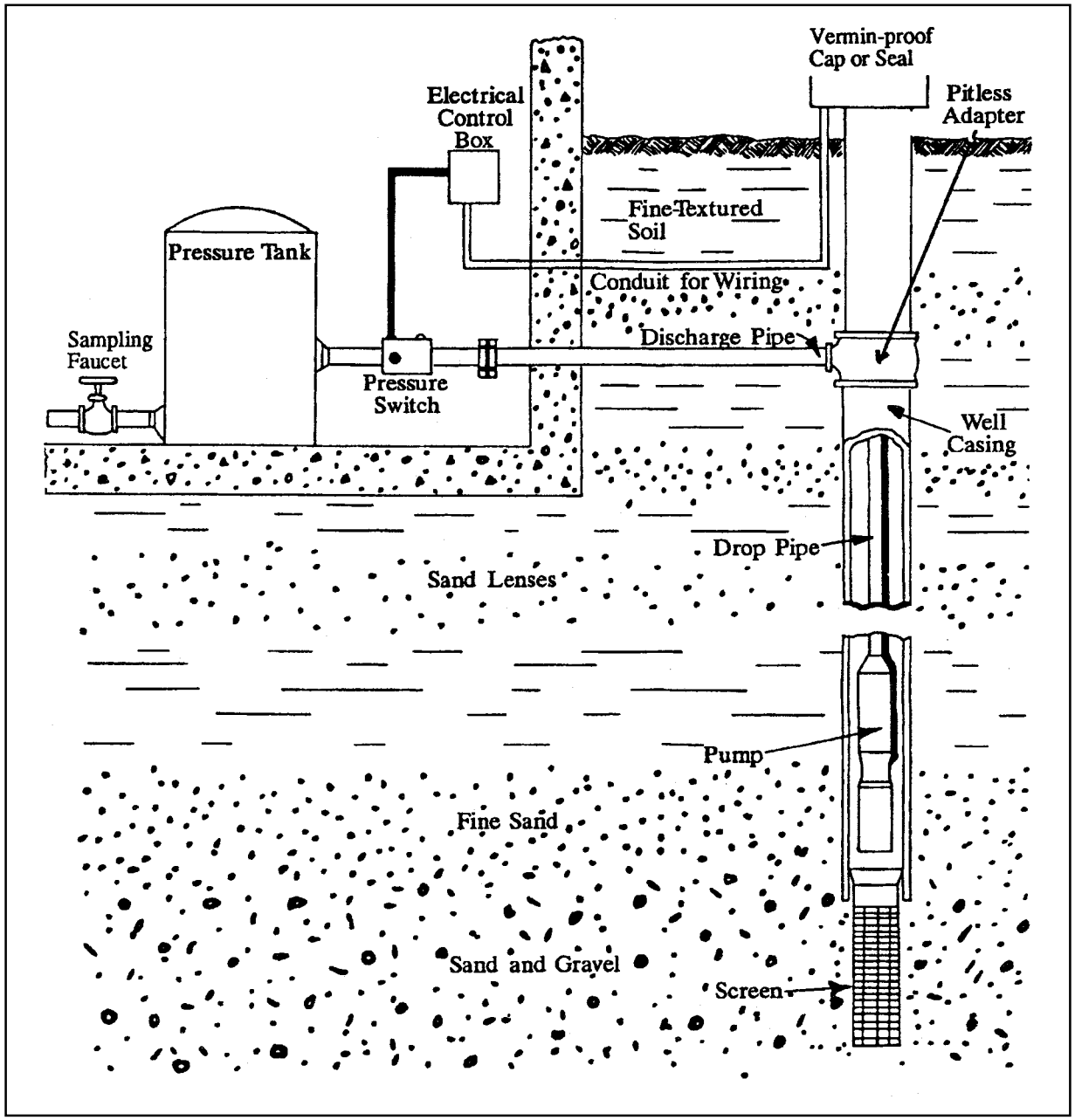
Other Recommended Separation Distances Not Included in Kentucky Regulations

contamination sources are given in 401 KAR 6:310. These include:

This regulation does not address home or farmstead activities such as pesticide mixing, pesticide and fertilizer storage, silage storage, fuel storage, liquid waste disposal systems, or home waste disposal areas. Recommended separation distances not included in Kentucky regulations are given in the box above.

