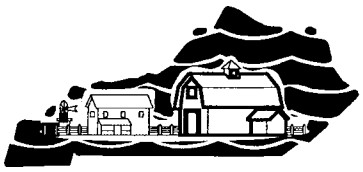

KY•A•Syst

Home and Farmstead
Water Quality Assessment

Assessing and Reducing the Risk of Groundwater Contamination from

LIVESTOCK YARDS MANAGEMENT

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.

Livestock yards, such as barnyards, holding areas, and feedlots, are areas of concentrated livestock wastes which can be a source of nitrate and bacteria contamination of groundwater.

Nitrate levels in drinking water above federal and state drinking water standards of 10 parts per million (ppm) nitrate-nitrogen can pose health problems for infants under six months of age, including the condition known as methemoglobinemia (blue baby syndrome). High nitrate can also affect adults, but the evidence is much less certain. Nitrate-nitrogen levels of 20 to 40 ppm may prove harmful to livestock, especially in combination with high levels (1,000 ppm) of nitrate-nitrogen from feed sources.

Fecal and coliform bacteria in livestock waste can contaminate groundwater, causing such infectious diseases as dysentery, typhoid, and hepatitis. Organic materials lend an undesirable taste and odor to drinking water and are not considered to be a health hazard. Their presence does suggest that other contaminants might be entering the groundwater supply.

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 your livestock yard management practices. 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 your livestock yard management practices.

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 Livestock Yards Management

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

How far is your livestock yard from any well, spring, sinkhole, or other water resource (pond, stream, etc.)?

4 More than 200 feet.
3 100-200 feet.
2 50-100 feet.
1 Less than 50 feet. Illegal for new well installation. Existing wells must meet separation requirements in effect at time of construction.

DESIGN AND MANAGEMENT

Is surface water diverted from the livestock yard?

4 All uphill surface and roof water diverted.
3 Most uphill surface and roof water diverted.
2 No surface water diverted. Some roof water collected and redirected.
1 All water (surface and roof water) runs through the yard.

Is runoff from the livestock yard controlled/collected?

4 No yard runoff (either barn or roofed area).
3 All runoff collected from curbed lot. Solids separated. Water directed to waste storage pit/lagoon.
2 Most of lot runoff collected. Some solids removed. Runoff directed to grass-covered slope.
1 Lot runoff uncontrolled.

How often is the livestock yard cleaned and scraped?

4 No yard (animals confined).
3 Daily.
2 Weekly.
1 Less than weekly.

CONCENTRATION OF ANIMALS ON YARD (square feet per animal [sf/a])*

Dairy replacements

4 No yard. Confined to barn or roofed yard.
3 More than 40 sf/a on fenced, curbed concrete surface, and/or 150-200 sf/a on earthen yard.
2 More than 20 sf/a on concrete and/or more than 75 sf/a on earthen surface.
1 Less than 75 sf/a on earth. Farm is in an area that has high or very high sensitivity to groundwater contamination (see Groundwater Sensitivity Map at the end of this publication), or water table is within 20 feet of surface.

*Animal concentrations derived from Midwest Plan Service publications and other sources.

Dairy cows

4 No yard. Confined to barn or roofed yard.
3 75 sf/a or more on fenced, curbed concrete surface, and/or 400 sf/a on graded earthen surface. More than 1,800 sf/a in exercise area.
2 50 sf/a or more on concrete, and/or 200-300 sf/a on earthen surface. More than 1,200 sf/a in exercise area.
1 Some concrete (less than 50 sf/a) and earth (less than 100 sf/a). Farm is in an area that has high or very high sensitivity to groundwater contamination (see Groundwater Sensitivity Map at the end of this publication), or water table is within 20 feet of surface.

Beef feeders

4 No yard. Confined to barn with slotted floor.
3 Barn and/or paved lot more than 50 sf/a. Earthen lot with mound more than 300 sf/a, or without mound more than 500 sf/a.
2 No shelter and paved lot 40-50 sf/a. Earthen with mound more than 150 sf/a, or earthen without mound less than 250 sf/a.
1 Paved less than 30 sf/a, or earthen less than 150 sf/a. Farm is in an area that has high or very high sensitivity to groundwater contamination (see Groundwater Sensitivity Map at the end of this publication), or water table is within 20 feet of surface.