In general, provide as much separation as possible between your well and any potential contamination sources. It is highly recommended to use at least these separation distances. Do not sacrifice the separation distance because of convenience.

Keeping the recommended separation distances between your well and pollution sources will help to prevent the contamination of your well, but it is not an excuse for poor management of your home or farmstead's pollution sources. Poor management of pollution sources can lead to the contamination of your **neighbors'** water source. For example, even if you have 250 feet between your well and a manure storage structure, poor management of that manure could still



Typical domestic well installation with discharge pipe extending into the home.
Source: Illinois Extension Service

contaminate the groundwater that serves as drinking water for another family. Any condition likely to cause groundwater contamination should be improved, even if your well is far away from the potential source. Whether or not drinking water is affected, contaminating groundwater is a violation of state law.

Simply separating your well from a contamination source may reduce the chance of pollution, but it does not guarantee that the well will be safe. Storm water can carry bacteria, oil products, pesticides, and other contaminants from one place to another. Wells located in the path of drainage water run a risk of contamination. As mentioned above, people who live in karst areas need to be especially careful with the management of pollution sources and use the recommended separation distances.

WELL CONSTRUCTION

The way a well is constructed affects its ability to keep out contaminants. Good well design reduces the risk of pollution by sealing the well from anything that might enter it from the surface. Uncapped wells that are buried, located in pits, or constructed without grout seals can allow surface water to carry bacteria, pesticides, fertilizer, or oil products into your drinking water supply. Several things that should be checked are described in the following sections. Well construction information may be available from the driller, the previous owner, or the well construction report (for wells installed after 1985). The Kentucky Geological Survey Groundwater Data Repository (606-257-5500–ask for the Repository Manager) may be able to help you locate this information for a small fee.

Casing and well cap

The well driller installs a steel or plastic pipe, called a casing, during well construction to provide stability to the well. The space between the casing and the sides of the hole can provide a direct channel for downward movement of surface water (and pollutants) to reach the water table. To seal off that channel, the space is normally filled with an impermeable material such as grout. If your well casing is cracked, made of clay tile, or made of steel that has corroded, you may want to have the well inspected by a certified well driller. To keep surface flow from entering the well, it should have a tight-fitting well cap. The cap prevents disturbance by children and entry by animals, insects, or surface water.

The well casing may need attention if the ground around the well is sunken. If you can move the casing around by pushing against it, you may also have a problem with your well's ability to keep out contaminants. Contact a certified well driller for help.

Casing depth and height

Kentucky regulations provide casing depth and height requirements for newly constructed or altered wells. Specific depths depend on the local geology and are described in 401 KAR 6:310 (copies of this regulation are available at no charge from the Kentucky Division of Water at 502-564-3410). Properly installed and sealed casing is the best way to keep contaminated water from entering your well.

Avoid making changes in the wellhead after drilling. Kentucky law requires that at least 4 inches of casing extend above the ground surface. Buried casing or well head, short casing, and improper pump installation are some of the leading causes of well contamination in the state.

Well age

Well age is an important factor in predicting the likelihood of high nitrate concentrations. An older well (50 years or older) is likely to be at the center of the home or farmstead; it may be shallow and is probably surrounded by many potential contamination sources. Older wells are more likely to have pumps that leak lubricating oils into the water, and may have corroded casings. Results of a well testing program in Kentucky found that older wells tend to have higher average concentrations of nitrate, and a greater percentage of old wells exceeded the recommended level of nitrates given by the federal government. If you have an older well, you may want to have it inspected by a certified well driller or the Kentucky Division of Water (Groundwater Branch).

Well type

Dug wells: The risk of drinking water contamination with dug wells is high. This type of well is usually shallow and often poorly protected from surface water. A dug well is a large-diameter hole (usually more than 2 feet wide), which is often constructed by hand.

Driven-point (sand point) wells: The risk of drinking water contamination with driven wells is moderate to high. They are constructed by driving assembled lengths of pipe into the ground. Driven-point wells are normally smaller in diameter (2 inches or less) and less than 50 feet deep. They can only be installed in areas of relatively loose soils, or unconsolidated sediments, such as sand.

Drilled wells: All other types of wells, including those constructed by a combination of jetting and driving, are

drilled wells. Drilled wells for home or farm use are commonly 4 to 8 inches in diameter.

Well depth

Well depth may or may not affect well water contamination, depending on the bedrock that is under your property. Certain types of bedrock do a pretty good job of protecting the groundwater because they act like a filter and keep pollutants from reaching the groundwater. Other types of bedrock do a poor job of protecting the groundwater because they allow surface water to quickly enter the groundwater. This surface water may carry with it pollution from the home or farmstead. As mentioned before, many areas of Kentucky have large springs, sinkholes, caves, or "disappearing" or "losing" streams. These areas are called karst. Karst areas are especially sensitive to groundwater contamination because they allow surface water to quickly reach the groundwater through sinkholes, caves, and "sinking" or "losing" streams, among other ways.

In areas with bedrock that does a good job of protecting the groundwater (low sensitivity to groundwater contamination), a deeper well may help prevent well contamination. This is because pollutants must travel deeper to reach the groundwater that the homeowner uses. The soil and bedrock may therefore have more ability to "filter out" the pollutants. In areas where there is a high sensitivity to groundwater contamination (karst areas), a deeper well may not help in preventing well contamination. A deeper well may get its water from an area with caves or conduits that are connected to the surface. This means that surface water may quickly travel into a shallow or deep well without being "filtered" by the soil and bedrock.

If your tap water gets muddy after a heavy rain, your well may be getting its water from a cave or conduit area that is connected to the surface. The solution to this problem may be a water treatment system. More important, you and your neighbors should be very careful with the management of your home and farmstead pollution sources. If you're not careful, home and farmstead pollutants can end up in the groundwater that serves as drinking water for the whole neighborhood. Look at the map at the end of this fact sheet to determine if you live in a county that has a moderate, high, or very high sensitivity to groundwater contamination. If you are in a moderate, high, or very high area, you need to pay especially close attention to how you manage your home or farmstead pollution sources. Consult a local, certified well driller or the Kentucky Division of Water (Groundwater Branch) if you want help with this issue.

MANAGING AND MAINTAINING EXISTING WELLS

You wouldn't let a car or tractor run too long without an oil change. Your well deserves the same kind of attention. Good maintenance means testing the water every year, keeping the well area protected, clean, and accessible, and keeping pollutants as far away as possible.

Better management of your existing well

Existing wells most likely were located according to traditional practice or regulations in place at the time of construction. While these wells are still legal, you may want to consider how your well's construction and location compares with current recommendations, which take into consideration new knowledge about groundwater contamination. You might want to move some activities, such as pesticide mixing or petroleum storage, farther away from your well.

In many cases, changing the location of other farmstead practices may prove expensive. Until you have an opportunity to meet minimum separation distance recommendations, work to change the way you manage such structures.

If your silo is too close to your well, for example, you may want to install a system for collecting any juices draining from the silage. You could install concrete curbs to direct barnyard runoff away from the well.

Short-term manure stacks are another farmstead practice that needs careful attention. They pose a risk of well contamination by bacteria and/or nitrates. By locating them on clay soil or, better yet, a concrete containment slab, you reduce the chance of polluting the groundwater.