Beef cows/heifers

4 Barn or roofed lot.
3 Barn with paved lot more than 60 sf/a. Earthen with mound more than 400 sf/a. Earthen without mound more than 600 sf/a.
2 Paved lot more than 30 sf/a. Earthen with mound more than 200 sf/a. Earthen without mound more than 300 sf/a.
1 Earthen without mound less than 200 sf/a. Farm is in an area that has high or very high sensitivity to groundwater contamination (see Groundwater Sensitivity Map at the end of this publication), or water table is within 20 feet of surface.

Sheep/ewes

4 No yard. Confined to barn or roofed yard.
3 Barn and paved lot more than 20 sf/a. Earthen more than 40 sf/a.
2 Barn and paved lot less than 15 sf/a. Earthen less than 25 sf/a.
1 Earthen less than 10 sf/a. Farm is in an area that has high or very high sensitivity to groundwater contamination (see Groundwater Sensitivity Map at the end of this publication), or water table is within 20 feet of surface.

Feeder lambs

4 No yard. Confined to barn.
3 Barn and paved lot more than 10 sf/a. Earthen more than 25 sf/a.
2 Barn and paved lot more than 5 sf/a. Earthen more than 10 sf/a.
1 Earthen less than 10 sf/a. Farm is in an area that has high or very high sensitivity to groundwater contamination (see Groundwater Sensitivity Map at the end of this publication), or water table is within 20 feet of surface.

Hogs/sows

4 No yard. Confined to barn.
3 Shed and paved lot more than 30 sf/a.
2 Shed and earthen lot less than 15 sf/a.
1 Shed and earthen lot less than 10 sf/a. Farm is in an area that has high or very high sensitivity to groundwater contamination (see Groundwater Sensitivity Map at the end of this publication), or water table is within 20 feet of surface.

Pigs: growing/finishing

4 No yard. Confined to barn.
3 Shed and paved lot more than 30 sf/a.
2 Shed and earthen lot less than 15 sf/a.
1 Shed and earthen lot less than 10 sf/a. Farm is in an area that has high or very high sensitivity to groundwater contamination (see Groundwater Sensitivity Map at the end of this publication), or water table is within 20 feet of surface.

Horses

4 No yard. Confined to barn or on pasture.
3 Earthen exercise lot more than 2,500 sf/a. No pasture.
2 Earthen lot more than 1,500 sf/a. No pasture.
1 Earthen lot less then 1,000 sf/a. No pasture. Farm is in an area that has high or very high sensitivity to groundwater contamination (see Groundwater Sensitivity Map at the end of this publication), or water table is within 20 feet of surface.

Chickens:

Broilers

4 No lot. In building with watering system in good working order. Runoff protected.
3 No lot. In building with watering system in good working order. Inadequate runoff protection.
2 Earthen lot of 2 sf/a or more, on medium-textured soils (silt loam, loam).
1 Earthen lot of 2 sf/a or more, on coarse-textured soils (sands, sandy loam). Farm is in an area that has high or very high sensitivity to groundwater contamination (see Groundwater Sensitivity Map at the end of this publication), or water table is within 20 feet of surface.

Layers

4 No lot. In building with watering system in good working order. Runoff protected.
3 No lot. In building with watering system in good working order. Inadequate runoff protection.
2 Earthen lot of 4 sf/a or more, on medium-textured soils (silt loam, loam).
1 Earthen lot of 4 sf/a or more, on coarse-textured soils (sands, sandy loam). Farm is in an area that has high or very high sensitivity to groundwater contamination (see Groundwater Sensitivity Map at the end of this publication), or water table is within 20 feet of surface.

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 4 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 Livestock Yards Management." 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: runoff from livestock yard is uncontrolled.	*Contact Soil Conservation Service or Extension agent about making efforts to control runoff from yard.*

Part II. *Reducing* the Risk of Groundwater Contamination by Improving Livestock Yards Management

Every livestock yard has the potential to pollute surface and groundwater. However, not every livestock yard pollutes. Besides protecting the groundwater, other good reasons for improving livestock yard management practices include improved herd health, increased ease of maintenance, and higher-quality milk or meat production.