Property owners with fuel storage tanks may want to consider moving them away from the well. If any tanks are underground, have them checked for leakage.

Water testing

Keep an eye on water quality in existing wells by having the well tested. It is a good idea to have the well tested once a year, or as often as possible. Although you cannot have your water tested for every possible pollutant, some basic tests can give you an idea of other problems that may exist.

A good start is to have your water tested every year for nitrate and fecal coliform bacteria. Where the well draws from sandy materials, testing once for corrosivity is also important. A good initial set of tests for a private well also includes hardness, alkalinity, pH, conductivity, and chloride.

In addition, you may choose to obtain a broad scan of your water quality for a number of contaminants. Some mail-in labs offer a screening for metals, inorganic chemicals, volatile organic chemicals, herbicides/pesticides, and coliform bacteria. Follow the laboratory's instructions for collection and preservation of the water sample.

The results may not include contaminants that could be common in your area–for example, the most commonly used pesticides in your area. Test for contaminants that are most likely at your home or farmstead. Test for lead if you have lead pipes or soldered copper joints. Test for volatile organic chemicals if there has been a nearby use or spill of oil, petroleum, or solvent. While testing for pesticides can be very expensive (often $80 to $100 per compound analyzed), the expense may be justified if:

- Your well has nitrate levels equal to or more than 10 mg/L nitrate-nitrogen or 45 mg/L nitrate.
- A pesticide spill has occurred near the well, or back siphoning has occurred.
- Your well is shallow, has less than 15 feet of casing, or is located in sandy soil or downslope from irrigated cropland where pesticides are used.
- There are sinkholes on or near your property, and intensive row cropping practices are used nearby.

If you are not sure what to test for, seek advice on appropriate tests from your county Extension agent, local Health Department, or the Kentucky Division of Water (Drinking Water Branch). These agencies can also tell you what the current standards are regarding the maximum recommended level of a particular contaminant in drinking water.

You may want to test your water more frequently if:

- Someone in the family is pregnant, or there are children younger than 2 years old (pregnant women and young children are particularly vulnerable to polluted water).
- There is unexplained illness in the family.
- There are noticeable changes in livestock performance.
- Your neighbors find a particular contaminant in their water.
- You note a change in water taste, odor, color, or clarity.
- You have a spill or back siphoning of chemicals or petroleum products near your well or on your property.
- You apply chemicals to your fields within 100 feet of your well.
- Your property has many sinkholes or "disappearing" or "losing" streams.

You can have your water tested by both public and private laboratories. A current list of certified labs is available from your local Health Department or the Kentucky Division of Water (Drinking Water Branch, 502-564-3410).

Because many materials, including bacteria and nitrate-nitrogen, are naturally present in minor amounts in groundwater and can vary seasonally, you may want to contact your county Extension agent or the local Health Department for help in interpreting test results.

Fecal coliform bacteria and nitrates are two important indicators of well contamination. At excessive levels, they can cause health problems and also may suggest problems with the well's location or construction.

Keep in mind that activities off the home or farmstead can affect your groundwater, especially in areas with large springs, caves, sinkholes, or "disappearing" or "losing" streams. Chemical spills, changes in land use, and the presence of landfills in the area can increase the chance of pollutants getting into your water. If your water has a high nitrate or fecal coliform bacteria level, you will want to talk with your county Extension agent or local Health Department as soon as possible about the need for additional testing.

It is important to record and save test results for future comparisons, so you can tell if water quality is changing over time.

Well maintenance

A few simple maintenance practices:

- Check the well cap to see that it is in place and tightly secured. Make sure electrical wiring to the well is enclosed in the conduit and meets electrical code. If your well has a vent, be sure that it faces the ground. Is it tightly connected to the well cap or seal, and is it properly screened to keep insects out?
- Do not use gasoline, lawn chemicals, or agricultural chemicals near your well.
- Do not discard empty pesticide containers near your well or in any sinkhole.
- Protect wells from wastewater treatment systems.

Protecting the well from physical damage

Another well maintenance consideration is to protect your well from physical damage. This is important in order to prevent any car, tractor, or other activities from running into the well and damaging its casing or cap. Physical protection can be a well house with a roof or cover, a fence, or maybe some posts to keep a vehicle from running into the well head. **A well house should not be used for storage.** The purpose of the well house

is to protect the well; storing things in the well house can result in well water contamination.

Backflow prevention

Backflow or back-siphoning from pesticide mixing tanks can allow chemicals to flow back into the well through the hose. It makes good sense to use a check valve (one-way valve) when filling pesticide sprayer tanks to prevent the chemical mixture from flowing back into the well and contaminating groundwater. Inexpensive anti-backflow devices for hoses used to fill sprayers may be available from irrigation or spray equipment suppliers. If you don't have such a device, keep the hose out of the tank a distance of at least twice the diameter of the fill hose when filling the pesticide sprayer (in other words, do not let the hose submerge into the spray tank solution).

Consider installing anti-backflow devices on all faucets with hose connections. Without a backflow prevention device, you risk having laundry tubs, sinks, washing machines, pressure washers, outside hydrants, and even swimming pools contaminate your water supply.

Consider purchasing an inexpensive, plastic nurse tank. A nurse tank is filled with water at the well and then used to fill pesticide sprayers away from the farmstead and away from the well.

Some families have both municipal or "city" water and well water on their property. They may use the "city" water for the home and well water for farm activities or lawn/garden maintenance. Kentucky regulations [815 KAR 20(120)] state that there should be no cross-connection between these two water sources. This prevents the contamination of the "city" water from well water backflow. For example, if the well water was being used to fill a pesticide spray tank or to spray fertilizer/pesticide on a lawn and there was back-flow, the backflow would contaminate both the well and "city" water.

Kentucky law (KRS 224.01-400) states that backflow and spill events must be reported to the Kentucky Department for Environmental Protection Emergency Response Team. For emergencies call 502-564-2380 or 1-800-928-2380. For information call 502-564-2150. For more information about preventing groundwater contamination from pesticide mixing and loading practices, see the KY•A•Syst publication *Preventing Groundwater Contamination from Agricultural Chemical Storage and Handling*.

NEW WELLS

Drilling a new well

Getting the most from the investment in a new well means locating the well away from contamination sources and working to maintain the quality of the well.

Some simple principles:

- Locate your well on ground higher than surrounding pollution sources, including septic systems, fuel tanks, barnyards, and pesticide mixing areas. Where practical, locate the well as far as possible from pollution sources and no closer than minimum separation distances.
- If the well is not housed, build soil up around the well so that all surface water drains away from it.
- If not housed, fence off the well area if farm animals roam free.
- Avoid areas that are prone to flooding.
- Groundwater **generally** follows surface drainage patterns. Unless you know the exact direction of groundwater flow on your property, locate the well so that pollution sources are between the well and the nearest stream, river, or lake. Groundwater generally flows from upland areas and discharges into a surface water body. In all cases, locate your well on ground higher than surrounding pollution sources such as fuel tanks, barnyards, or pesticide mixing areas.
- Make the well accessible for pump repair, cleaning, testing, and inspection.
- Hire a competent, certified well driller and pump installer. Make sure the driller tests the water after drilling (as required by state regulations) and provides you with detailed information about the well's depth and construction (Kentucky Water Well Record) and with the results of the water test.

UNUSED WELLS

Many homes and farmsteads have unused wells. Old home sites or shallow wells once pumped by windmills are common. No one knows how many of these wells there are in Kentucky.

Pipes sticking out of the ground around the home or farmstead, in an area where a home or farmstead used to be, or under an old windmill are the most obvious places for finding unused wells.

If not properly filled and sealed, these wells can provide a direct conduit for surface water carrying pollutants into the groundwater. Do not dispose of any waste down unused wells. Besides being a threat to groundwater, large open wells are safety hazards for small children, animals, and the general public.