DISTANCE FROM WELLS, SPRINGS, SINKHOLES, OR OTHER WATER RESOURCES

Runoff from the livestock yard should not run into the vicinity of any wells, springs, sinkholes, or other water resources (streams, ponds, etc.). A livestock yard should be no closer than 50 feet to any well (401 KAR 6:310), spring, sinkhole, or other water resource. With good farmstead planning, livestock facilities would be 300-400 feet from the house. Since water wells are often near the house, it is likely that there would be more than 200 feet between the well and the livestock yard. If your existing livestock yard is too close to any well, spring, sinkhole, or other water resource, efforts should be made to prevent livestock yard runoff from reaching those areas.

SITE CHARACTERISTICS

If groundwater protection is a major consideration in locating a livestock yard, soil and bedrock characteristics are the important factors. Important soil characteristics include surface and subsoil texture, soil depth, permeability, and drainage class. The best soil for a livestock yard is a deep, well-drained silt loam/clay loam soil with low permeability. In Kentucky, bedrock characteristics are a very important consideration in locating a livestock yard. Areas which have springs, sinkholes, caves, or "disappearing" streams are called karst. Karst areas are very sensitive to groundwater contamination because the bedrock is "dissolved" by water, and large cracks and caves are formed underground. These cracks allow runoff to flow very quickly from the surface to the groundwater. When considering the location for a new livestock yard, be sure to keep it far from any spring, sinkhole, or other water resource. Read the final section of Part II ("A Few Words About Your Site") for more information about your site's ability to protect the groundwater.

For existing livestock yards, the water pollution potential can be reduced by diverting all upgrade drainage and roof runoff away from livestock yards. Existing livestock yards with poor site location may require relocation, hard surfacing the lot in conjunction with the installation of a waste storage system, or elimination of the livestock yard by using total confinement.

CLEAN WATER DIVERSION

One way to reduce water pollution from livestock yards is to reduce the amount of clean water entering the yard.

- Waterways, small terraces, and roof gutters should direct water away from livestock yards.
- An earthen ridge or terrace can be constructed across the slope upgrade from a feedlot or barnyard to prevent runoff from entering the yard.
- In some areas, if a diversion terrace is not practical, a catch basin with a tile outlet could be installed above the barnyard.

In all cases, these structures need to be maintained. The design of waste storage facilities must be approved by the Kentucky Division of Water. Contact the Division of Water (502-564-3410) for information about the procedure required for building a waste storage facility.

RUNOFF CONTROL SYSTEMS

A livestock yard without a runoff control system typically has an earthen surface compacted by animal traffic. This surface is not shaped for water drainage, so it is sometimes dry and sometimes muddy. Manure typically accumulates on the surface.

Research completed in Nebraska shows that feedlot soils become compacted from animal traffic and prevent water infiltration through the compacted layer. Ammonia (NH_4) is released instead of nitrates because of the chemical-reducing conditions in the compacted feedlot soil (moisture, no oxygen). Nitrates are formed when feedlots are empty, and soil cracks allow infiltration of oxygen and water.

Uncontrolled feedlot runoff can flush manure from the yard and create vegetation burns and mudholes. Such a yard is difficult to manage, and the absence of runoff controls may lead to water quality problems. Contaminated runoff that accumulates in areas adjacent to feedlots and yards may filter through the soil and threaten groundwater quality. This risk is particularly high on sites with high infiltration and percolation rates, such as sandy soils and other soils with good to moderate drainage.