Kentucky regulations (401 KAR 6:310-section 12) state that unused wells must be sealed within thirty calendar days after the owner has made the decision that the well will not be used. This law also states that the sealing of these wells can be performed only by a certified well driller.

A FEW WORDS ABOUT YOUR SITE

The way home or farmstead structures such as the condition of your drinking water well affect the groundwater depends in part on the type of soil and bedrock that is on your property.

How do soils affect the potential for groundwater contamination?

Soil characteristics are important in determining whether a contaminant breaks down to harmless compounds or leaches into groundwater. In general, the soil on your property may act as a filter that prevents contaminants from reaching the groundwater. Different soils have different abilities to "filter" contaminants. Areas with soils that let water flow through them quickly have a greater risk of groundwater contamination. This is because the soil doesn't get a long enough chance to absorb or "grip" the contaminant, and it may flow to the groundwater with leaching rainwater. On the other hand, soils that allow water to flow through slowly will do a better job of protecting the groundwater, but pose a higher risk of contaminating streams because the water will run off and may carry pollutants with it.

Sandy soils have large spaces between individual particles and therefore let water pass through quickly. Contaminants from your property can flow with this water. Because of this, sandy soils have a greater potential to pollute groundwater than clays.

Clay soils, on the other hand, have smaller spaces between individual particles and therefore water passes through slowly. Slower-moving water allows contaminants a greater chance to be absorbed by or "grip" onto the soil. Because of this, clays do a better job of protecting the groundwater. Since water moves through a clay soil slowly, there is a higher chance of runoff. This can result in surface water (stream) contamination. In other words, there is a tradeoff between groundwater and surface water protection. If your site has a clay soil, it will do a better job of protecting the groundwater, but you must also look out for surface water contamination.

In Kentucky, the type of bedrock on your property is more important than the type of soil in determining your site's ability to protect the groundwater.

How does the bedrock on your site affect the potential for groundwater contamination?

Bedrock is the rock that lies underneath the soil on your property. Like the soil, different types of bedrock have different abilities to protect (or not protect) the groundwater from pollution. Knowing the bedrock that underlies your property is therefore important, because it can tell you if you live in an area that is sensitive to groundwater contamination. Earlier in this publication, the sensitivity of karst areas to groundwater contamination was discussed. These areas are especially sensitive to groundwater contamination because the bedrock is dissolved by water, and large conduits and caves are formed underground. These conduits and caves allow pollution to flow very quickly from the surface to the groundwater. Basically, karst areas may act like a sewer system which connects your home or farmstead to the groundwater. Look at the map at the end of this publication to see if you live in a region of the state that has a low, medium, high, or very high sensitivity of groundwater contamination. If you live in an area that has a high or very high sensitivity (karst areas), you need to be especially careful with how you manage your home or farmstead pollution sources. This means being very careful around sinkholes and water resources (wells, springs, streams, etc.). **Do not dump garbage into sinkholes, or you will contaminate the groundwater that serves as drinking water for many families.**

Potential effects of underground mining

Underground coal mining done underneath or near your property may result in the subsidence, or settling, of your property. This settling may cause damage to structures as well as put groundwater at risk of being contaminated. The settling causes cracks in the land that can then allow pollution from the soil surface to enter the groundwater. The chance of subsidence occurring on your property depends on when the underground mining occurred, the depth of the mine, and what type of mining was done. Depending on the type of underground mining done, different precautions are taken by mining companies to prevent subsidence. "Room and pillar" mining leaves pillars in the mines that support the land above when the mine is abandoned. As time passes, there is a greater risk that these pillars can degrade and result in the subsidence, or settling, of the land above. Certain types of "longwall" mines do not provide pillars. Therefore, these mines have a greater chance of resulting in subsidence. The depth of the mining also affects the chance that subsidence will occur. Deeper mines (greater than 400 feet) are less likely to cause subsidence than shallow mines (less than 200 feet). Information regarding the type and depth of underground coal mines may be obtained from the Department of Mines and Minerals at 606-254-0367 (ask for the Map Room). Be prepared to describe the location of your property in as much detail as possible (use a topographical map if possible).