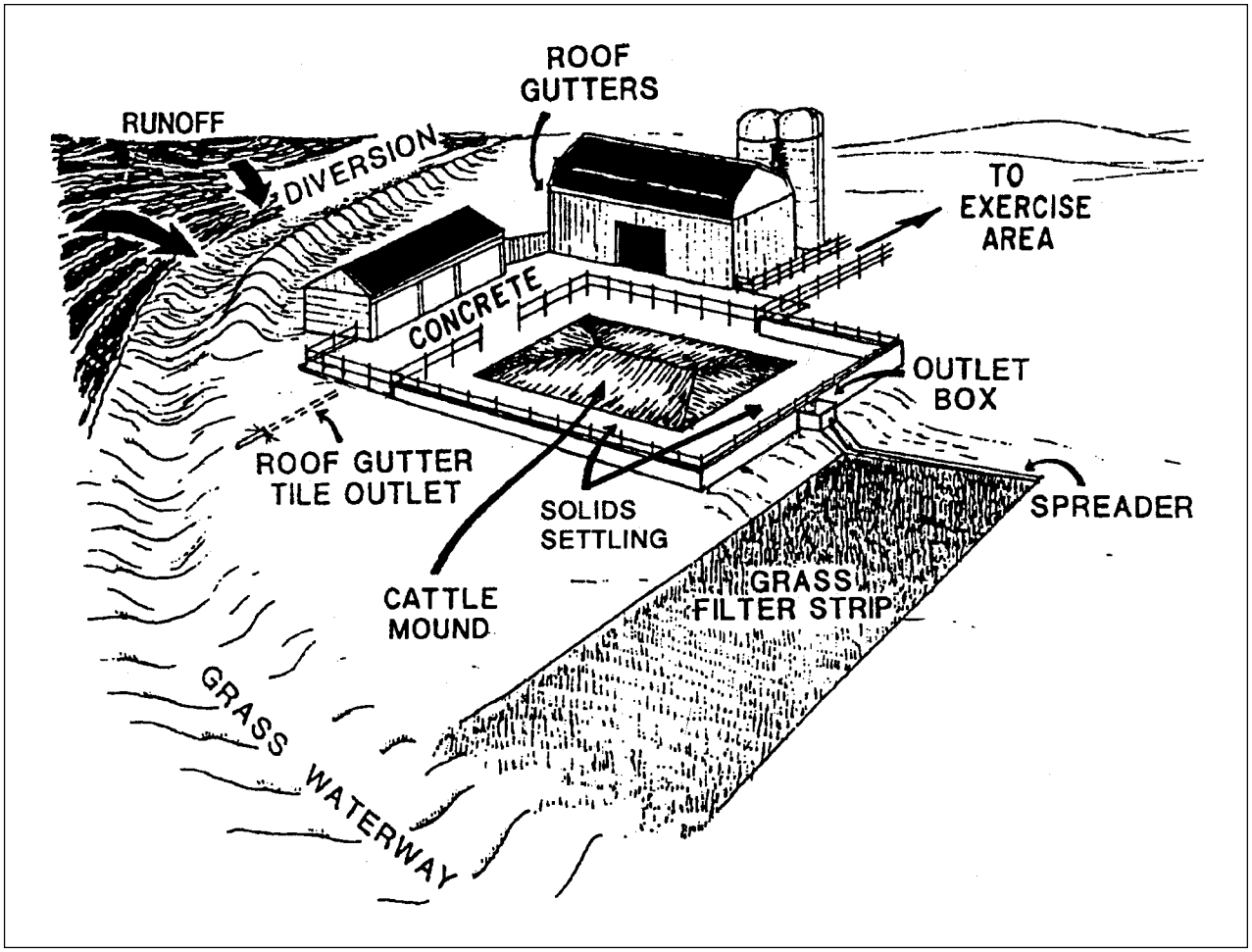

Figure 1. Typical livestock yard runoff system. *Source: Wisconsin DNR and Wisconsin Dept. of Ag.*

The risk is also high in karst areas (areas with sinkholes, caves, etc.).

Long-term waste storage facilities can remedy such problem situations. One common method uses a stack pad to separate out manure solids and allow liquids to drain to a long-term waste storage pit/lagoon. Both solid and liquid wastes are therefore collected and later applied to fields at a recommended rate. All runoff from the yard should be directed to the waste storage pit/lagoon. If a long-term waste storage pit/lagoon is not used, efforts should at least be made to direct runoff water to open fields or grass filter strips (a grass filter strip is a thick, healthy stand of vegetation which allows runoff to seep into the soil and uses the nutrients in the water), and away from any wells, springs, streams, ditches, and other water resources. Runoff should not run towards any sinkhole, as sinkholes act as a direct conduit to groundwater.

YARD CLEANING OR SCRAPING

Livestock yards should be cleaned regularly and as often as practical. The more often manure is collected, the higher the nutrient value will be. When cleaning livestock yards with dirt surfaces, two inches of the compacted manure and soil should be left to maintain the compacted layer that slows downward water movement.

- Clean livestock yards regularly. The amount of manure on a livestock yard depends on the number of animals and the hours per day animals spend on the lot.
- Cleaning and scraping once per week is preferable. Heavy concentration of animals may require solids removal more often.
- Concrete surfaces are much easier to clean than earthen lots. Earthen yards are cleaned when dry, so solids may be removed less frequently.

CONCENTRATION OF ANIMALS AND TYPE OF YARD SURFACE

The area needed per animal for minimizing the risk of surface and groundwater contamination depends on the type of lot surface. The amount of concrete surface area needed is much less than that required for an earthen lot.

The concrete area needed is a balance between traffic on the lot and resting area provided for animals. Too

large an area results in manure freezing to the surface for long periods, while too small an area will result in animals having difficulty moving about.

Example: For dairy operations, good protection for groundwater is to confine animals to a free-stall barn or roofed yard. Where a yard is needed, provide 75 square feet of fenced concrete area per cow* (400 square feet per cow of earthen surface) and, if needed, provide roughly 2,000 square feet per cow of exercise area.

Direct runoff water carefully from the concrete onto the earthen area. A curb will keep runoff from flowing off the edges of the concrete lot.

Yard management involves considerations other than surface and groundwater protection. A combination of yard surfaces can offer the most flexibility in adapting to weather conditions. Location of livestock can be based on the amount of mud in the yard: on concrete in sloppy conditions, on an earthen surface in dry weather, and on a mound in intermediate conditions.

The type of surface also affects management. Earthen yards, for example, might be cleaned only once or twice per year, concrete weekly or bimonthly.

If you live in a region of the state that has a high sensitivity to groundwater contamination (see map at end of this publication), consider paving the surface with concrete or eliminating the yard by using total confinement.

* MWPS (Midwest Plan Service) recommendations

LIVESTOCK STORAGE AND WASTE UTILIZATION

In addition to the condition of your livestock yards, your farm animal waste management should consider waste storage and utilization.

Livestock wastes are a valuable fertilizer and soil conditioner. When managed properly, the nutrients in waste can be substituted for commercial fertilizers, reducing fertilizer expenditures and protecting groundwater and surface water. Matching nutrient applications to crop nutrient needs is critical and requires the testing of both the manure and soil. Estimates of nutrients supplied by waste can be obtained from the MWPS-18 *Livestock Waste and Facilities Handbook.*

(The KY•A•Syst Publication Assessing and Reducing the Risk of Groundwater Contamination from: Livestock Waste Storage *provides guidelines for minimizing the impact of livestock waste on the groundwater.)*

ABANDONED LIVESTOCK YARDS

With active feedlots or yards, the compacted layer of organic matter mixed with soil at the soil surface lies over compacted subsurface soil, forming a layer through which water moves very slowly. Therefore, leaching of nitrate and bacteria through the surface seal and compacted layers is not likely within the barnyard. If barnyard runoff is discharged to permeable soils or to areas considered karst (areas with sinkholes, springs, caves, etc.), groundwater contamination will occur. Some research studies have found little nitrate in the soil under active feedlots, but more research is necessary.

Nevertheless, abandoned yards can pose a particular groundwater contamination risk. As the manure pack breaks up from lack of use, water can leach through and reach the groundwater.

If you have a permanently abandoned yard, remove and spread the manure pack and the top 1 ft of soil on fields at rates recommended by testing, and seed the former yard with a vegetative cover. Another option is to till and plant the yard to a high-nitrogen-demand crop (like corn or sorghum) which will use the nitrogen released by the soil and manure during the decomposition period.

An untouched, abandoned yard will allow leaching of nitrates from the decomposing, compacted manure layer into the groundwater.

A FEW WORDS ABOUT YOUR SITE

The way farmstead practices such as livestock yard management affect the groundwater depends in part on the type of soil and bedrock that is on your property. We have already discussed how many areas of Kentucky are very sensitive to groundwater contamination (karst) because of the bedrock that underlies their soils. The following is some more detail about the ability of your site to protect the groundwater.

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 that 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 buildings 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...

Livestock yards management

County Extension agent . . . . . check local listing
Soil Conservation Service . . . . . check local listing

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, former 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: Leonard Massie, University of Wisconsin-Madison). Special thanks to Bill Thom, Department of Agronomy, and Tony Pescatore, Department of Animal Sciences, University of Kentucky, for technical review and comments.