CONTACTS AND REFERENCES

Who to call about...

Certified water testing labs (list)
Local Health Department . . . . . check local listing
Ky. Division of Water
(Drinking Water Branch) 502-564-3410
(ask for list of certified water testing labs)

Certified well drillers (list)
Ky. Division of Water 502-564-3410
(ask for "Ky. Directory of Certified Water and Monitoring Well Drillers")

Drinking water quality standards and health advisories
U.S. EPA's Safe Drinking Water Hotline 1-800-426-4791
(between 8:30 AM and 5:00 PM Eastern time)

Groundwater information
Kentucky Division of Water,
Groundwater Branch . . . . . 502-564-3410 (Pat Keefe)

Maps
Kentucky Geological Survey
(Map Sales) 606-257-3896
Soil Conservation Service . . . . . check local listing
County Extension agent . . . . . check local listing

Unused wells
Certified well driller: check Ky. Division of Water, list of certified well drillers

Well Testing
Local Health Department . . . . . check local listing
County Extension agent . . . . . check local listing
Certified lab . . . . . check local listing
(or call Ky. Div. of Water, Drinking Water Branch, for list)

Well construction information
Ky. Geological Survey,
Groundwater Data Repository 606-257-5500
(Repository Manager)

Well construction, inspection, repair
Certified well driller: refer to Ky. Div. of Water list

What is KY•A•Syst?
KY•A•Syst is a series of publications which will help you assess *and improve* how effectively your home or farmstead practices protect the groundwater. The publications ask you about your home or farmstead structures and activities. Your answers will help you see how your practices might be affecting the groundwater. Each publication then gives suggestions about things you can do to improve your home or farmstead practices to better protect the groundwater.

The topics of the program include:
- Drinking Water Well Condition
- Agricultural Chemical Storage and Handling
- Petroleum Product Storage
- Household Waste Management
- Household Wastewater Treatment
- Livestock Waste Storage
- Livestock Yards Management
- Silage Storage
- Milking Center Wastewater Treatment

Some of these topics apply only to people who have farms, and others apply to both farm owners and non-farm owners. ***This program is a completely voluntary program: it is an assessment you can perform in the privacy of your own home. No information from the publications needs to leave your home. The goal of KY•A•Syst is to help you protect the groundwater that supplies drinking water for many families.***

Edited and compiled by Mark Dravillas, Extension Associate for Water Quality, and Tom Ilvento, former Associate Extension Professor in Sociology, University of Kentucky Cooperative Extension Service. Based on materials from the National Farm•A•Syst Program, University of Wisconsin (author: Susan Jones, EPA Region V). Special thanks to the Kentucky Cabinet for Natural Resources and Environmental Protection, Division of Water, Groundwater Branch; the Kentucky Geological Survey; and Gerald Haszler, formerly of the Department of Agronomy, University of Kentucky, for technical review and comments.

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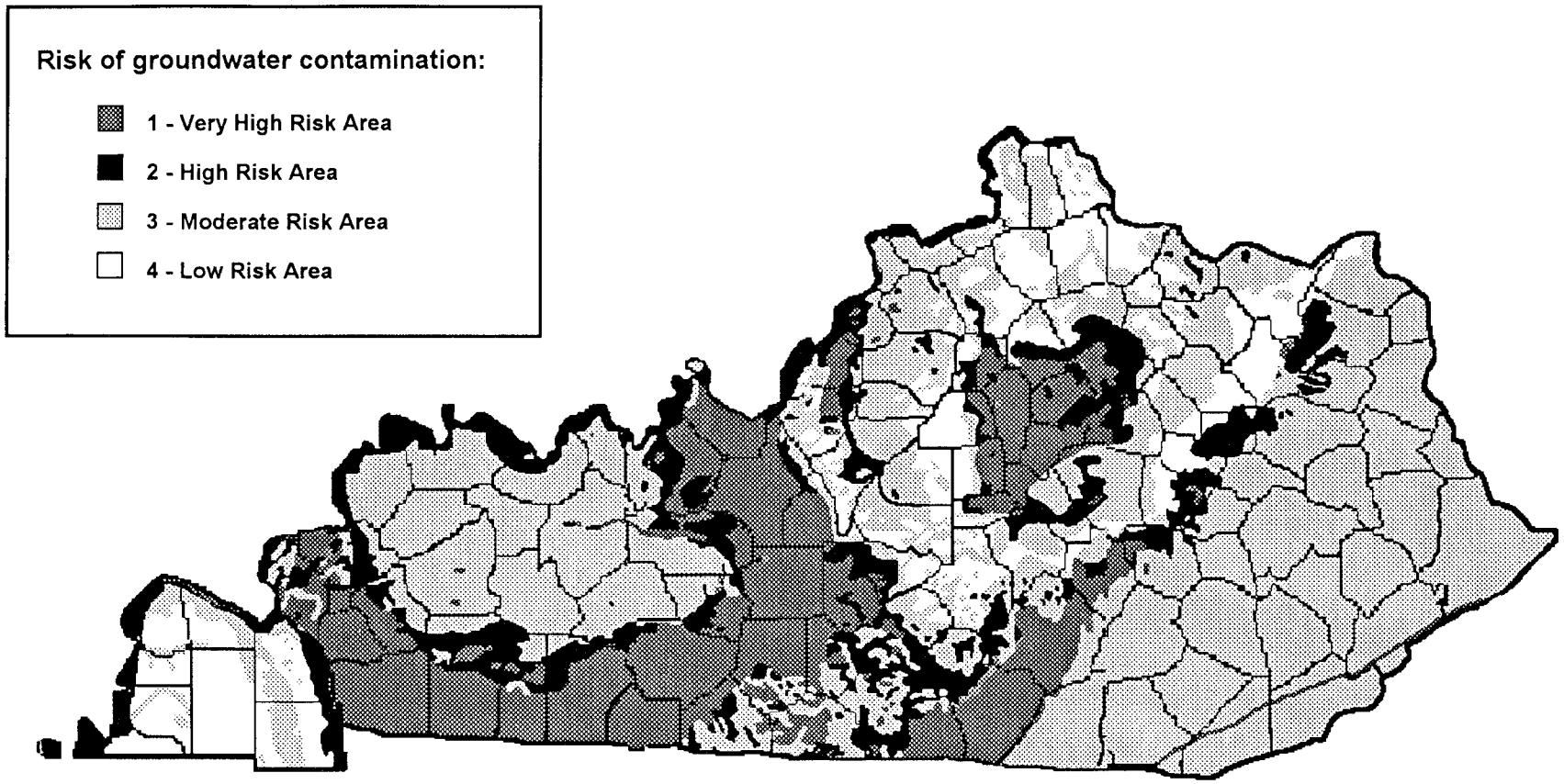
The KY•A•Syst project is coordinated by the Kentucky Cooperative Extension Service in collaboration with various Kentucky state and federal organizations and agricultural commodity and environmental groups.

KY•A•Syst publications can be obtained at your county Cooperative Extension Service office. For additional information on the KY•A•Syst program, contact Marla Barnett at (606) 257-2735 or Dr. Curtis W. Absher at (606) 257-1846.

Groundwater Sensitivity Map



Reproduced from a map created by Division of Water - Groundwater Branch : Frankfort, Ky.

This map shows the potential for groundwater contamination in the different areas of Kentucky. Find the county you live in to determine how sensitive your region is to groundwater contamination.