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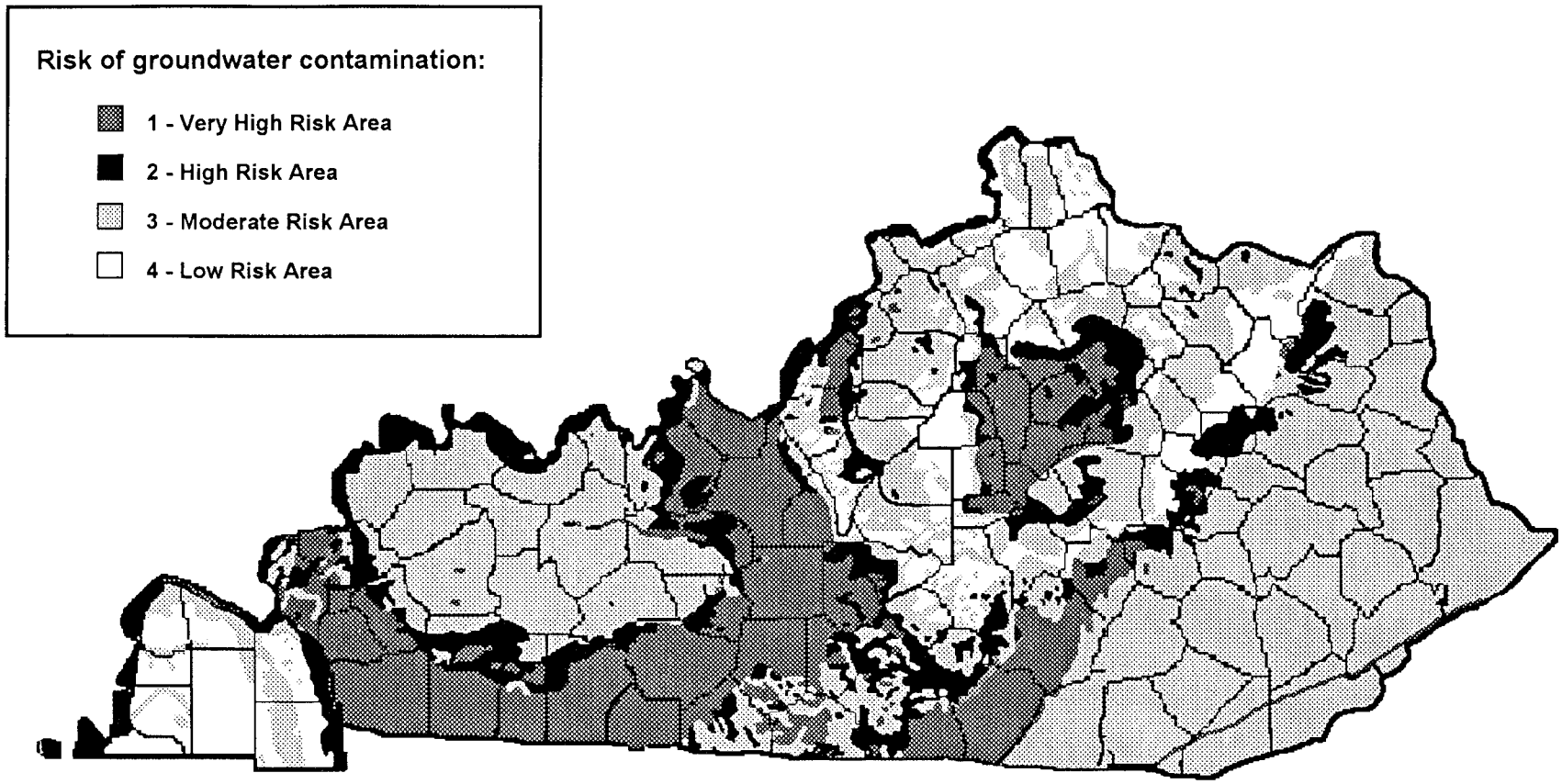
The KY•A•Syst project is coordinated by the Kentucky Cooperative Extension Service in collaboration with various Kentucky state and federal organizations and agricultural commodity and environmental groups.

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.